

simulacionesjup

May 31, 2023

1 Simulations

$$f(x) = 0.1 \sin(\pi x)$$

```
[ ]: import numpy as np
import math
import csv
import matplotlib.pyplot as plt
import pandas as pd
from scipy.stats import sem

from cpsplines.mosek_functions.interval_constraints import IntConstraints
from cpsplines.psplines.bspline_basis import BsplineBasis
from cpsplines.psplines.penalty_matrix import PenaltyMatrix
from cpsplines.fittings.fit_cpsplines import CPsplines
from cpsplines.utils.gcv import GCV
import statsmodels.genmod.families.family
import mosek.fusion as mf

from Functions import poly

from Functions import simpleGCV
from Functions import choose_lambda
from Functions import simpson_spline_full
from Functions import simpson_spline_matrices
from Functions import intGCV
from Functions import choose_lambda_int
from Functions import create_obj_mat
from Functions import unconstrained_sof_fit
from Functions import cp_sof_fit
import time
```

```
[ ]: #ESTO PARA NUESTRO PROBLEMA
rankX = 20
alpha = 0.15
#Trabajaremos con estos datos
m = 50
T = np.linspace(0, 1, num=m)
```

```

Phi = np.append(np.tile(1/np.sqrt(m), (m, 1)), poly(T, degree=rankX-1)[0],axis= 1)
lambda1_ = np.arange(rankX, 0, -1)

T2 = np.linspace(0, 1, num=501)
beta = lambda t: 0.1 * np.sin(np.pi*t)
betaT2 = beta(T2)

betaT = beta(T)
#weights. 1/3 for the limits, 2/3 for the odd subintervals, 4/3 for the even
#ones.

w = [1/3] + [4/3 if i%2==0 else 2/3 for i in range(2,501)] + [1/3]
W = np.diag(w)

```

1.0.1 Unconstrained

```

[ ]: #####ESTO PARA NUESTRO PROBLEMA#####
#ESTO PARA NUESTRO PROBLEMA
np.random.seed(1)
n_sims = 10

fitted_means_matrix = np.zeros((n_sims, 501))
lower_ci_matrix = np.zeros((n_sims, 501))
upper_ci_matrix = np.zeros((n_sims, 501))

time_unconstrained = np.zeros(3)

IMSE=np.zeros(n_sims)

cont=0
for N in [200]:
    start_time = time.time()
    normalfunc = lambda l: np.random.normal(scale=math.sqrt(l), size=N)
    for i in range(n_sims):
        #Trabajaremos con estos datos
        eps = np.random.normal(loc=0, scale=0.01, size=N)

        Xi=[]
        for j in range(rankX):
            Xi.append(normalfunc(lambda1_[j]))
        X = np.dot(np.transpose(Xi), np.transpose(Phi))

        lfterm = np.dot((1/m)*X, betaT)

```

```

y = alpha + lfterm + eps

y_hat, betagorro = unconstrained_sof_fit(X=X, y=y, k=30, u
↳initial_grid=T, newgrid_size=501, plot=False)
plt.figure()
plt.plot(T2,betagorro, label=f'approx {i+1}')
plt.legend()
plt.show()
# Store fitted values in matrix
fitted_means_matrix[i,:] = betagorro.reshape((501,))

#IMSE
IMSE[i] = (W @ (betaT2-betagorro)**2).sum()
print('IMSE for N=' ,N, IMSE.sum()/n_sims)
print(sem(IMSE))
end_time = time.time()
time_unconstrained[cont] = end_time - start_time
cont+=1
mean_fitted_vals = np.mean(fitted_means_matrix, axis=0)
mean_lower_ci = np.quantile(fitted_means_matrix, 0.025, axis=0)
mean_upper_ci = np.quantile(fitted_means_matrix, 0.975, axis=0)

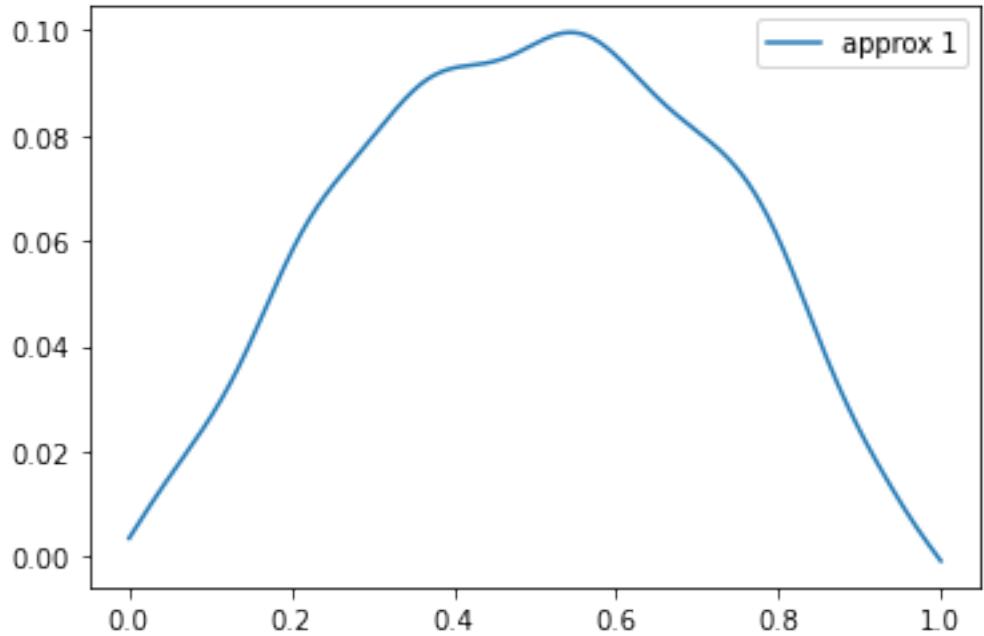
plt.plot(T2, betaT2, label = 'True beta')
plt.plot(T2,mean_fitted_vals)
plt.plot(T2,mean_lower_ci, linestyle='dashed', color='orange')
plt.plot(T2,mean_upper_ci, linestyle='dashed', color='orange')
# Plot a horizontal line at y=0
plt.axhline(0, color='black')
plt.legend()
plt.show()
print('Times', time_unconstrained)

```

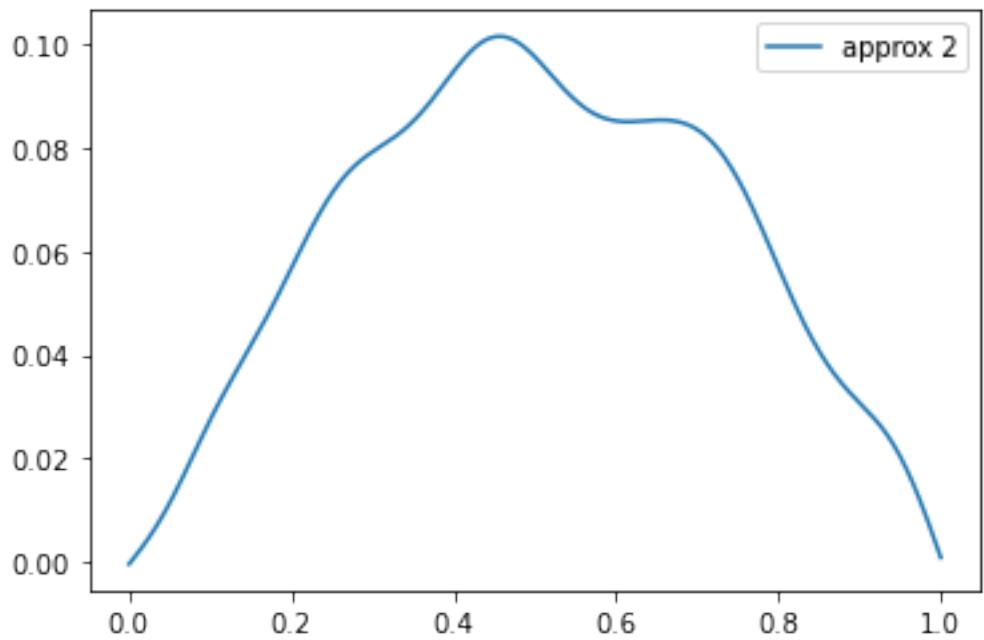
```

c:\Users\Diego\anaconda3\lib\site-packages\scipy\optimize\optimize.py:282:
RuntimeWarning: Values in x were outside bounds during a minimize step, clipping
to bounds
    warnings.warn("Values in x were outside bounds during a "

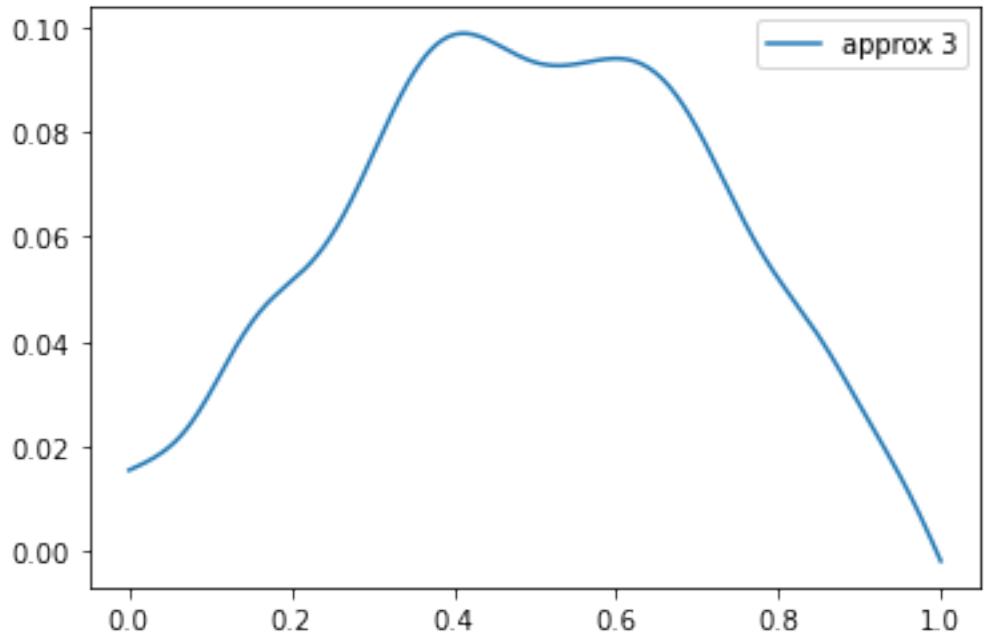
```



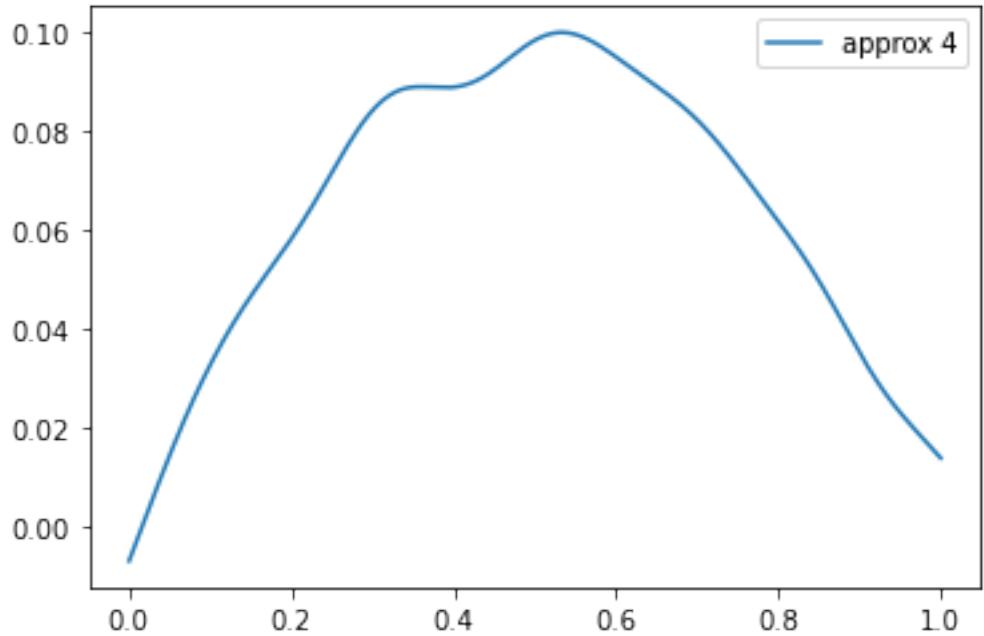
```
c:\Users\Diego\anaconda3\lib\site-packages\scipy\optimize\optimize.py:282:  
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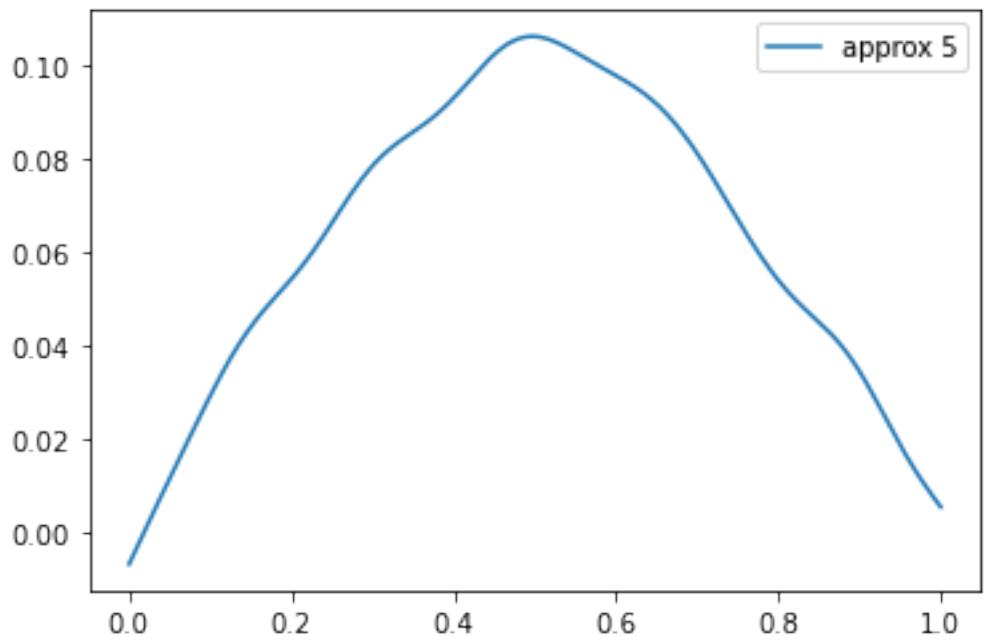
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c:\Users\Diego\anaconda3\lib\site-packages\scipy\optimize\optimize.py:282:  
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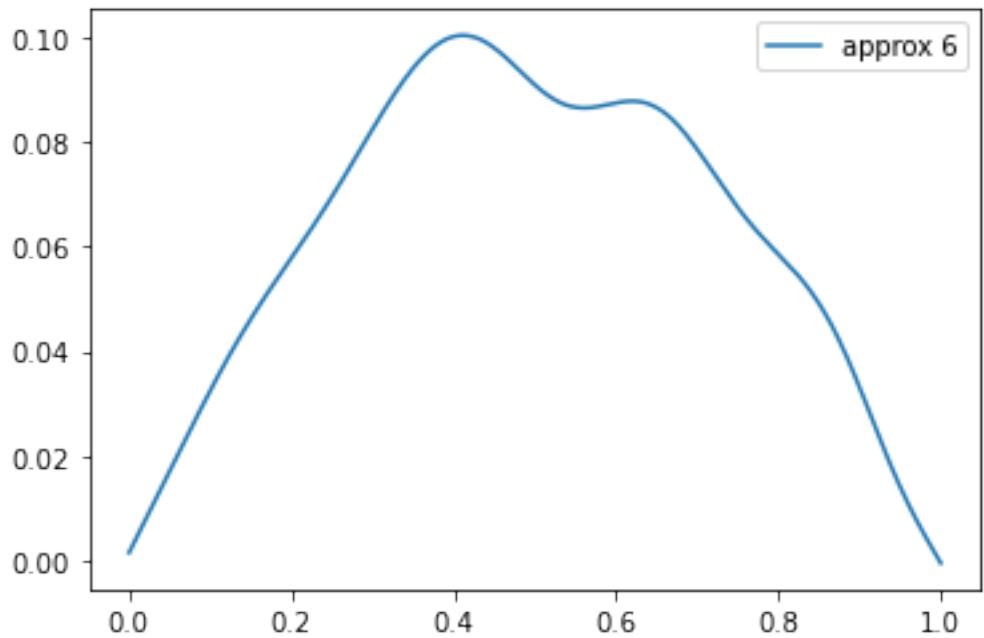
```
c:\Users\Diego\anaconda3\lib\site-packages\scipy\optimize\optimize.py:282:  
RuntimeWarning: Values in x were outside bounds during a minimize step, clipping  
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```



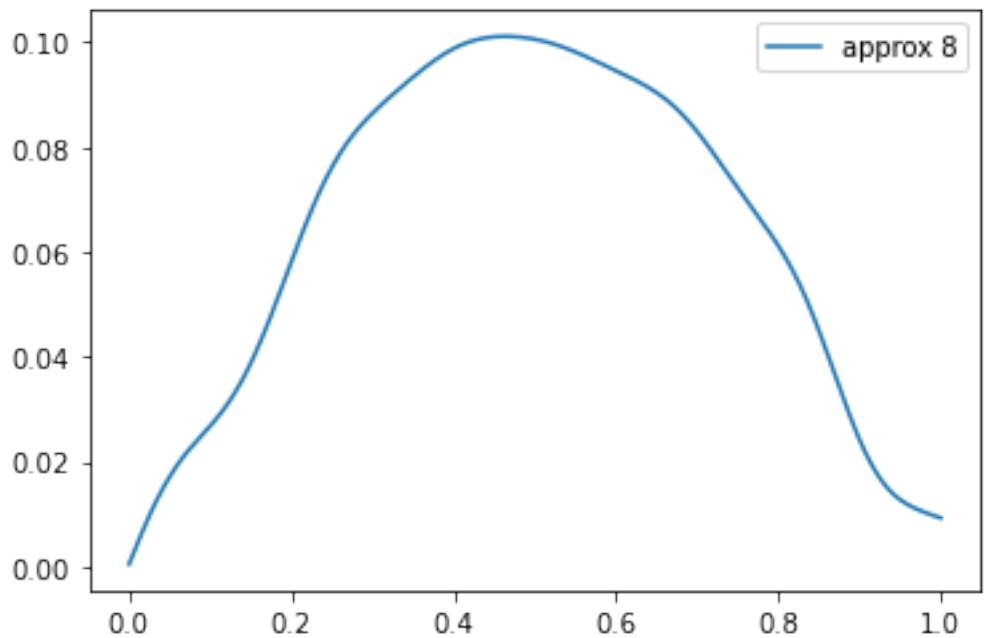
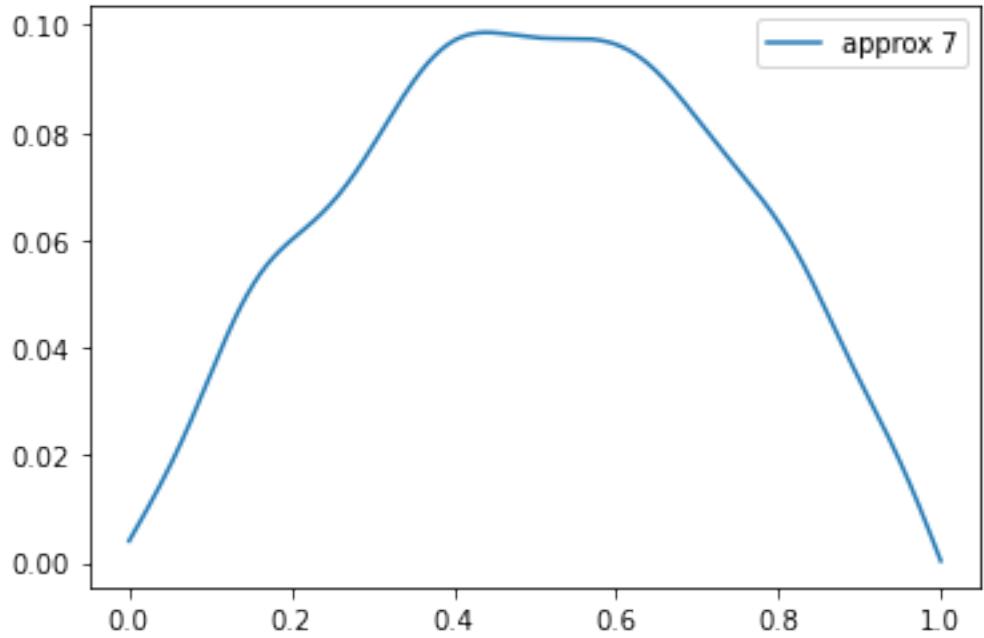
```
c:\Users\Diego\anaconda3\lib\site-packages\scipy\optimize\optimize.py:282:  
RuntimeWarning: Values in x were outside bounds during a minimize step, clipping  
to bounds  
    warnings.warn("Values in x were outside bounds during a "
```



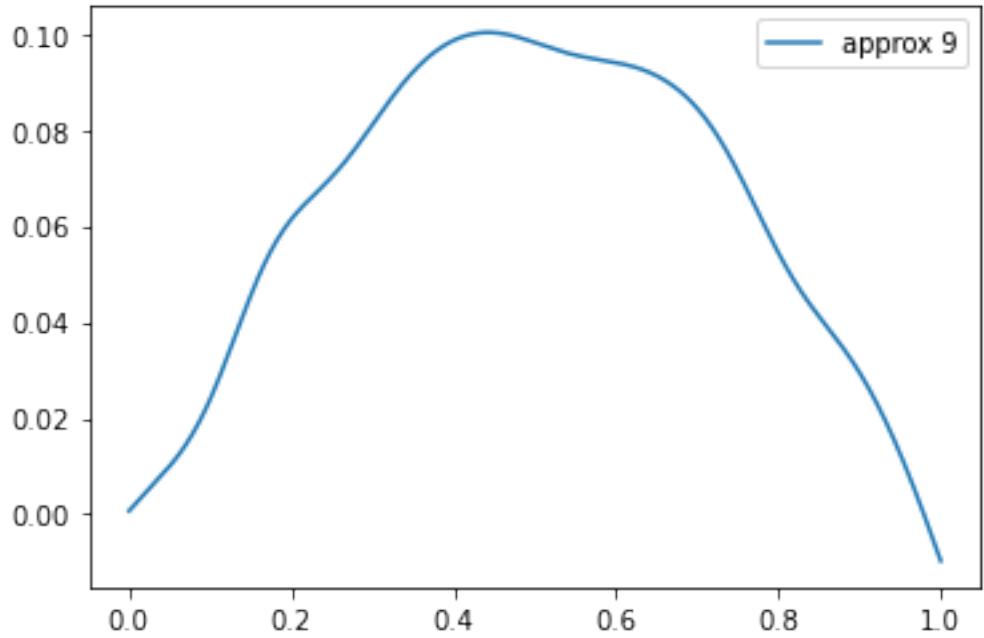
```
c:\Users\Diego\anaconda3\lib\site-packages\scipy\optimize\optimize.py:282:  
RuntimeWarning: Values in x were outside bounds during a minimize step, clipping  
to bounds  
    warnings.warn("Values in x were outside bounds during a "
```



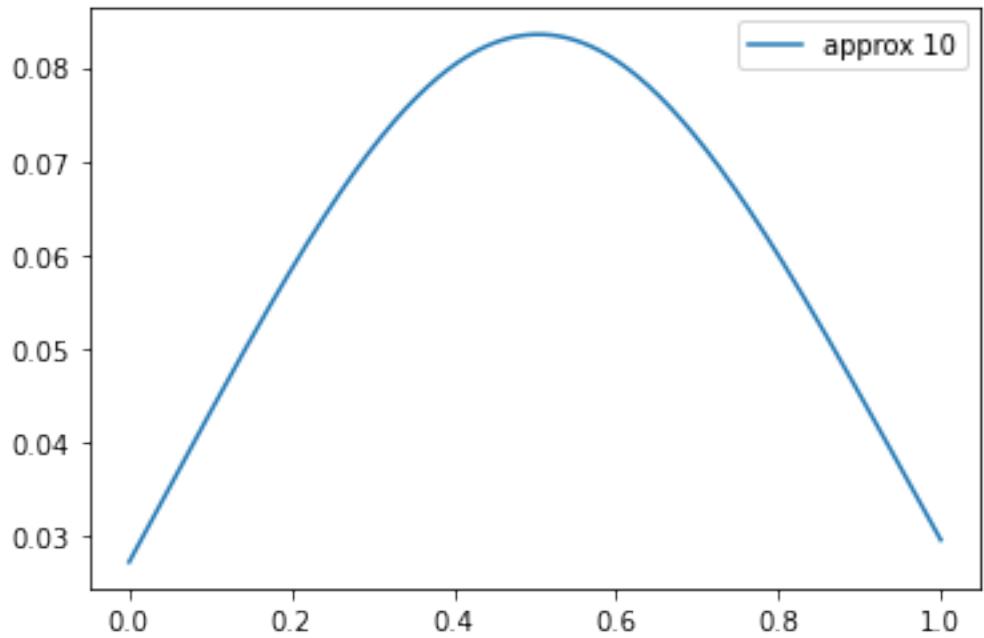
```
c:\Users\Diego\anaconda3\lib\site-packages\scipy\optimize\optimize.py:282:  
RuntimeWarning: Values in x were outside bounds during a minimize step, clipping  
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    warnings.warn("Values in x were outside bounds during a "
```



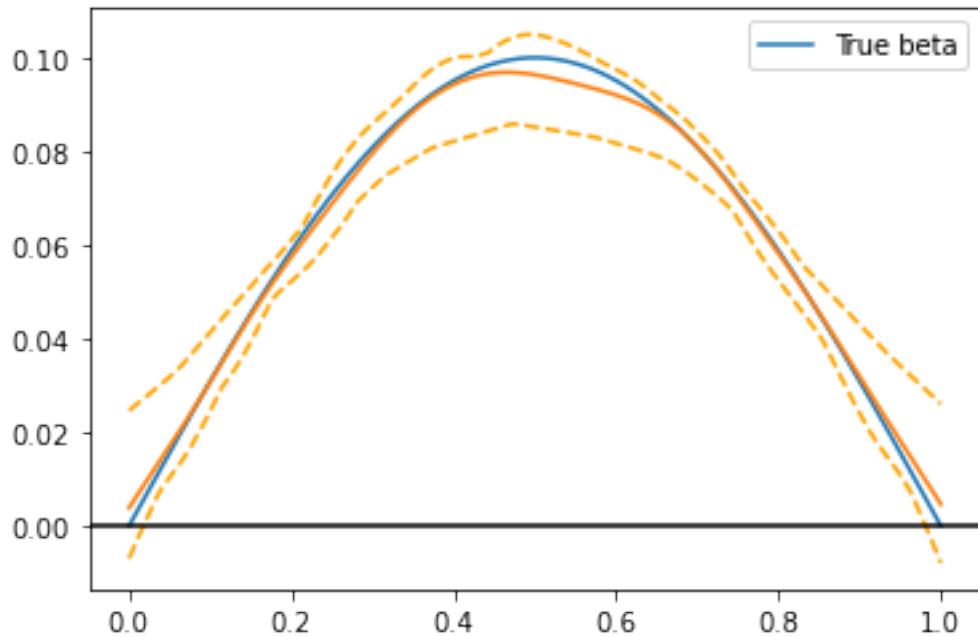
```
c:\Users\Diego\anaconda3\lib\site-packages\scipy\optimize\optimize.py:282:  
RuntimeWarning: Values in x were outside bounds during a minimize step, clipping  
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    warnings.warn("Values in x were outside bounds during a "
```



```
c:\Users\Diego\anaconda3\lib\site-packages\scipy\optimize\optimize.py:282:  
RuntimeWarning: Values in x were outside bounds during a minimize step, clipping  
to bounds  
    warnings.warn("Values in x were outside bounds during a "
```



```
IMSE for N= 200 0.01601085730480959  
0.008704779973029216
```



```
Times [29.39567208  0.          0.          ]
```

```
[ ]: import pandas as pd  
f = open(r"C:\Users\Diego\Desktop\Master\TFM\upper.csv", 'r')  
#some code  
f.close()  
up=pd.read_csv(r"C:\Users\Diego\Desktop\Master\TFM\upper.csv")  
  
f = open(r"C:\Users\Diego\Desktop\Master\TFM\lower.csv", 'r')  
#some code  
f.close()  
low=pd.read_csv(r"C:\Users\Diego\Desktop\Master\TFM\lower.csv")  
  
f = open(r"C:\Users\Diego\Desktop\Master\TFM\mean.csv", 'r')  
#some code  
f.close()  
me=pd.read_csv(r"C:\Users\Diego\Desktop\Master\TFM\mean.csv")
```

```
[ ]: up=np.array(up['x'])  
low=np.array(low['x'])  
me=np.array(me['x'])
```

```
[ ]:
```

1.0.2 Concavidad

```
[ ]: #####  
#ESTO PARA NUESTRO PROBLEMA  
n_sims = 200  
  
fitted_means_matrix = np.zeros((n_sims, 501))  
lower_ci_matrix = np.zeros((n_sims, 501))  
upper_ci_matrix = np.zeros((n_sims, 501))  
  
time_constrained_concave = np.zeros(3)  
IMSE=np.zeros(n_sims)  
#ESTO PARA NUESTRO PROBLEMA  
  
rankX = 20  
  
#Trabajaremos con estos datos  
Phi = np.append(np.tile(1/np.sqrt(m), (m, 1)), poly(T, degree=rankX-1)[0],  
axis= 1)  
lambda1_ = np.arange(rankX, 0, -1)  
  
normalfunc = lambda l: np.random.normal(scale=math.sqrt(l), size=N)  
  
betaT = beta(T)  
  
alpha = 0.15  
lambda1_ = np.arange(rankX, 0, -1)  
Phi = np.append(np.tile(1/np.sqrt(m), (m, 1)), poly(T, degree=rankX-1)[0],  
axis= 1)  
cont=0  
for N in [200]:  
    start_time = time.time()  
    normalfunc = lambda l: np.random.normal(scale=math.sqrt(l), size=N)  
    for i in range(n_sims):  
        #Trabajaremos con estos datos  
        eps = np.random.normal(loc=0, scale=0.01, size=N)  
  
        #Trabajaremos con estos datos  
  
        Xi=[]  
        for j in range(rankX):  
            Xi.append(normalfunc(lambda1_[j]))  
        X = np.dot(np.transpose(Xi), np.transpose(Phi))
```

```

lfterm = np.dot((1/m)*X, betaT)

y = alpha + lfterm + eps

y_hat, thetasim, betagorro = cp_sof_fit(X=X, y=y, k=35, initial_grid=T,
                                         newgrid_size=501, derivative_order=2, sign='-', sign_threshold=-0.0,
                                         plot=False)

# Store fitted values in matrix
fitted_means_matrix[i,:] = betagorro.reshape((501,))

#IMSE
IMSE[i] = (W @ (betaT2-betagorro)**2).sum()
print('IMSE for N=',N, IMSE.sum()/n_sims)
print(sem(IMSE))

end_time = time.time()
time_constrained_concave[cont] = end_time - start_time
cont+=1

mean_fitted_vals = np.mean(fitted_means_matrix, axis=0)
mean_lower_ci = np.quantile(fitted_means_matrix, 0.025, axis=0)
mean_upper_ci = np.quantile(fitted_means_matrix, 0.975, axis=0)

plt.plot(T2, betaT2, label = 'True beta')
plt.plot(T2,mean_fitted_vals)
plt.plot(T2,mean_lower_ci, linestyle='dashed', color='orange')
plt.plot(T2,mean_upper_ci, linestyle='dashed', color='orange')
# Plot a horizontal line at y=0
plt.axhline(0, color='black')
plt.legend()
plt.show()
print('Times', time_constrained_concave)

```

1.0.3 No negatividad

```

[ ]: #####
#ESTO PARA NUESTRO PROBLEMA
n_sims = 10

fitted_means_matrix = np.zeros((n_sims, 501))
fitted_lower_matrix = np.zeros((n_sims, 501))
fitted_upper_matrix = np.zeros((n_sims, 501))

time_constrained_positive = np.zeros(3)

IMSE=np.zeros(n_sims)

```

```

#ESTO PARA NUESTRO PROBLEMA
m = 50

rankX = 20

#Trabajaremos con estos datos
Phi = np.append(np.tile(1/np.sqrt(m), (m, 1)), poly(T, degree=rankX-1)[0],  

    ↪axis= 1)
lambda1_ = np.arange(rankX, 0, -1)

cont=0
for N in [200]:
    start_time = time.time()
    normalfunc = lambda l: np.random.normal(scale=math.sqrt(l), size=N)
    for i in range(n_sims):
        #Trabajaremos con estos datos
        eps = np.random.normal(loc=0, scale=0.01, size=N)

        #Trabajaremos con estos datos

        Xi=[]
        for j in range(rankX):
            Xi.append(normalfunc(lambda1_[j]))
        X = np.dot(np.transpose(Xi), np.transpose(Phi))

        lfterm = np.dot((1/m)*X, betaT)

        y = alpha + lfterm + eps

        y_hat, thetasim, betagorro = cp_sof_fit(X=X, y=y, k=35, initial_grid=T,  

            ↪newgrid_size=501, derivative_order=0, sign='+', sign_threshold=0.0,  

            ↪plot=False)

        # Store fitted values in matrix
        fitted_means_matrix[i,:] = betagorro.reshape((501,))

        plt.figure()
        plt.plot(T2,betagorro)
        plt.show()

#IMSE
IMSE[i] = (W @ (betaT2-betagorro)**2).sum()
print('IMSE for N=',N, IMSE.sum()/n_sims)
print(sem(IMSE))
end_time = time.time()

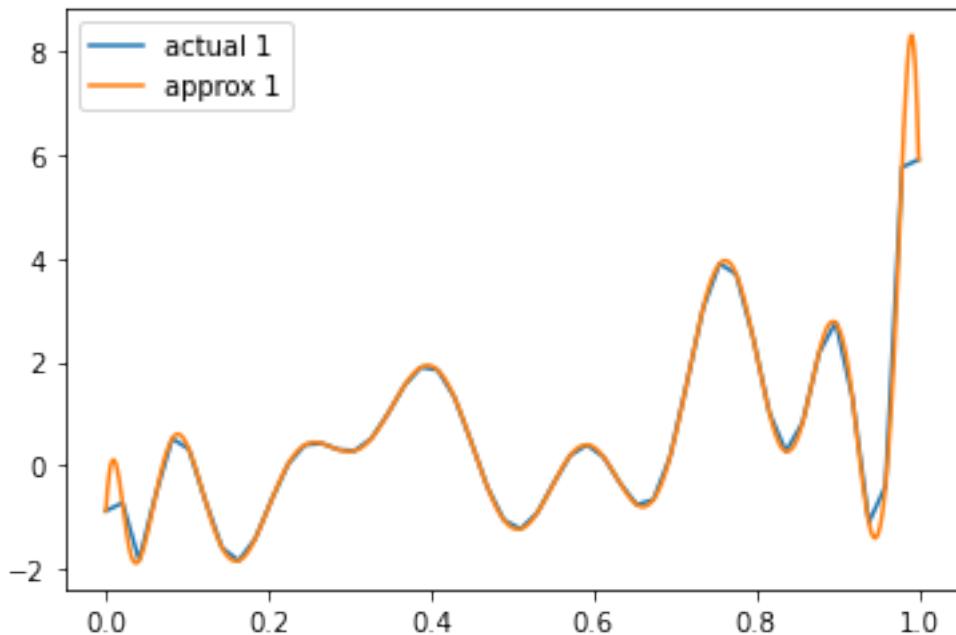
```

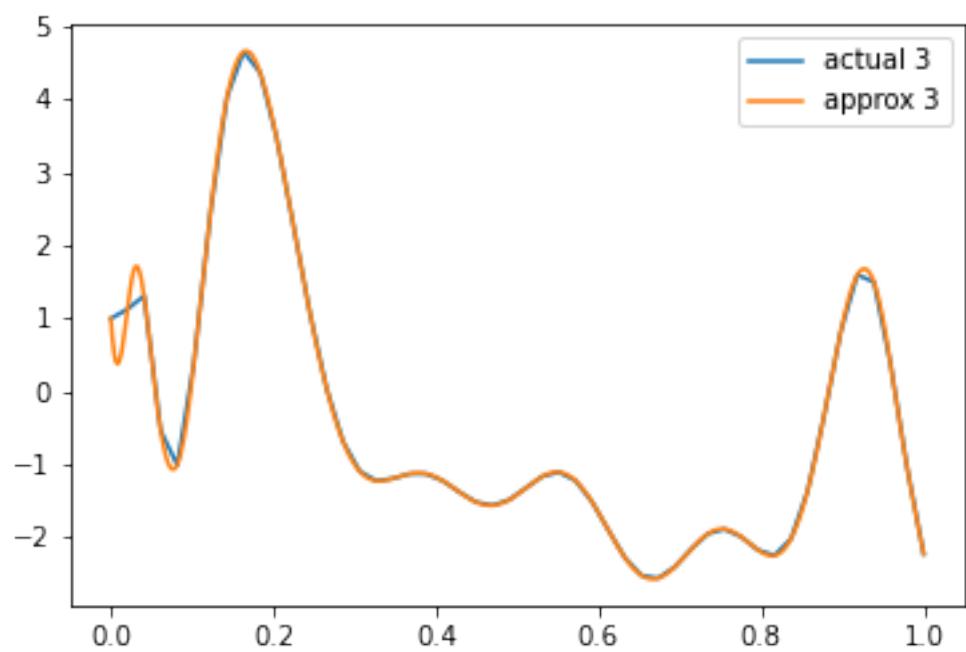
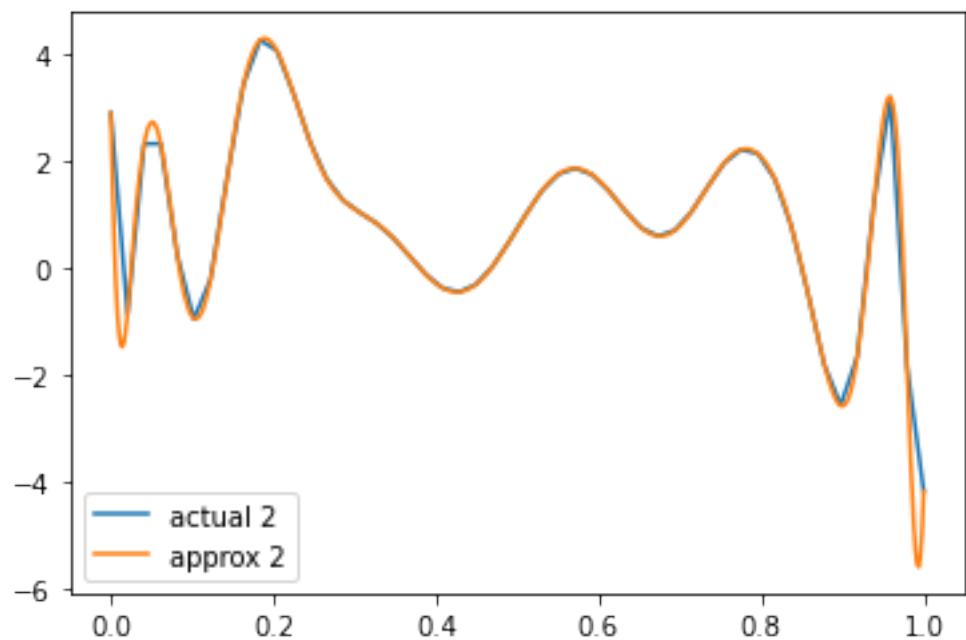
```

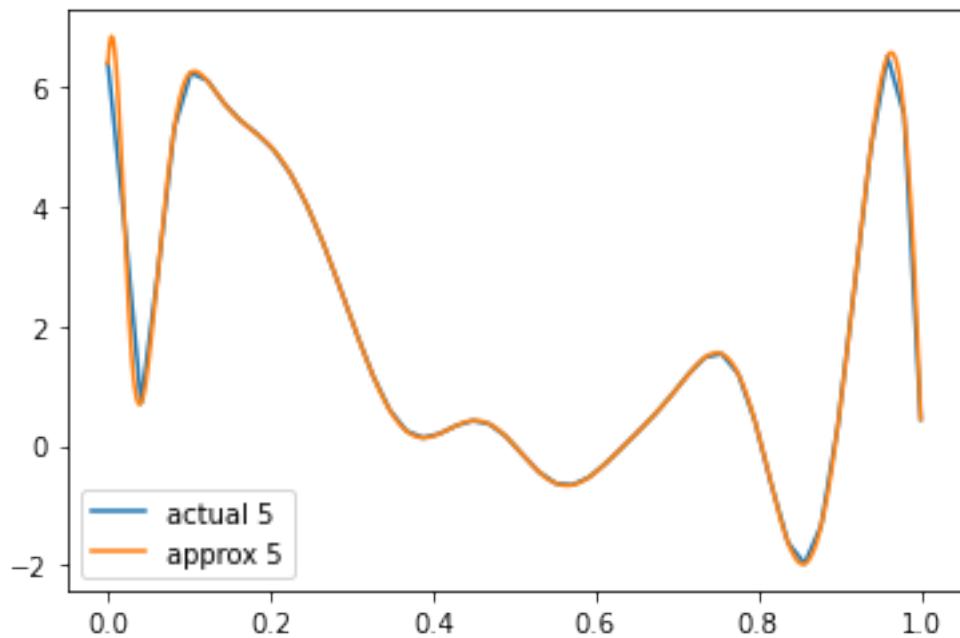
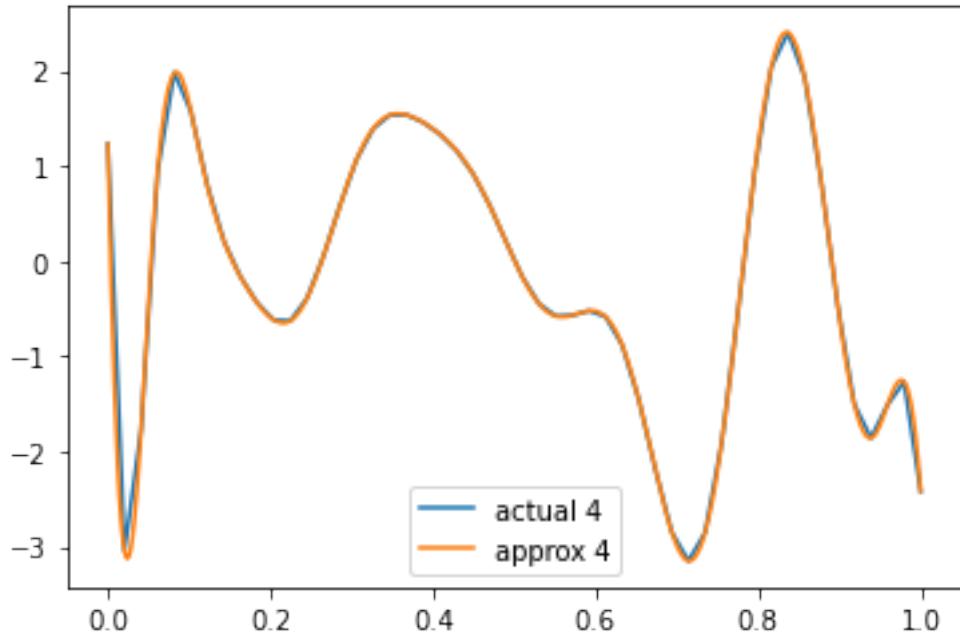
time_constrained_positive[cont] = end_time - start_time
cont+=1
mean_fitted_vals = np.mean(fitted_means_matrix, axis=0)
mean_lower_ci = np.quantile(fitted_means_matrix, 0.025, axis=0)
mean_upper_ci = np.quantile(fitted_means_matrix, 0.975, axis=0)
#PLOT N=100. THEY PLOT N=50
plt.figure()
plt.plot(T2, betaT2, label = 'True beta')
plt.plot(T2,mean_fitted_vals)
plt.plot(T2,mean_lower_ci, linestyle='dashed', color='orange')
plt.plot(T2,mean_upper_ci, linestyle='dashed', color='orange')
# Plot a horizontal line at y=0
plt.axhline(0, color='black')
plt.legend()
plt.show()

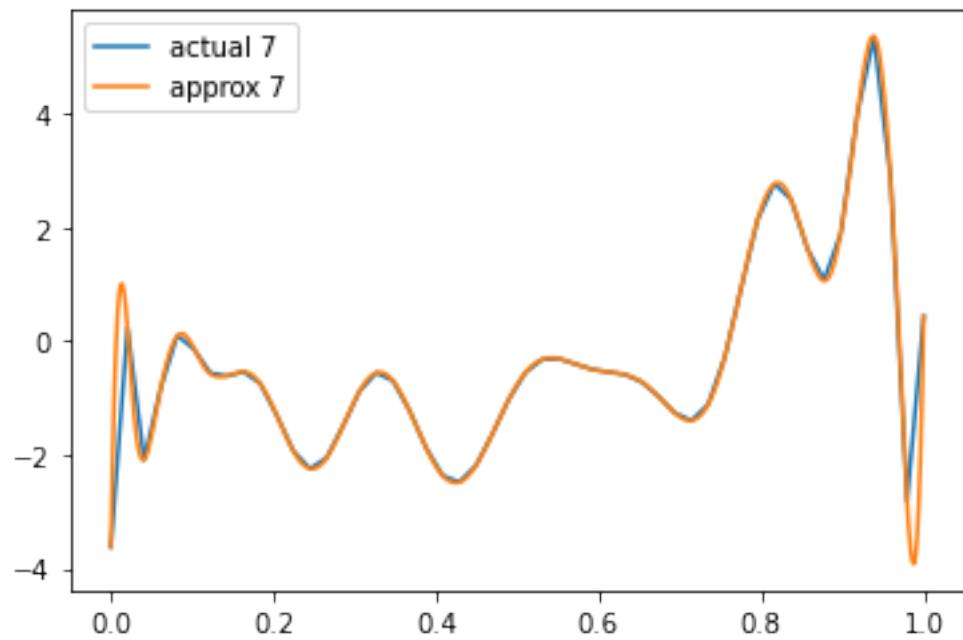
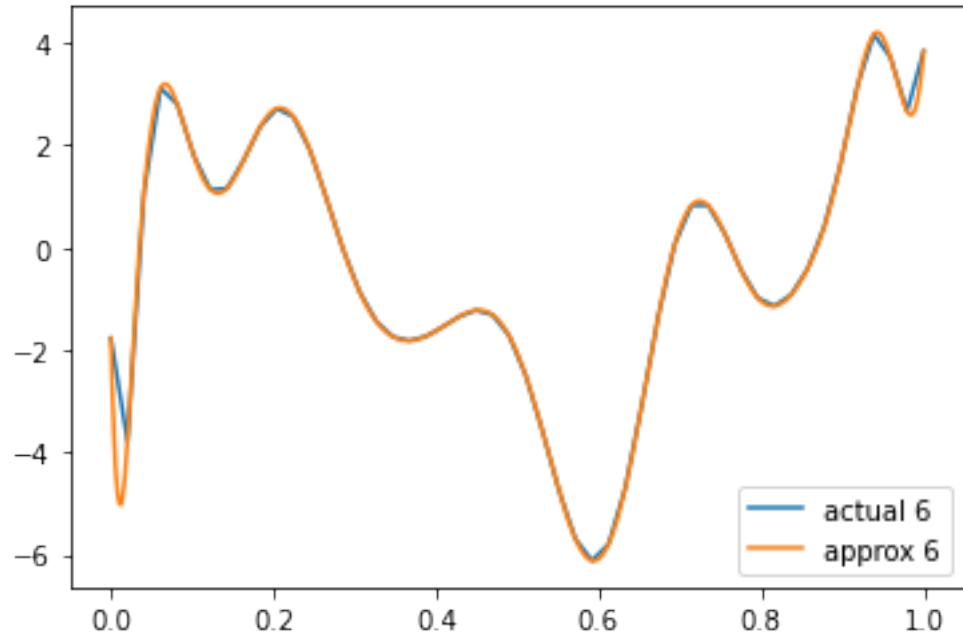
print('Times', time_constrained_positive)

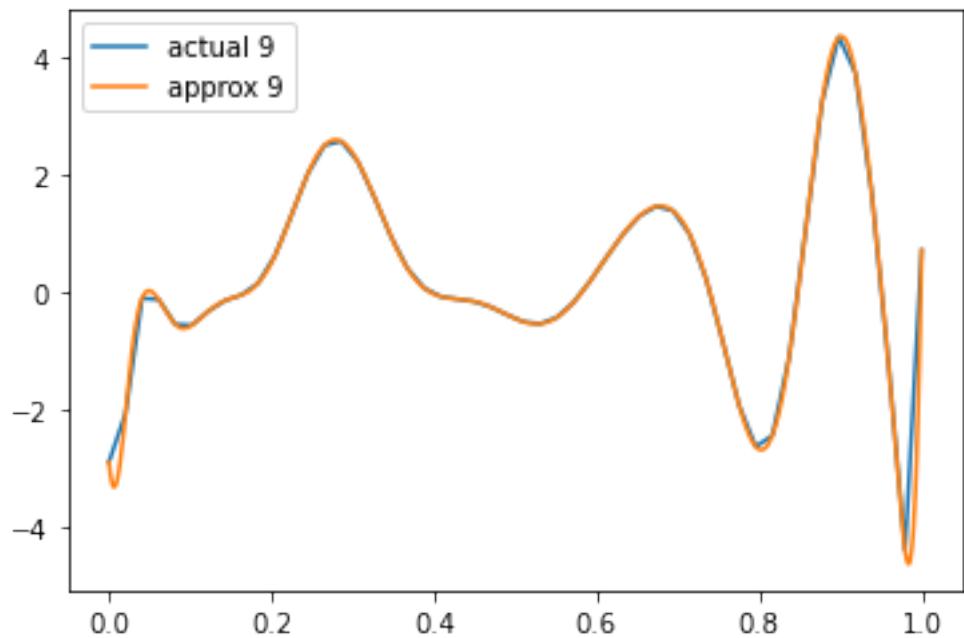
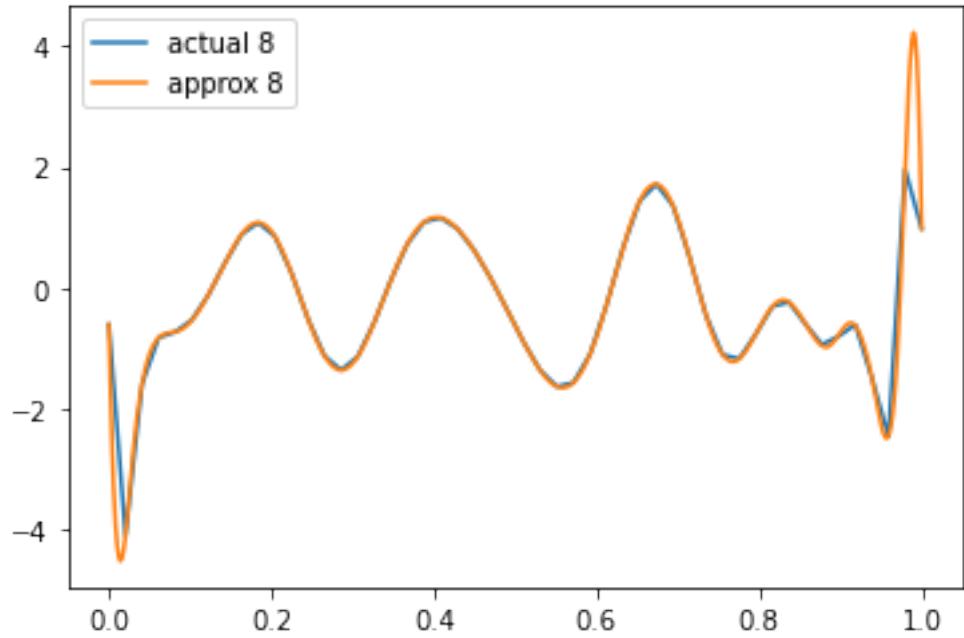
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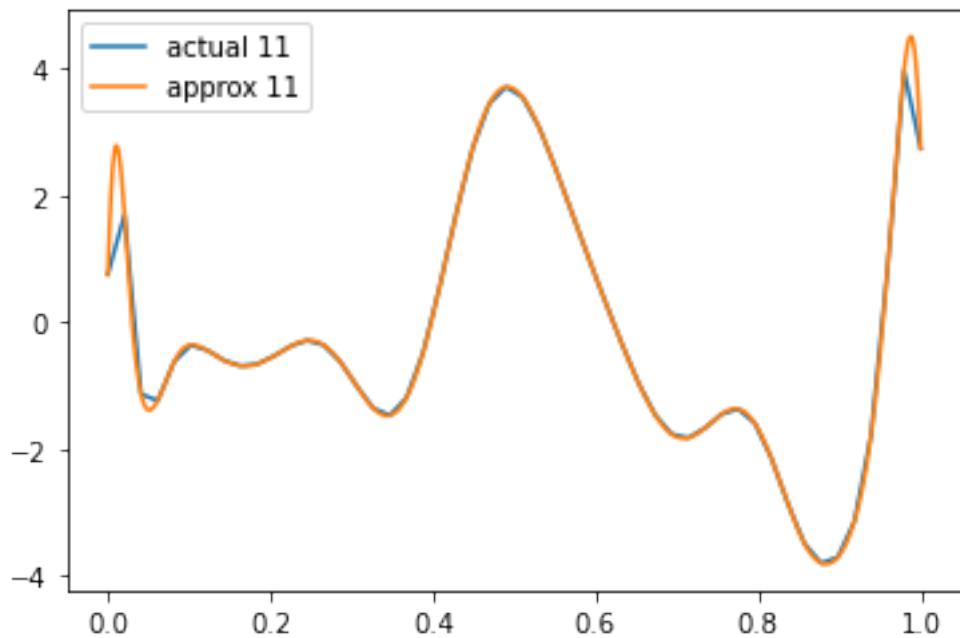
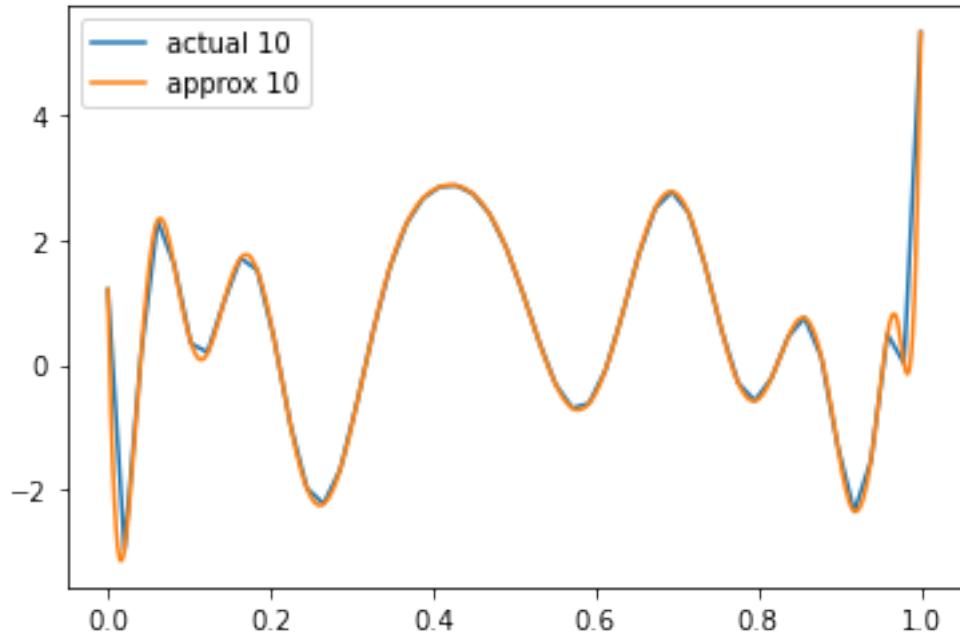


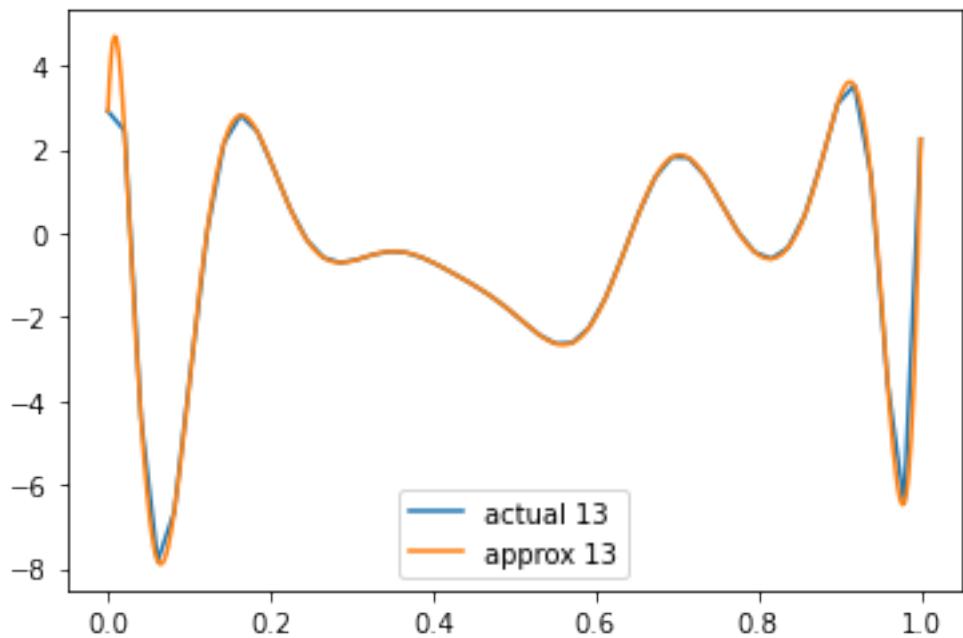
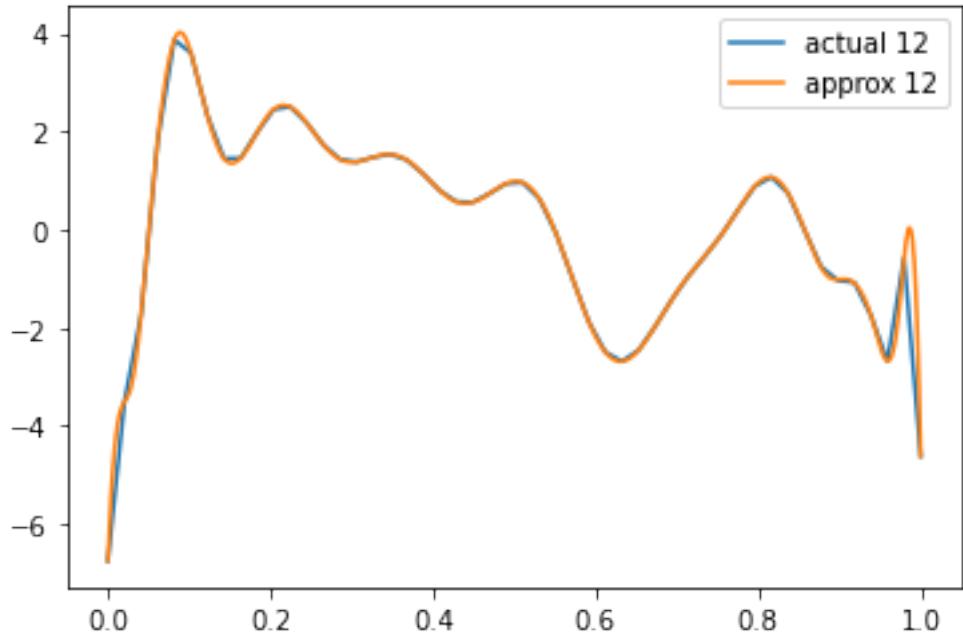


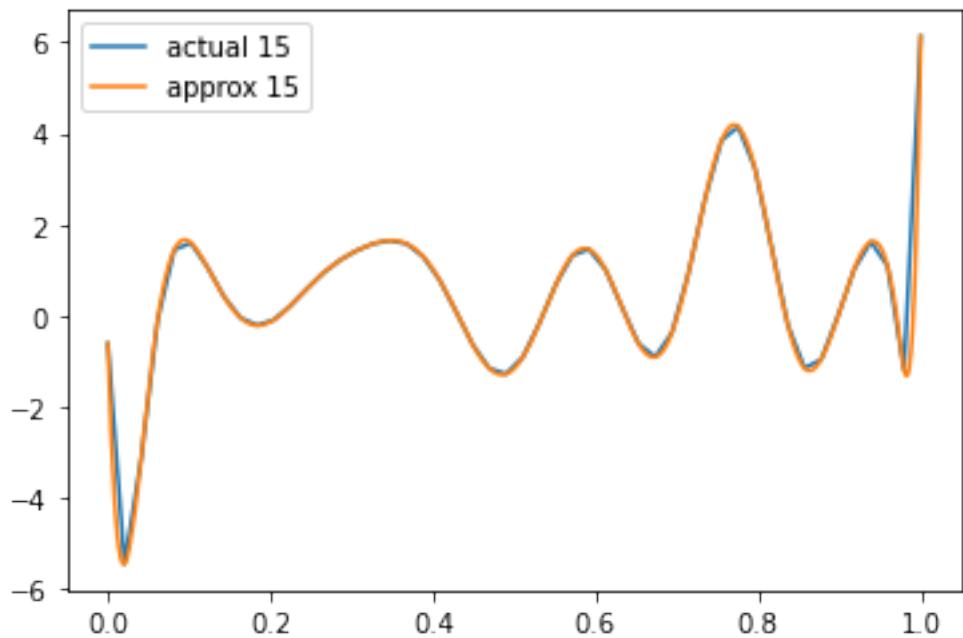
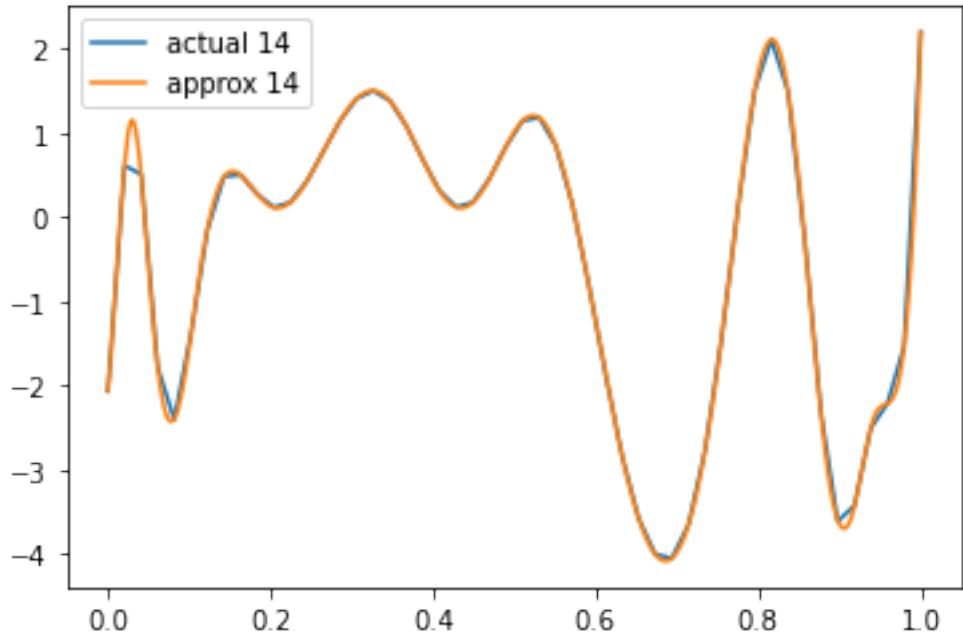


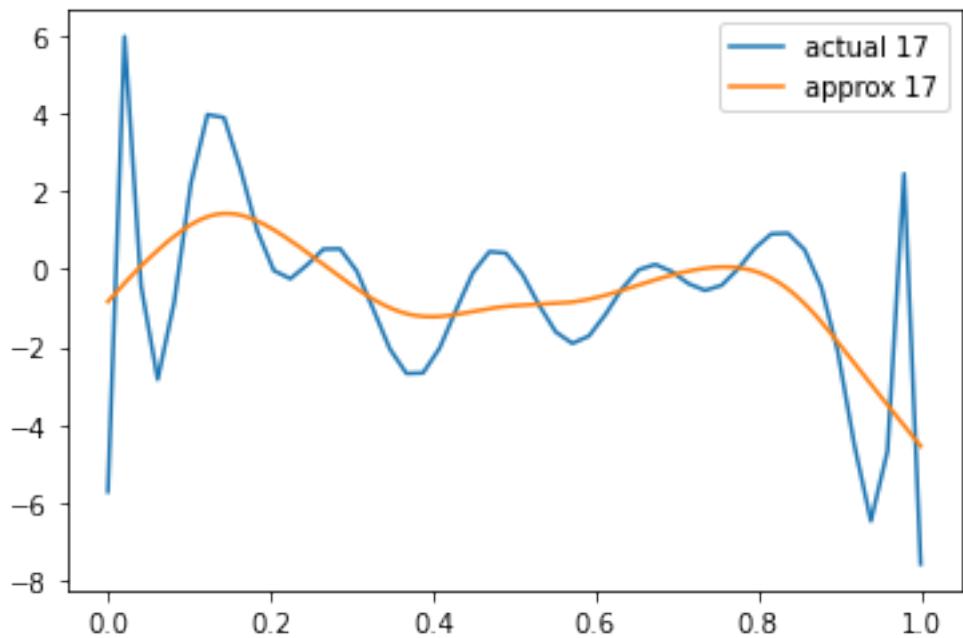
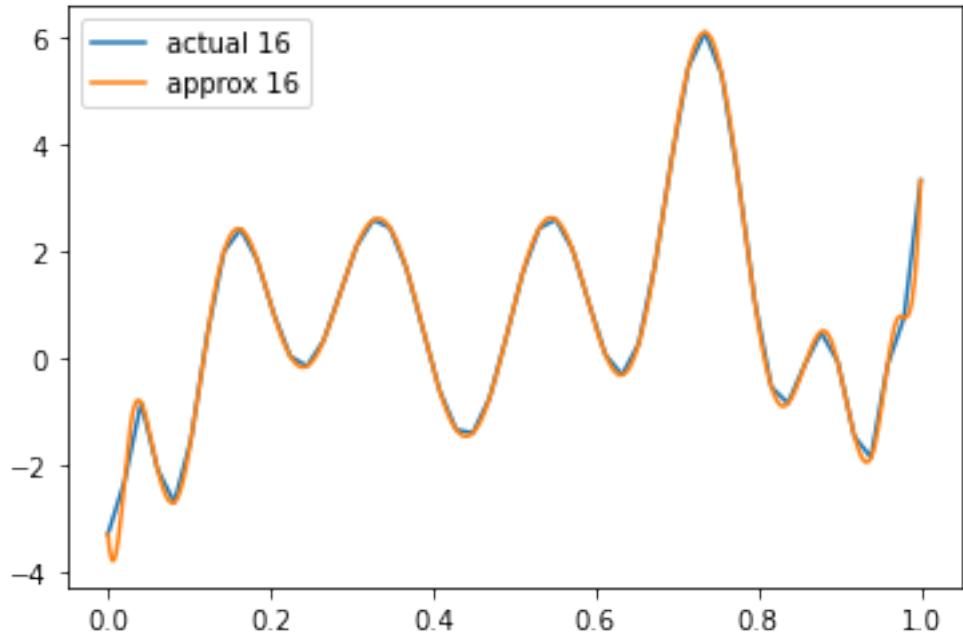


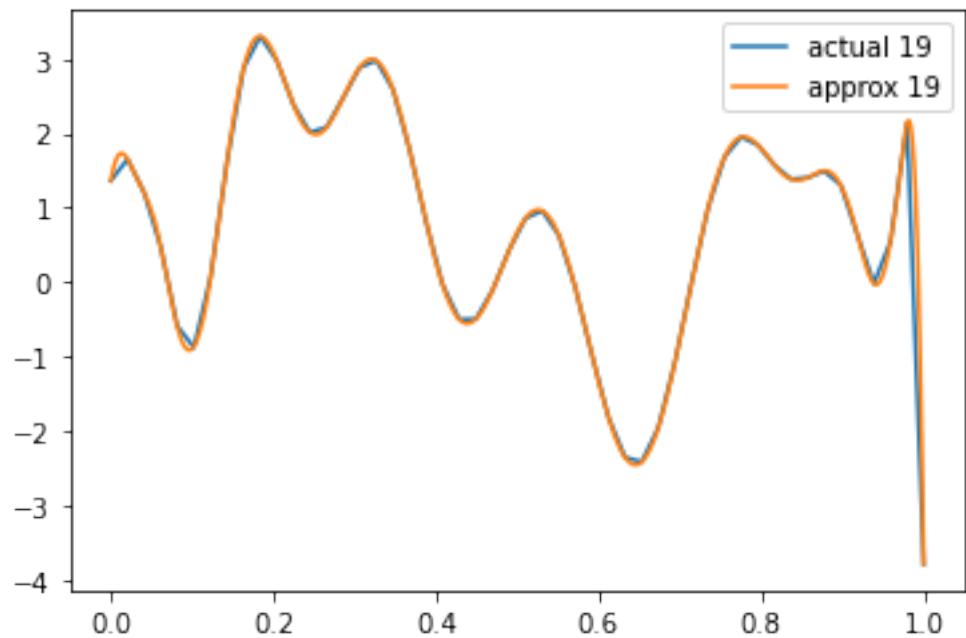
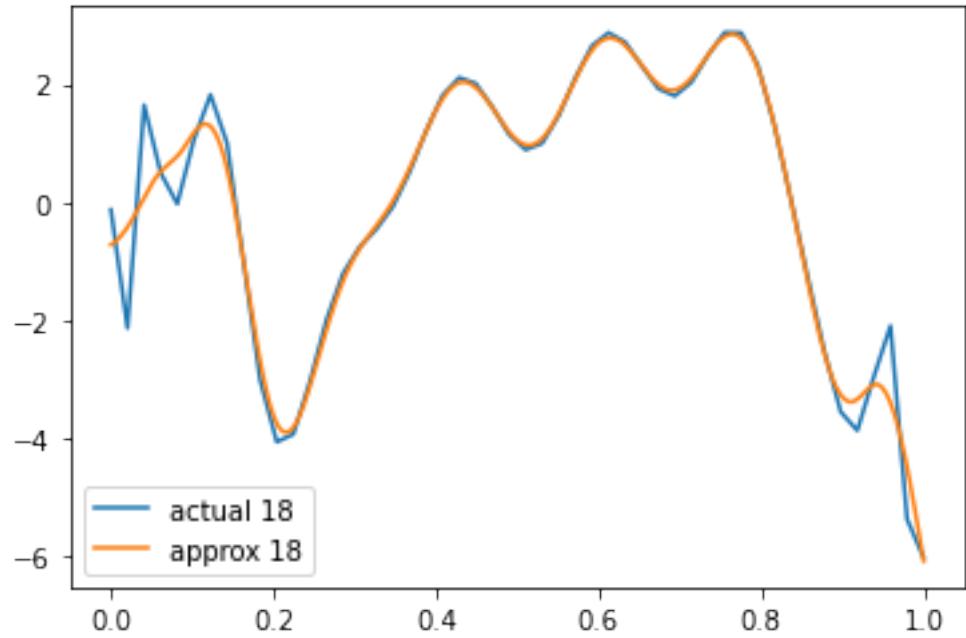


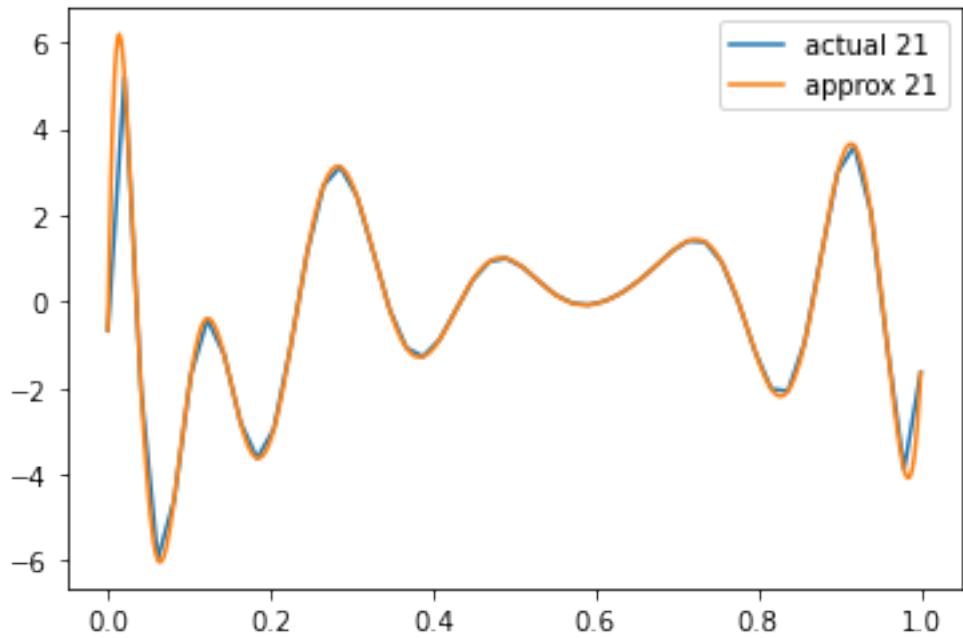
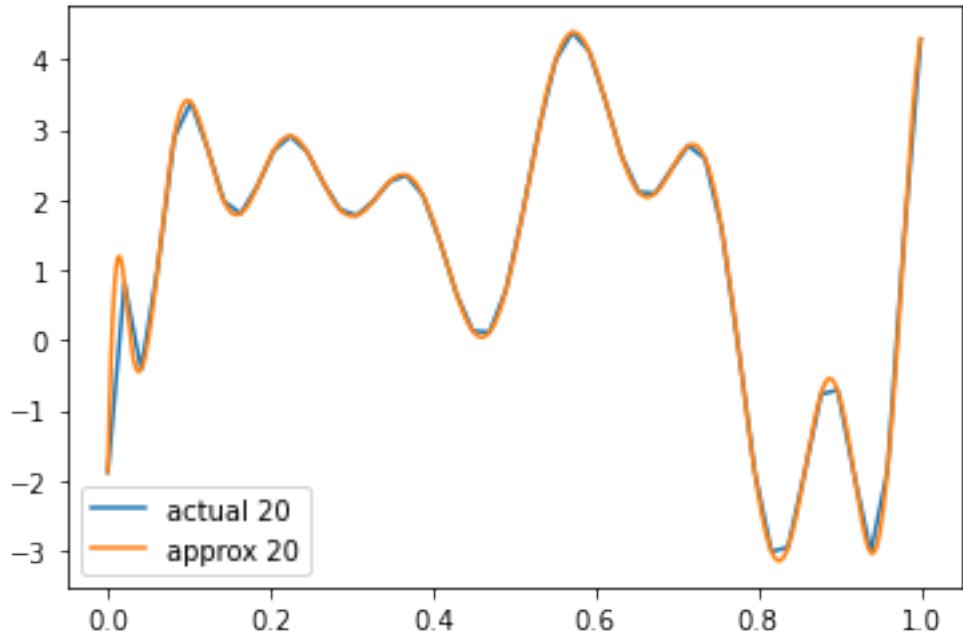


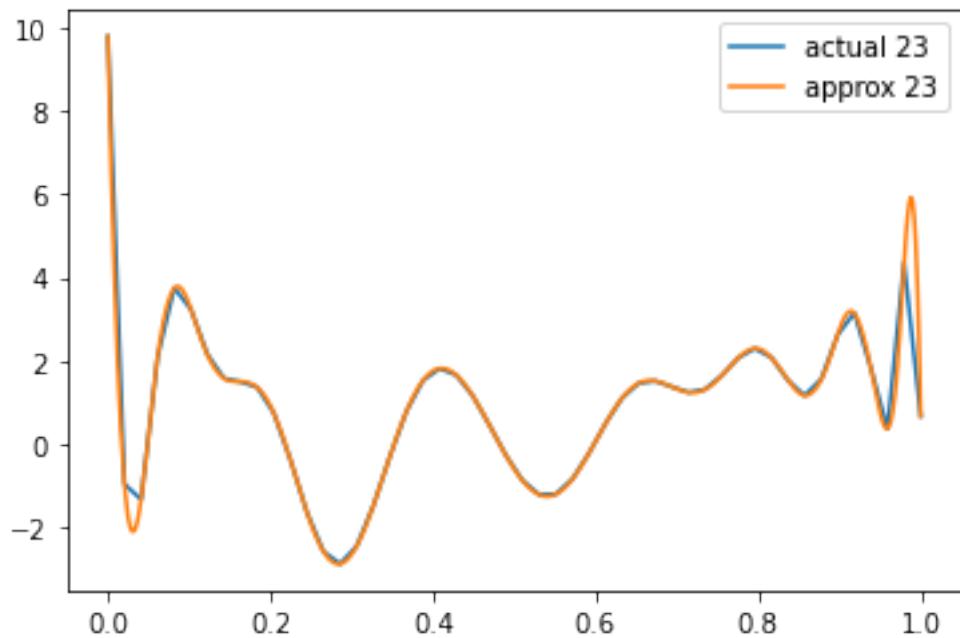
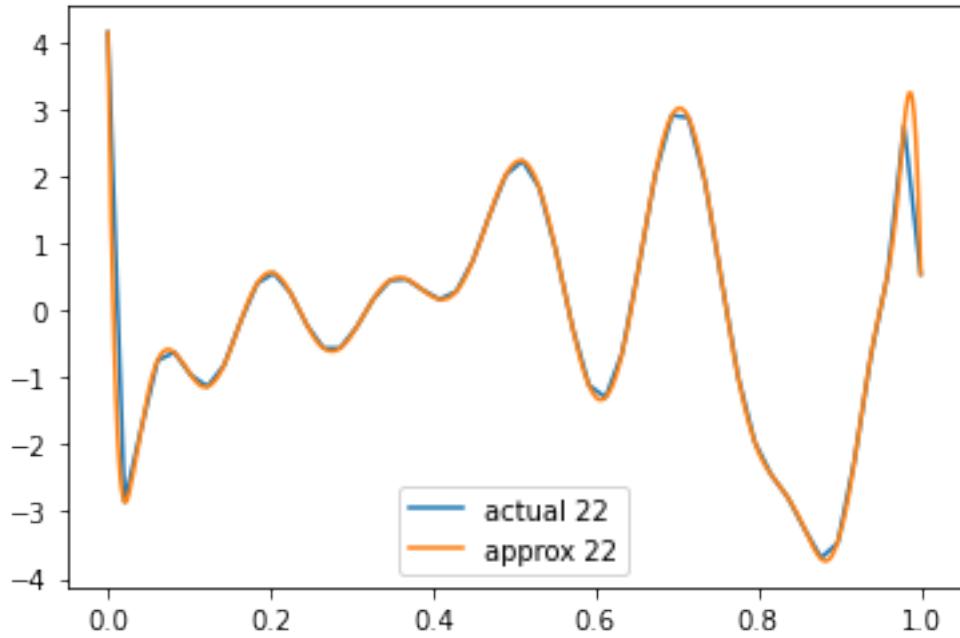


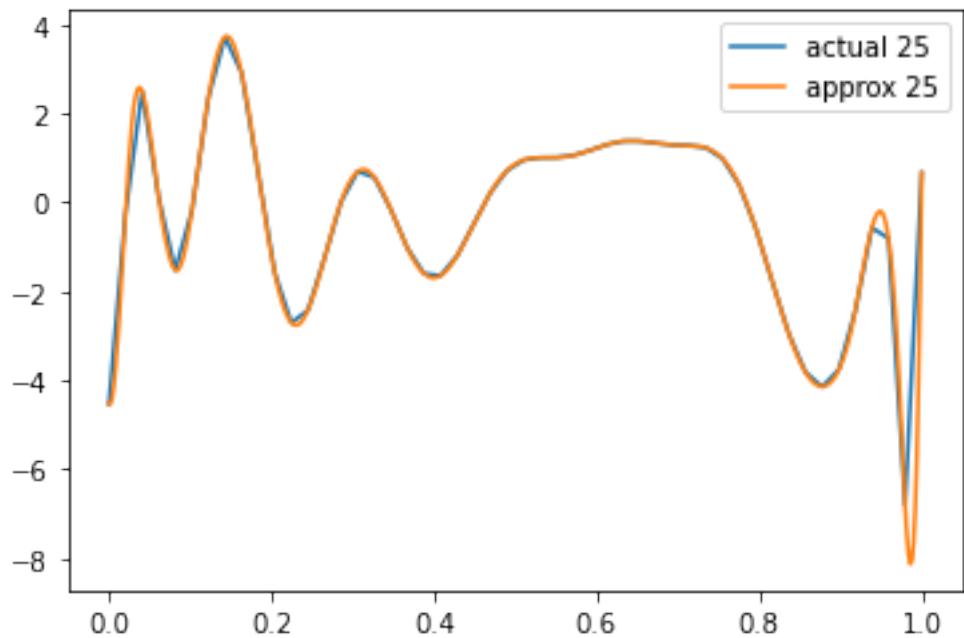
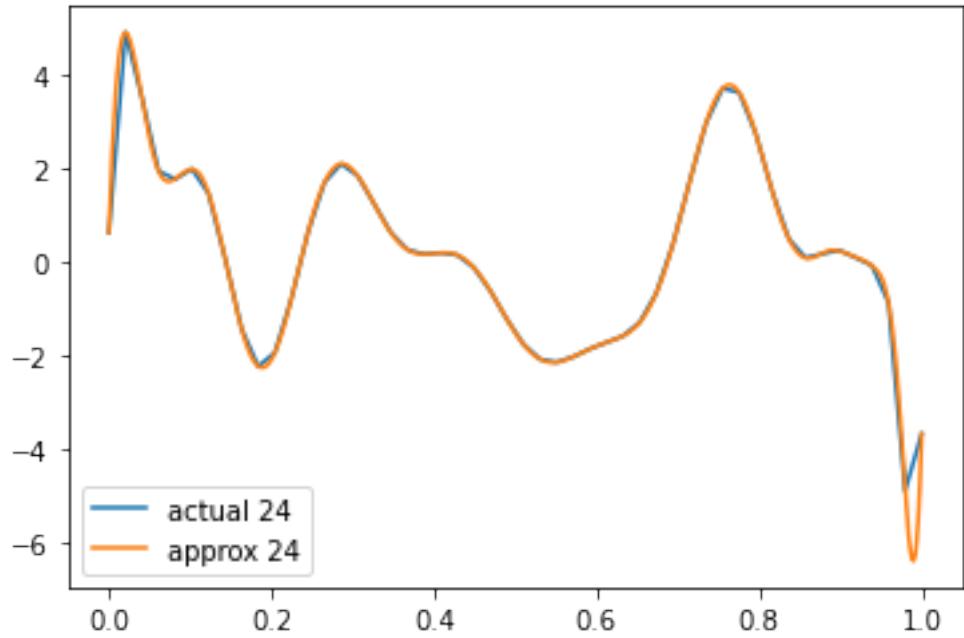


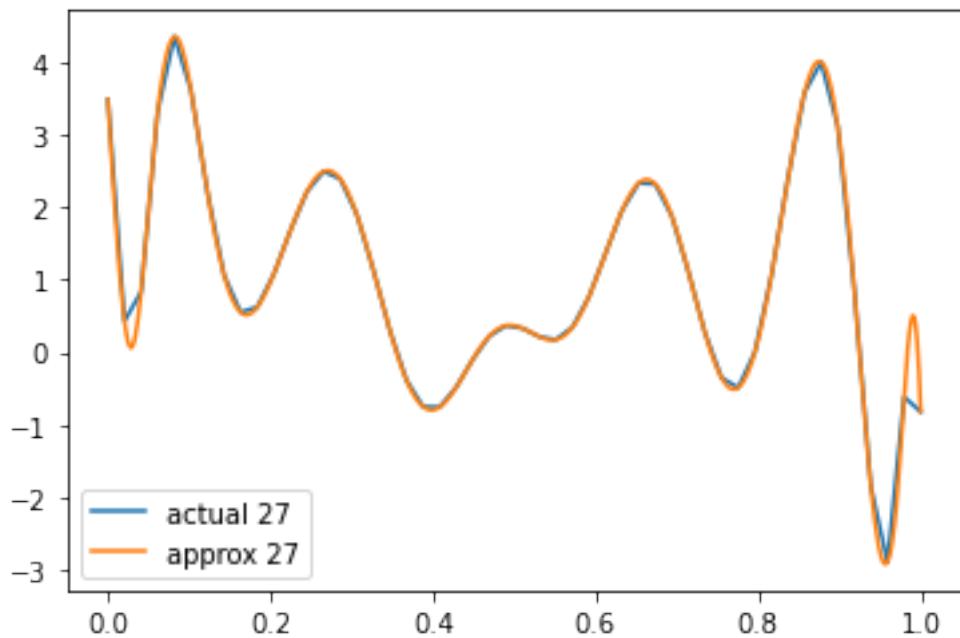
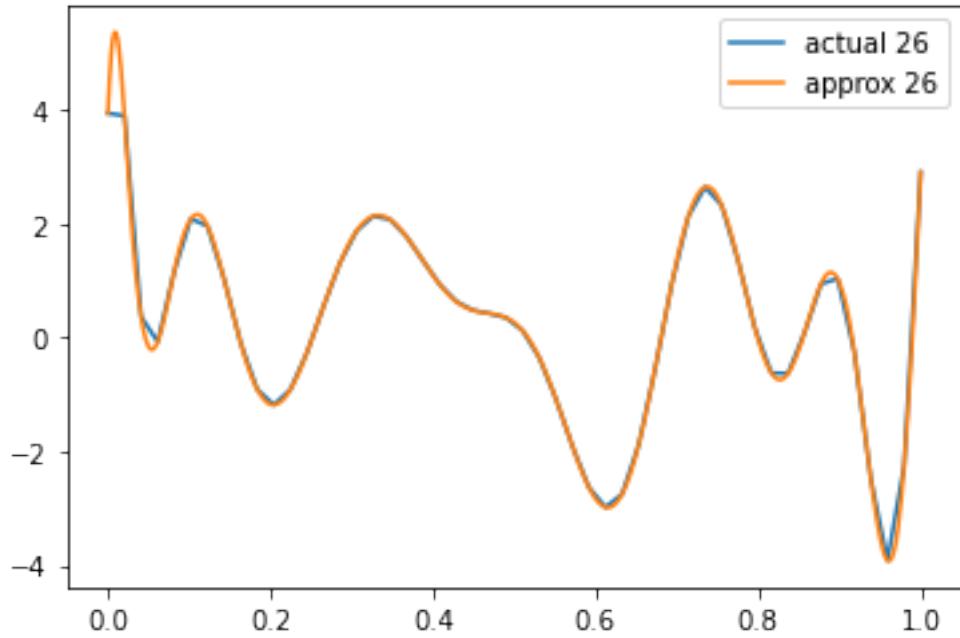


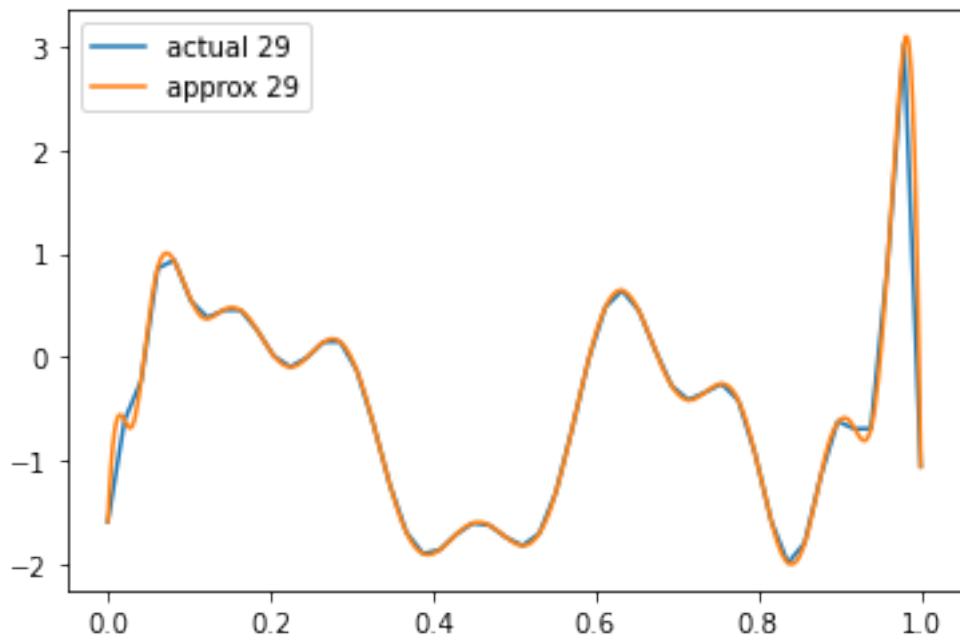
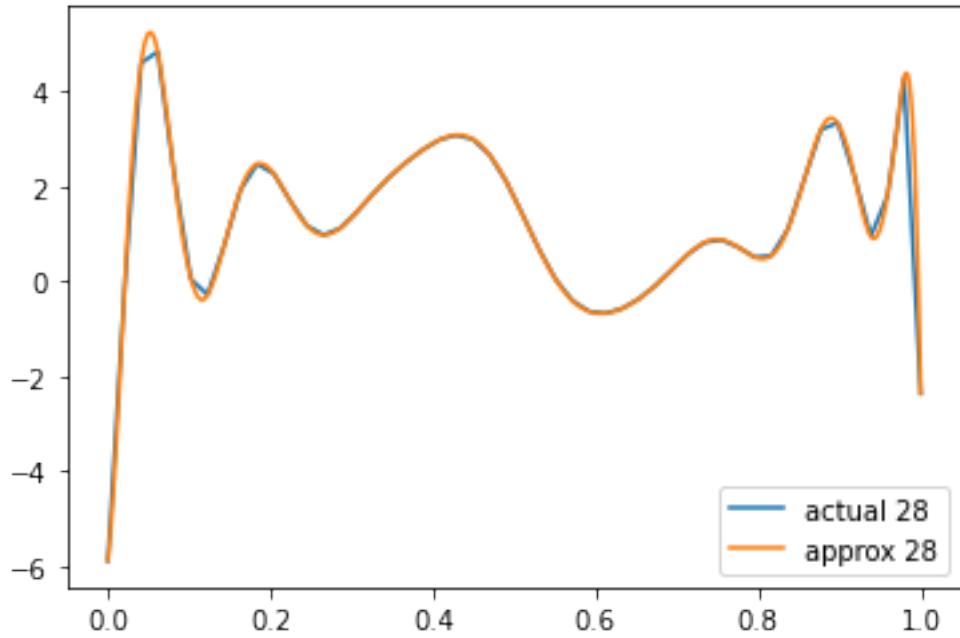


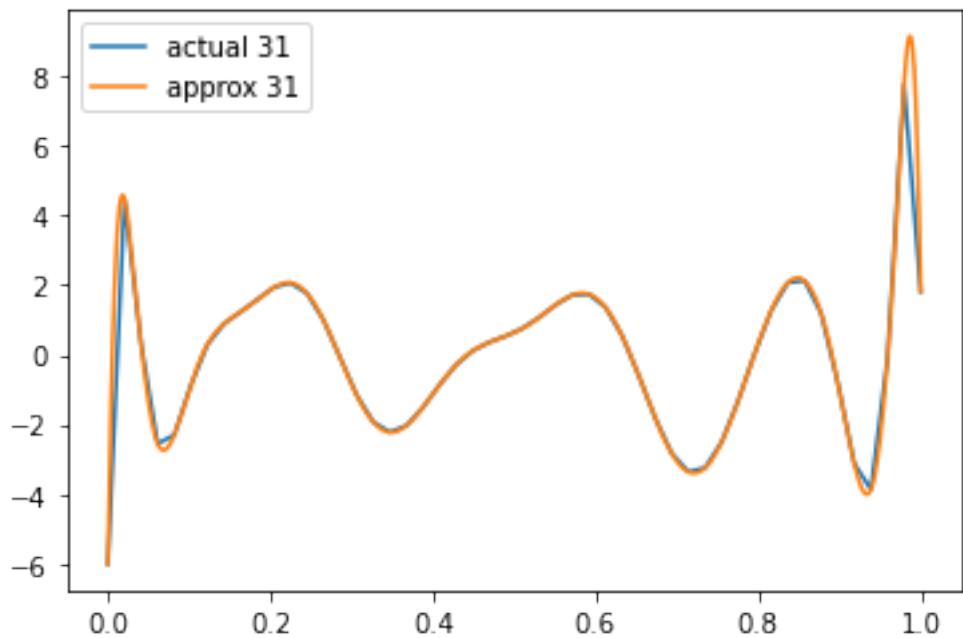
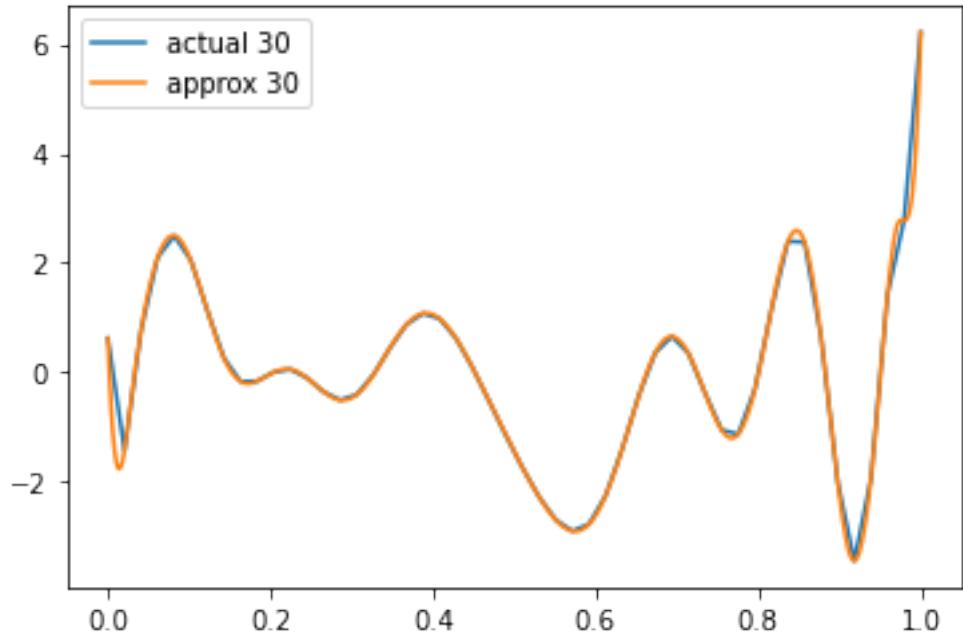


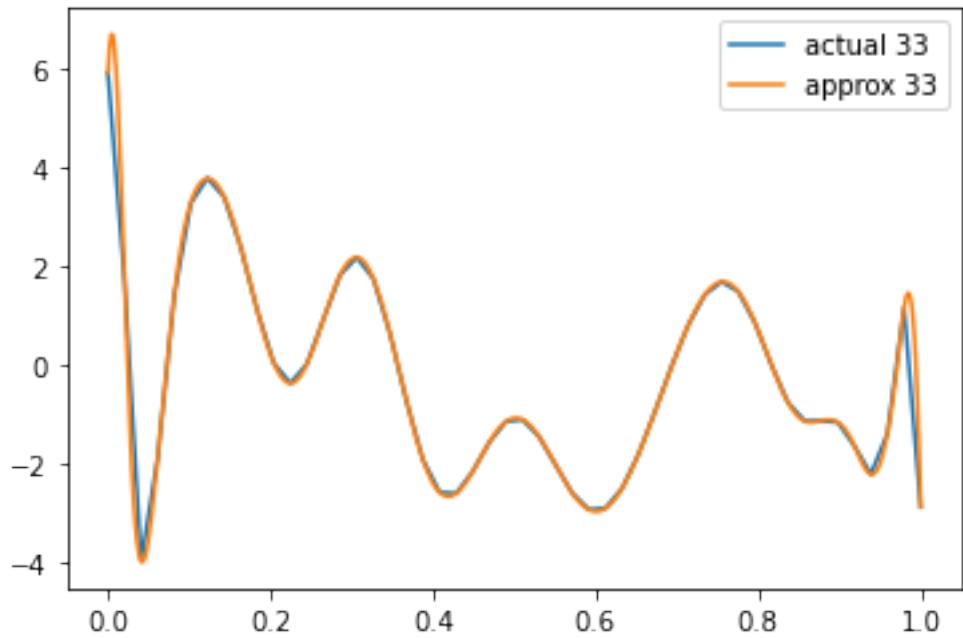
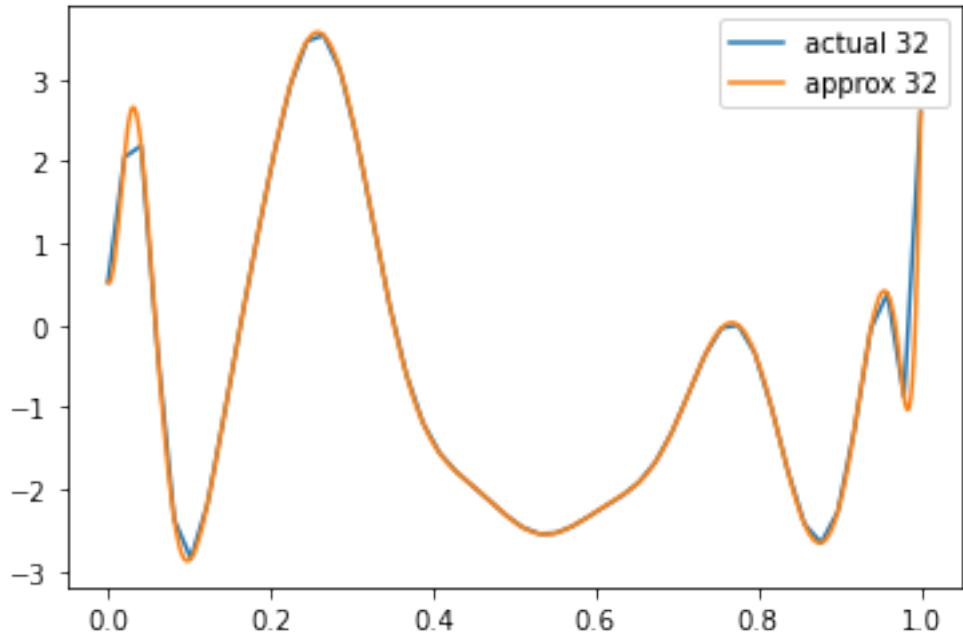


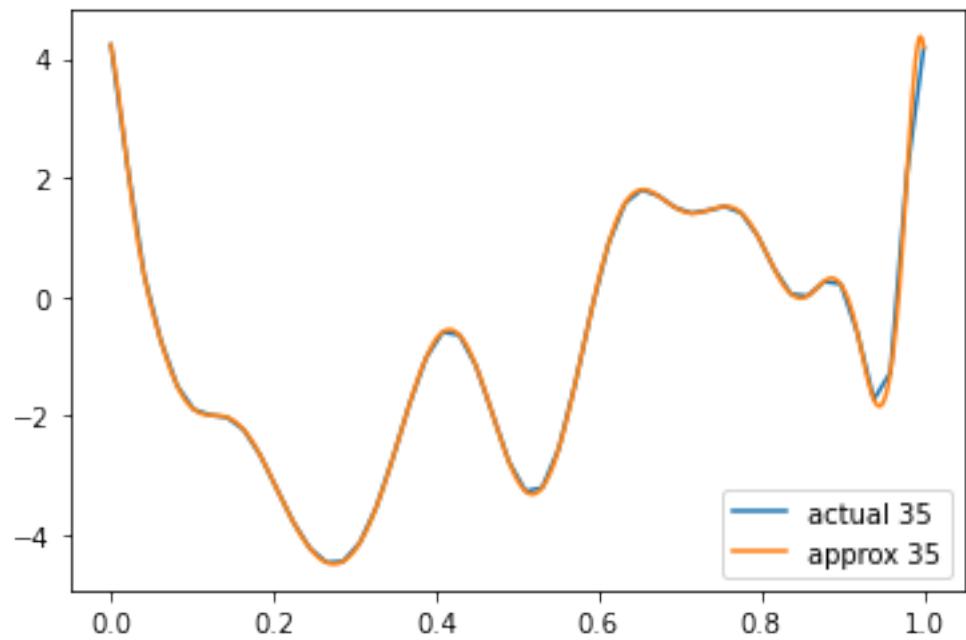
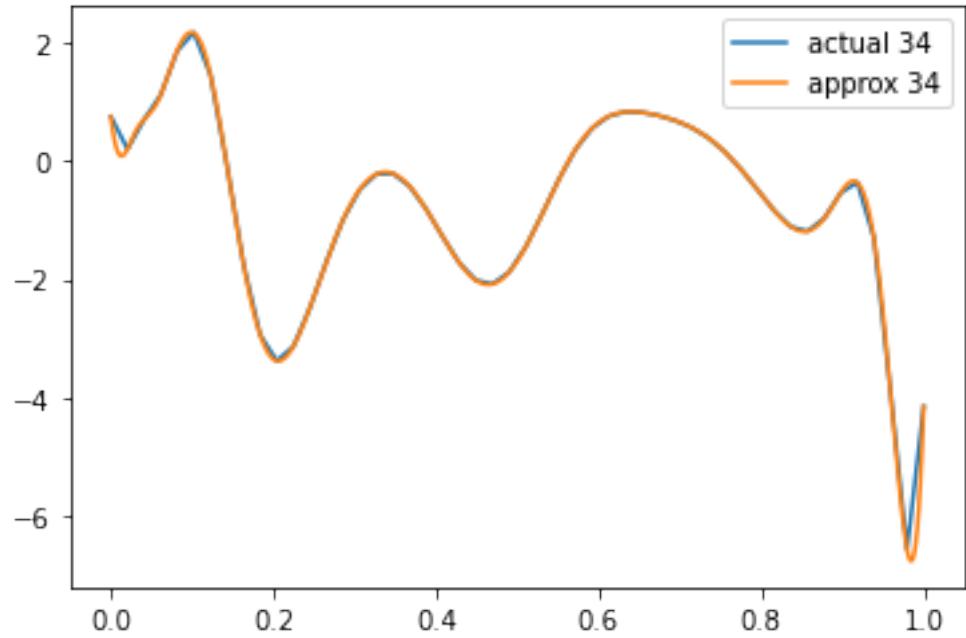


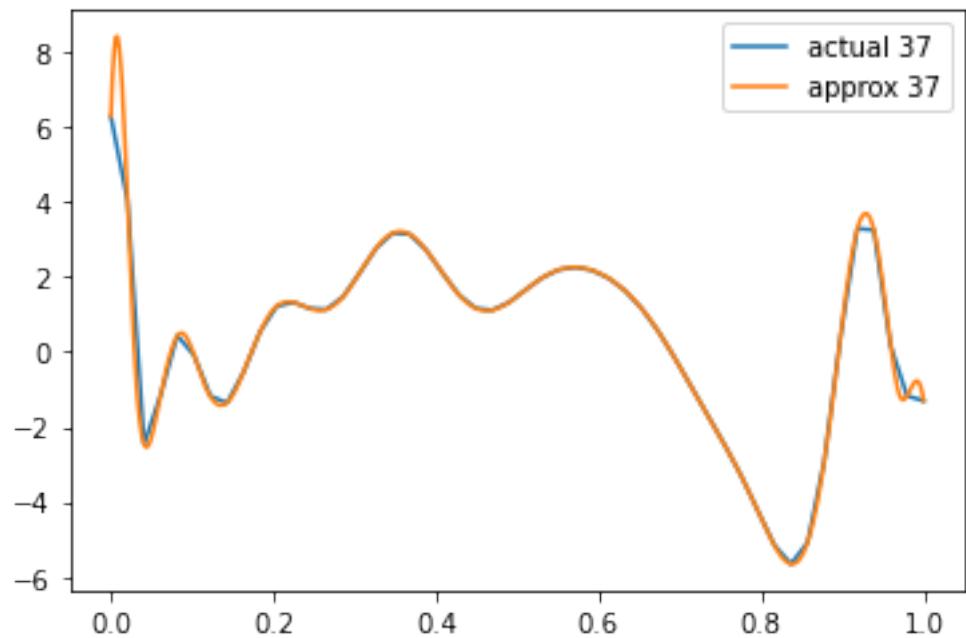
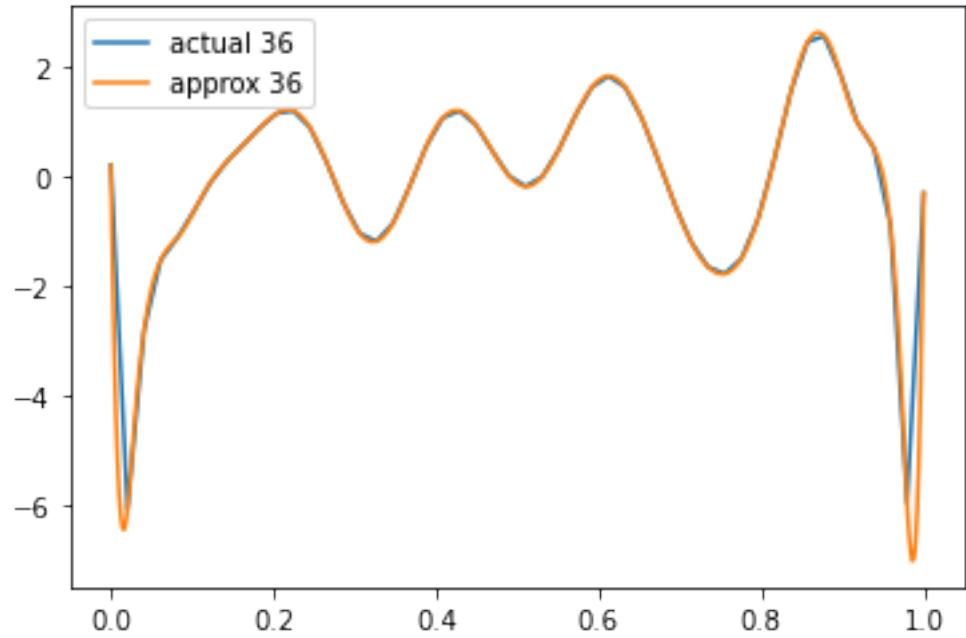


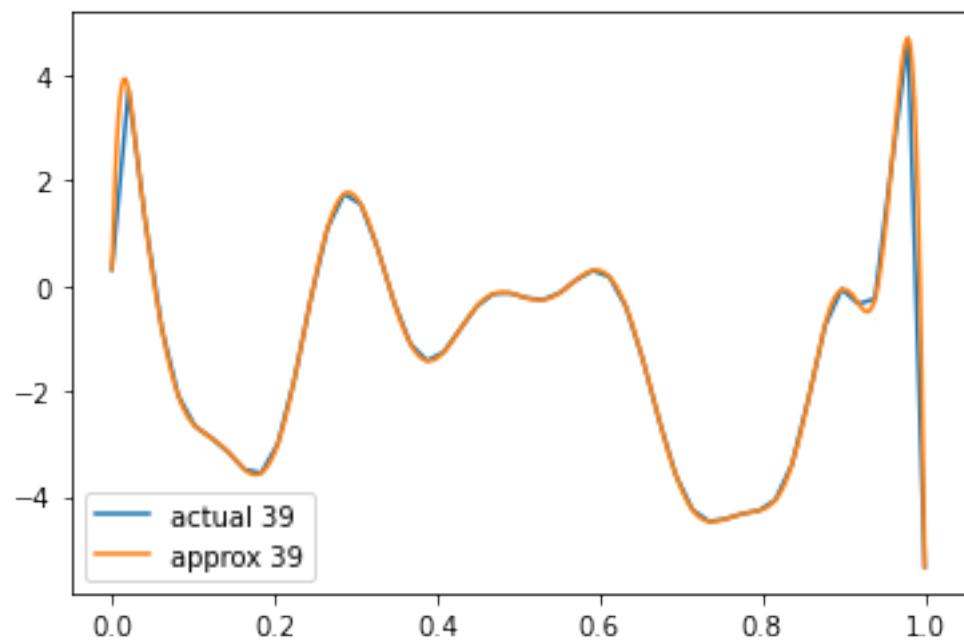
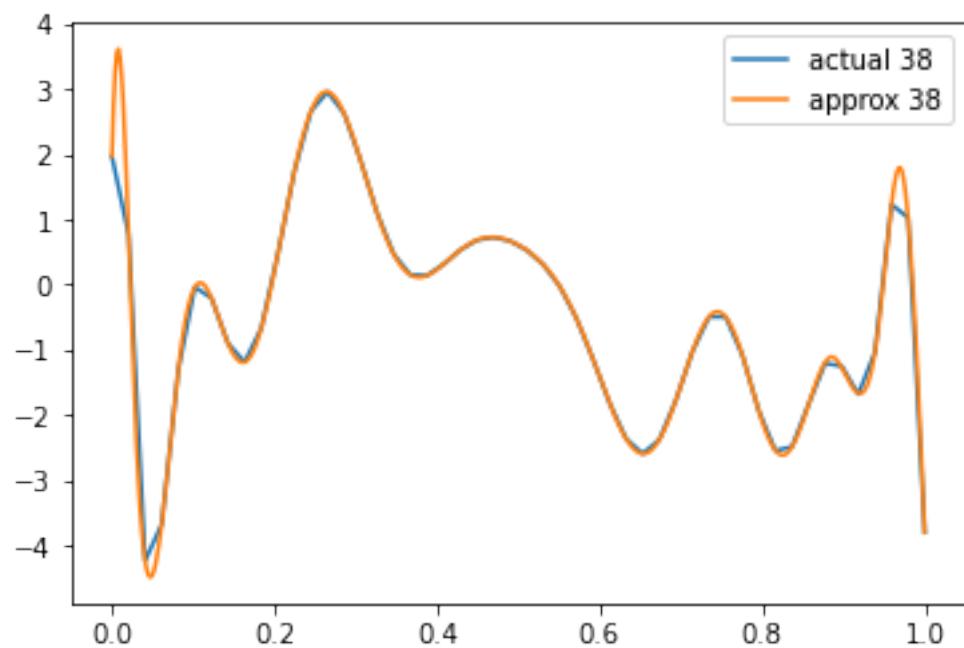


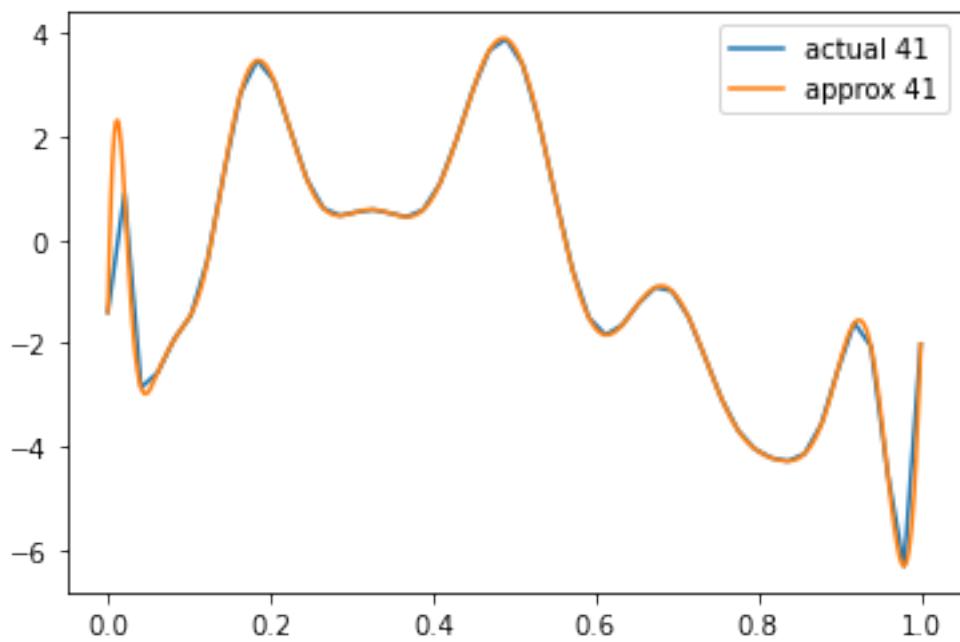
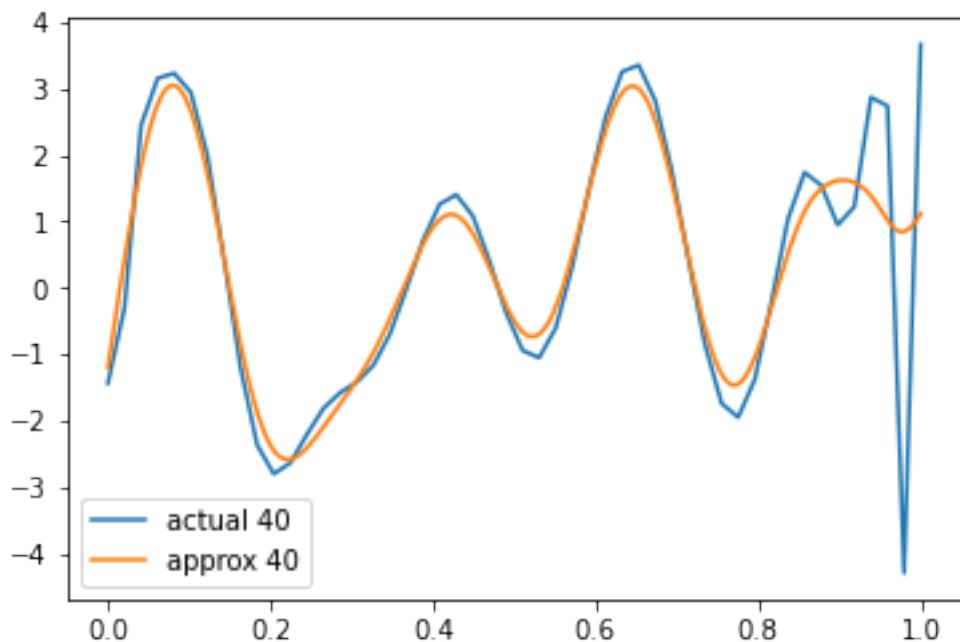


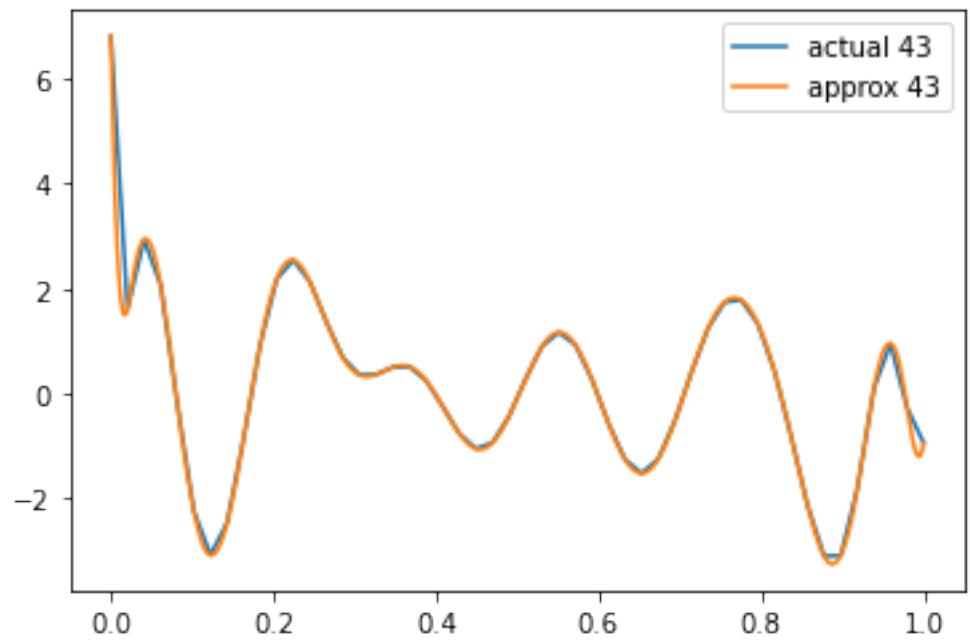
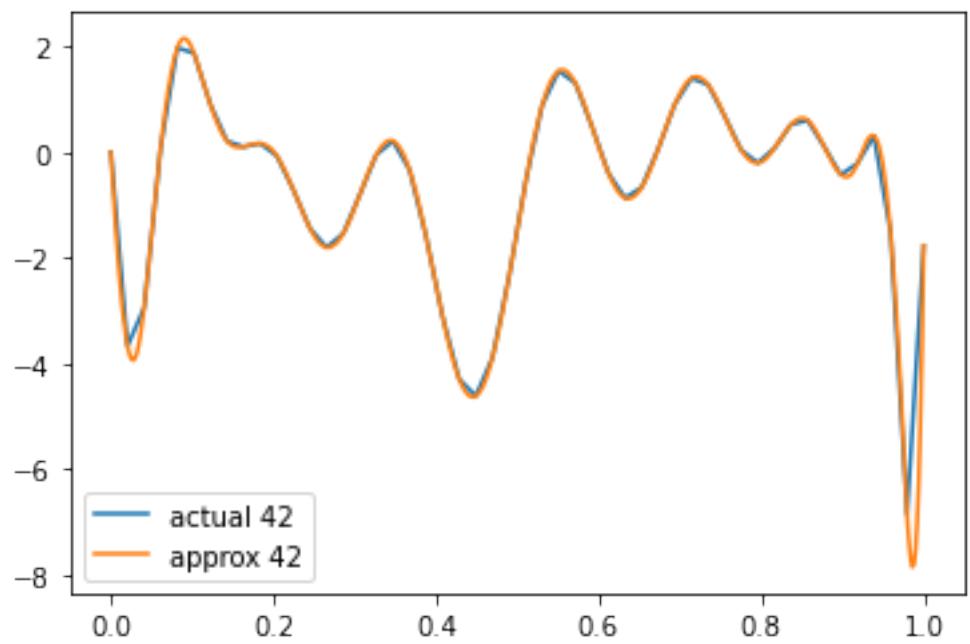


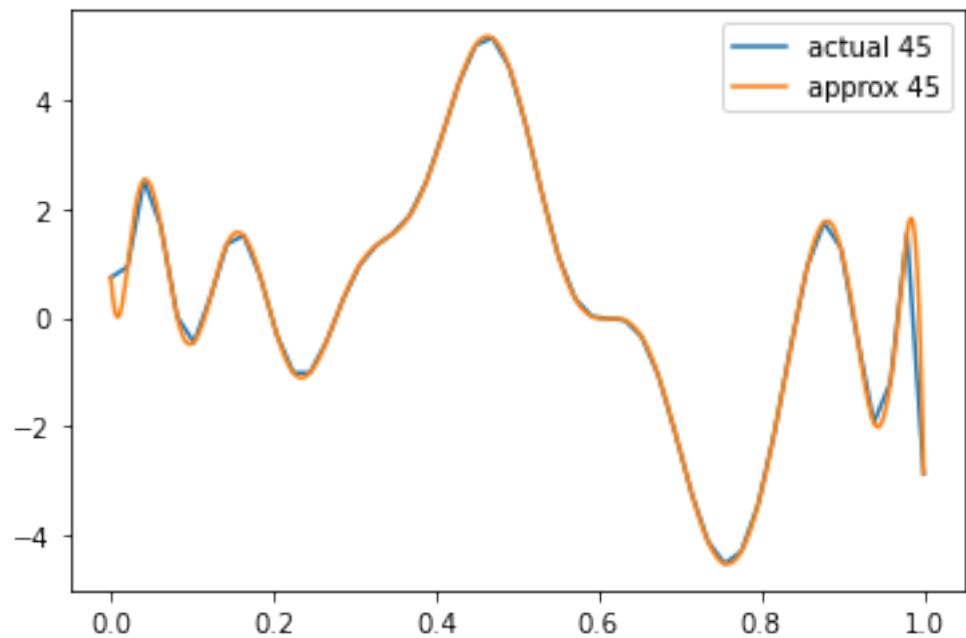
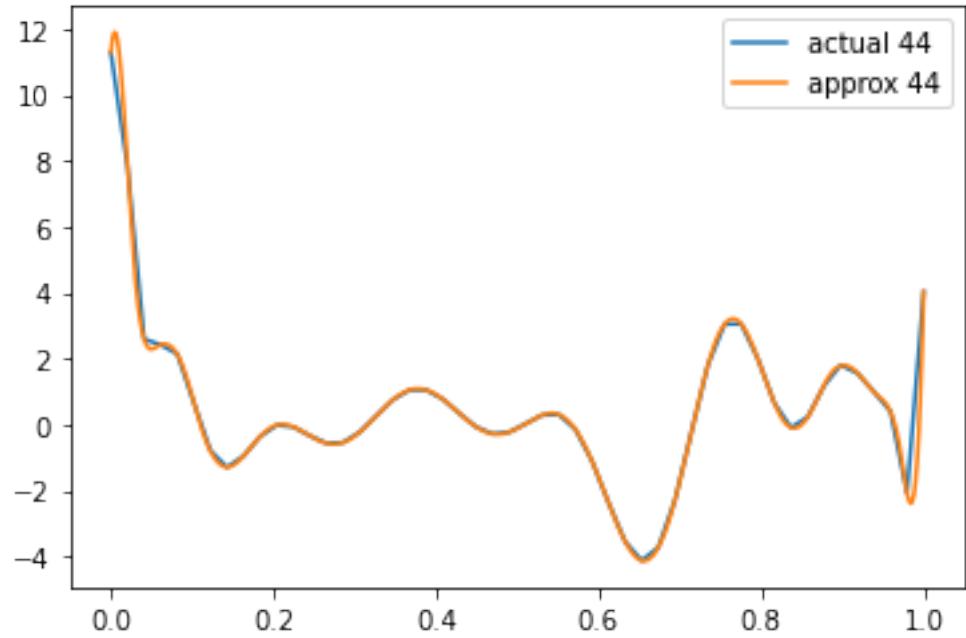


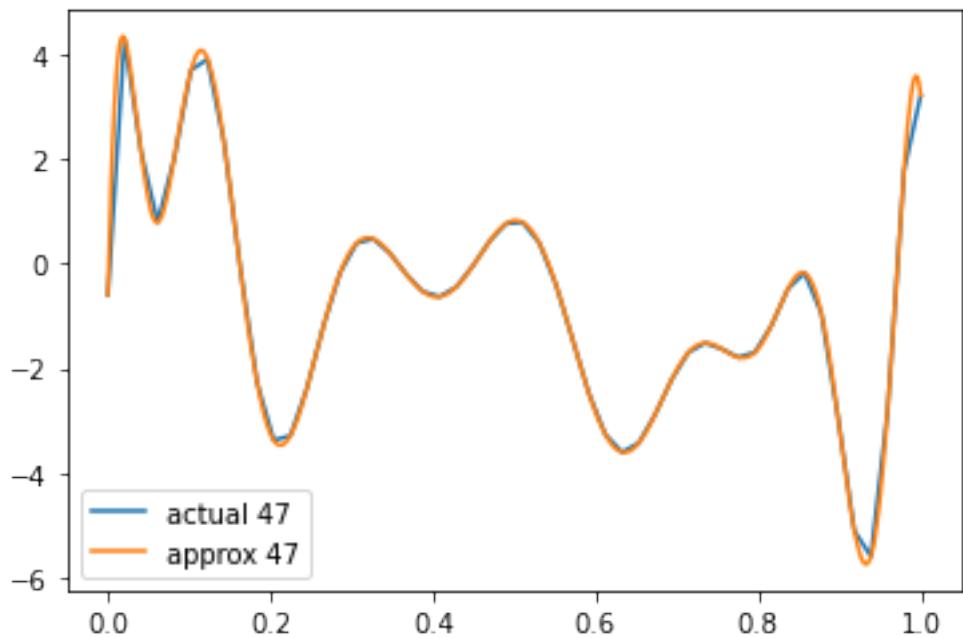
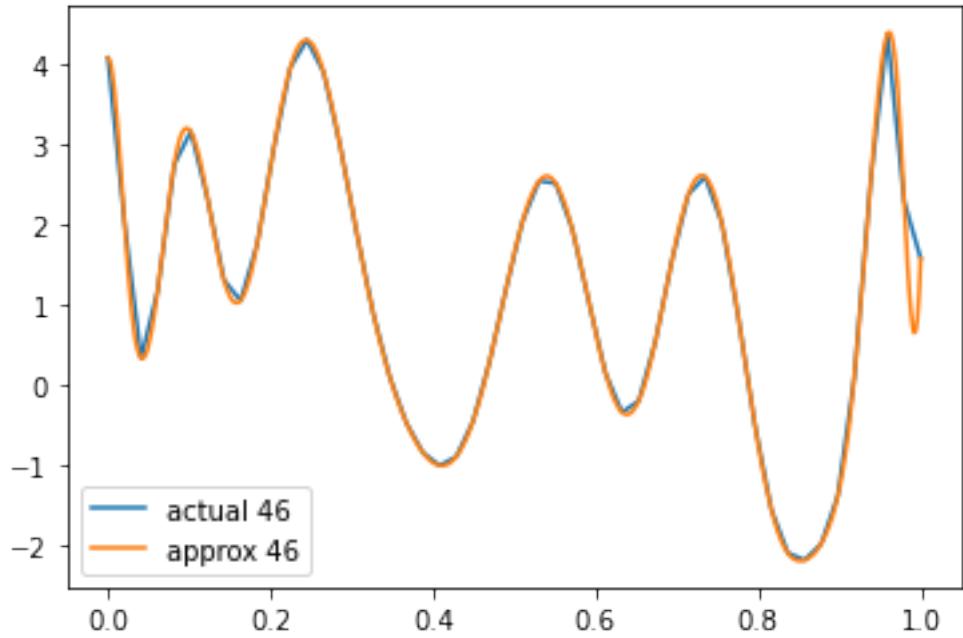


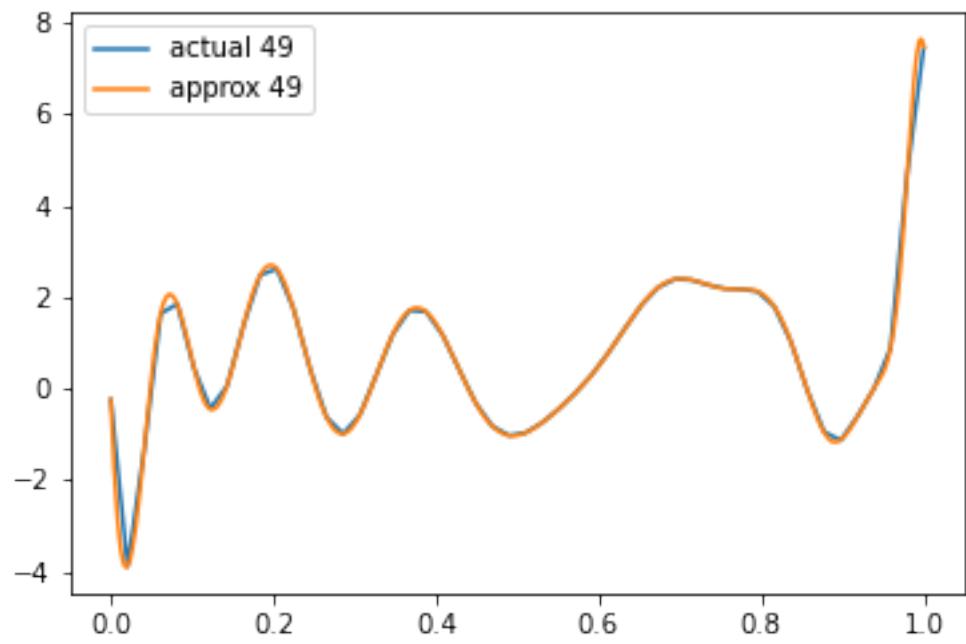
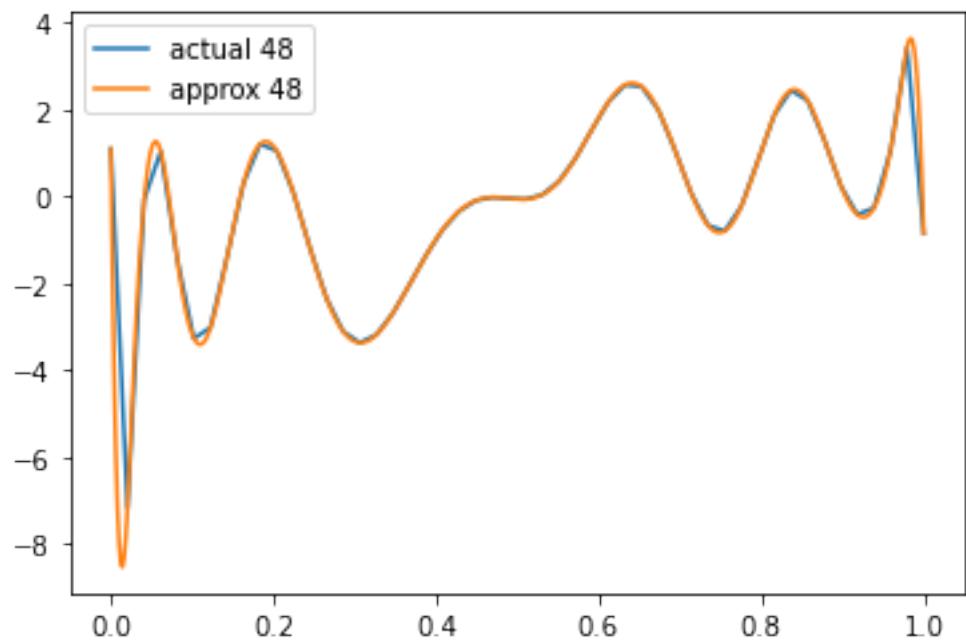


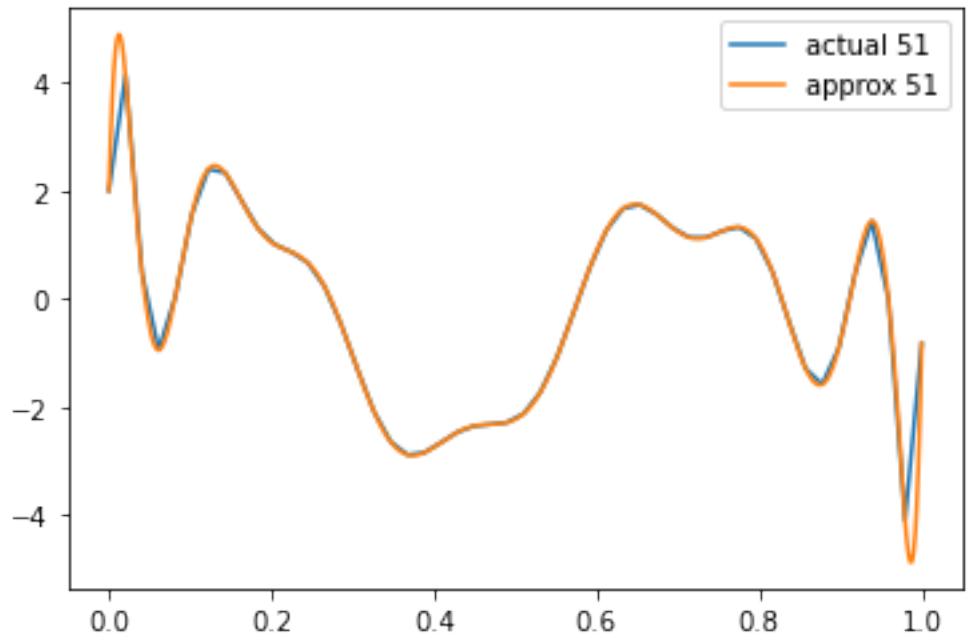
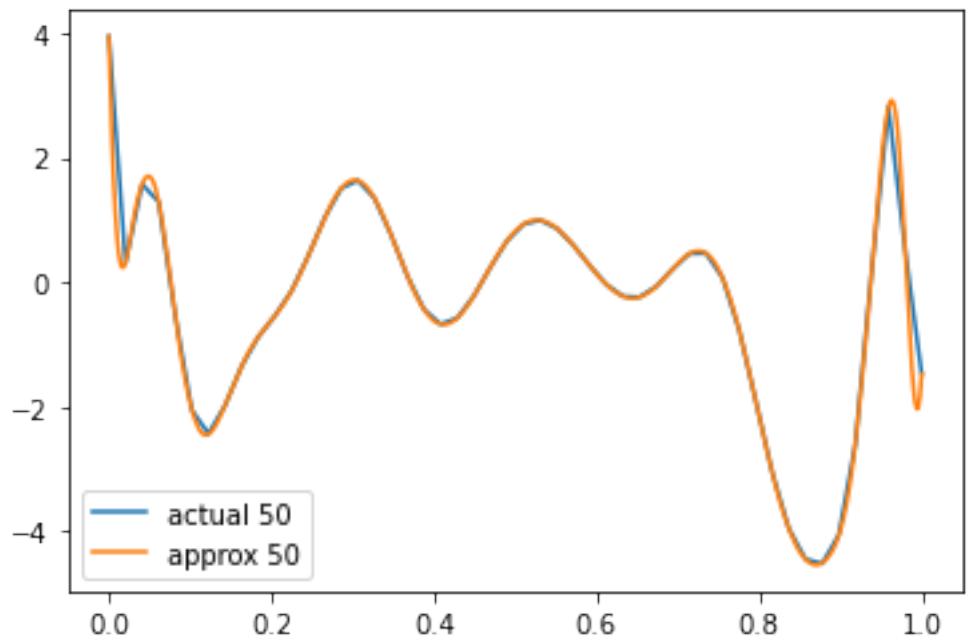


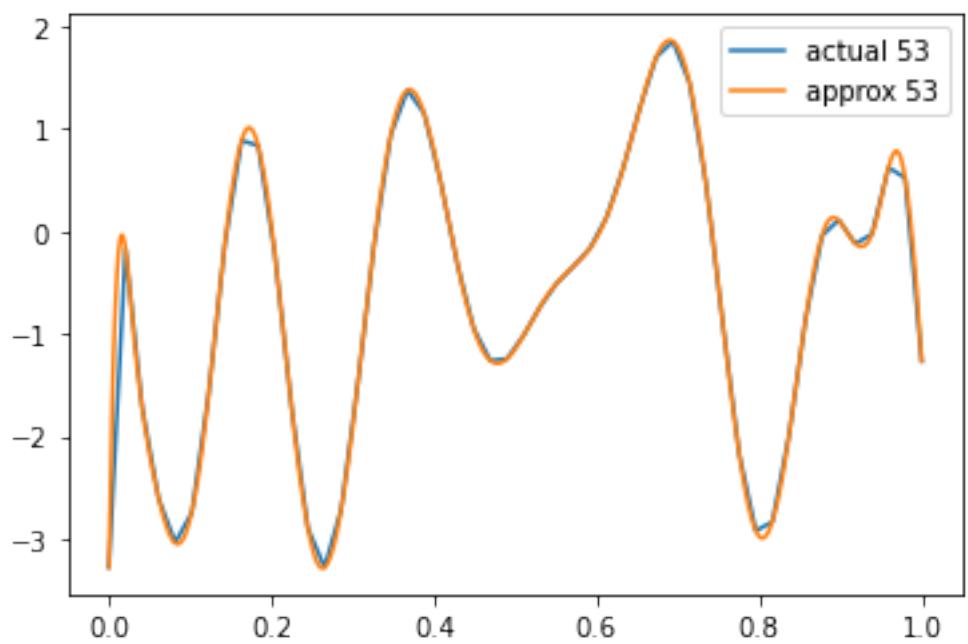
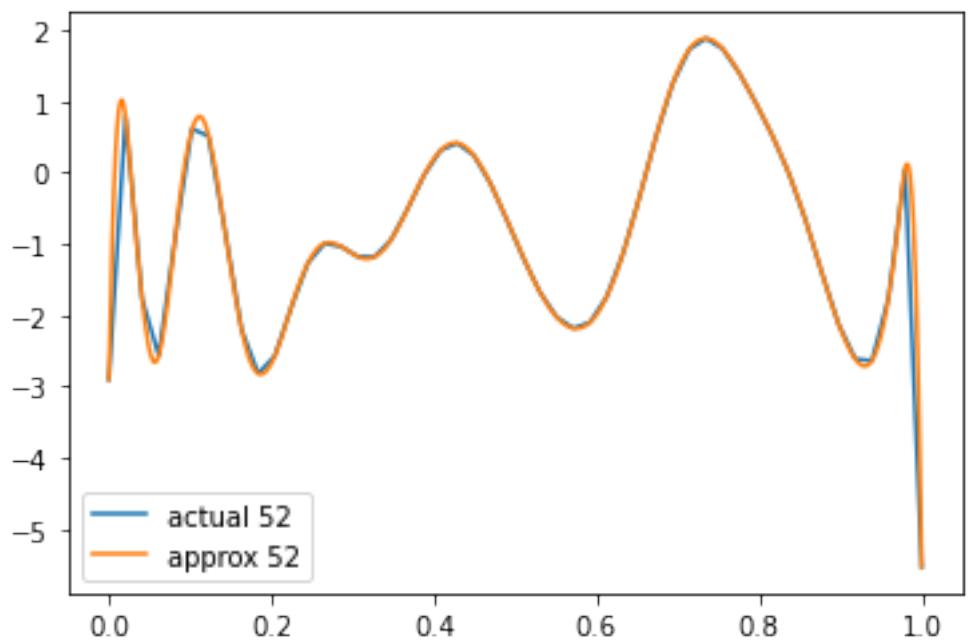


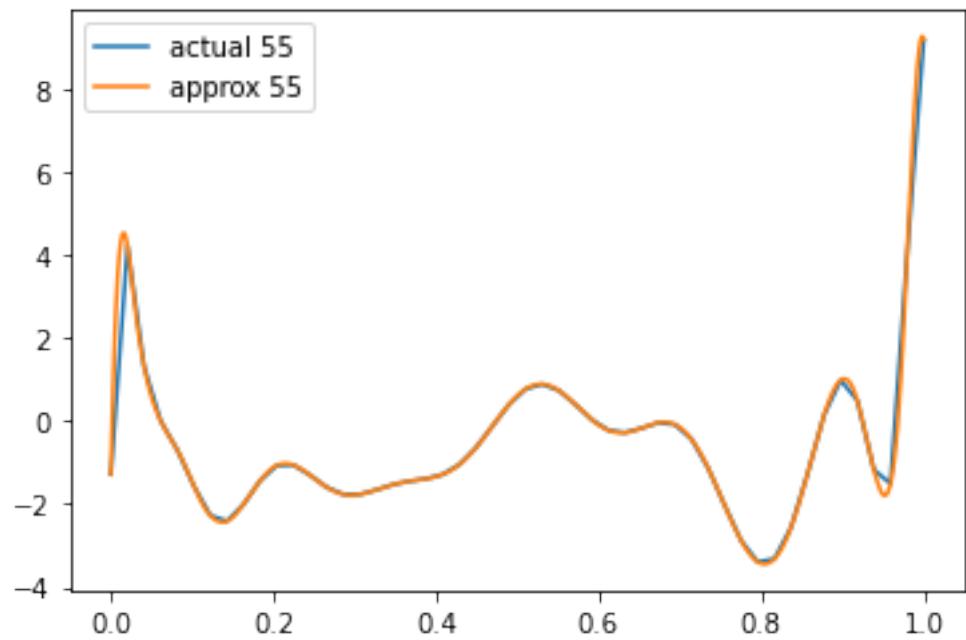
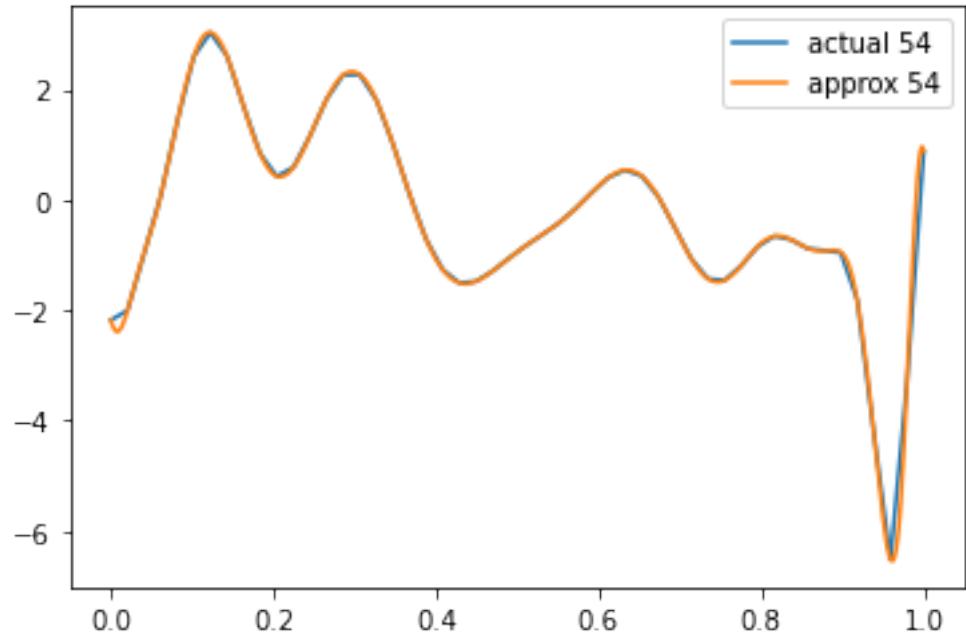


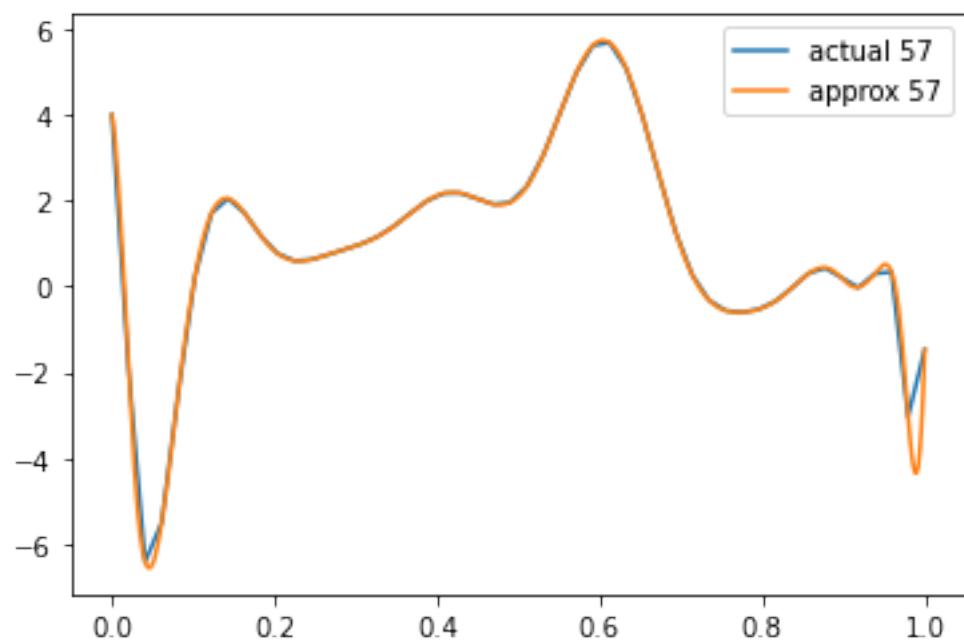
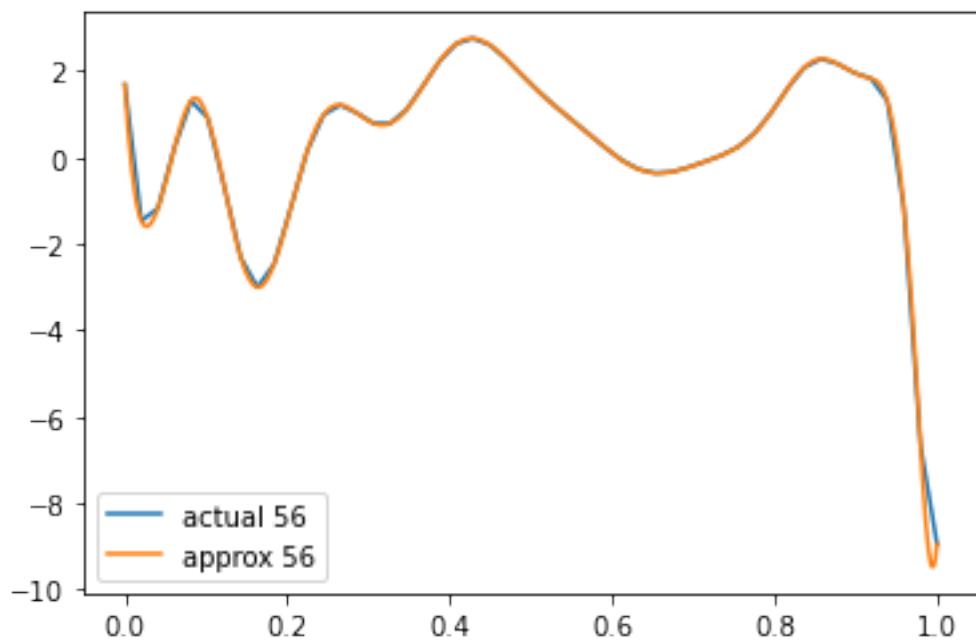


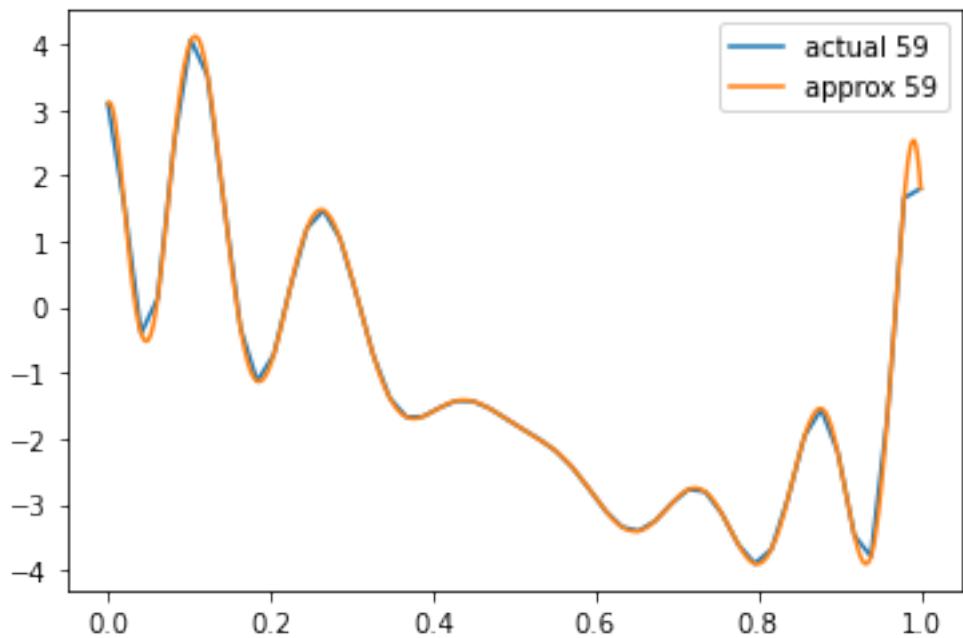
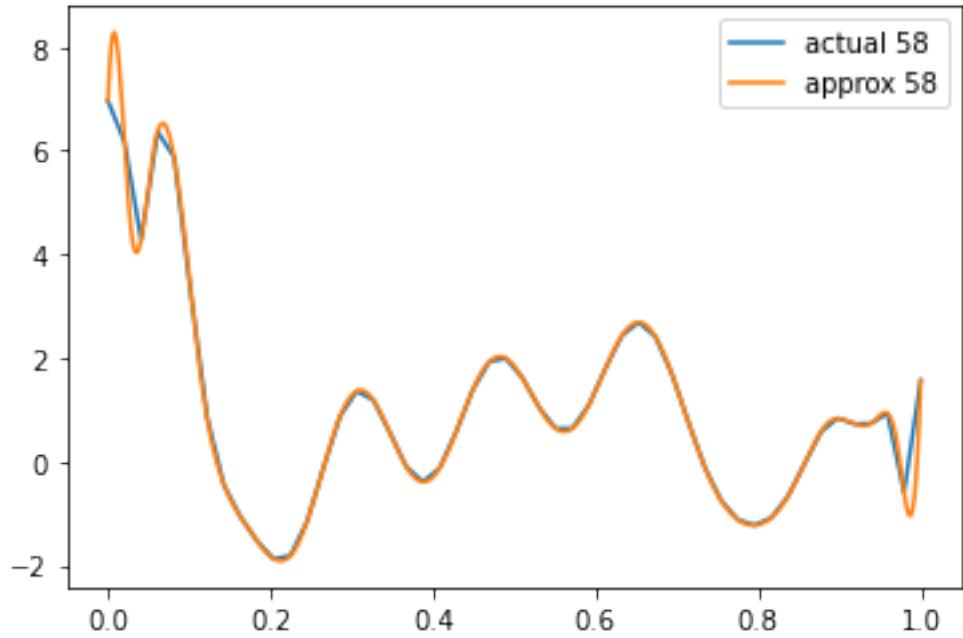


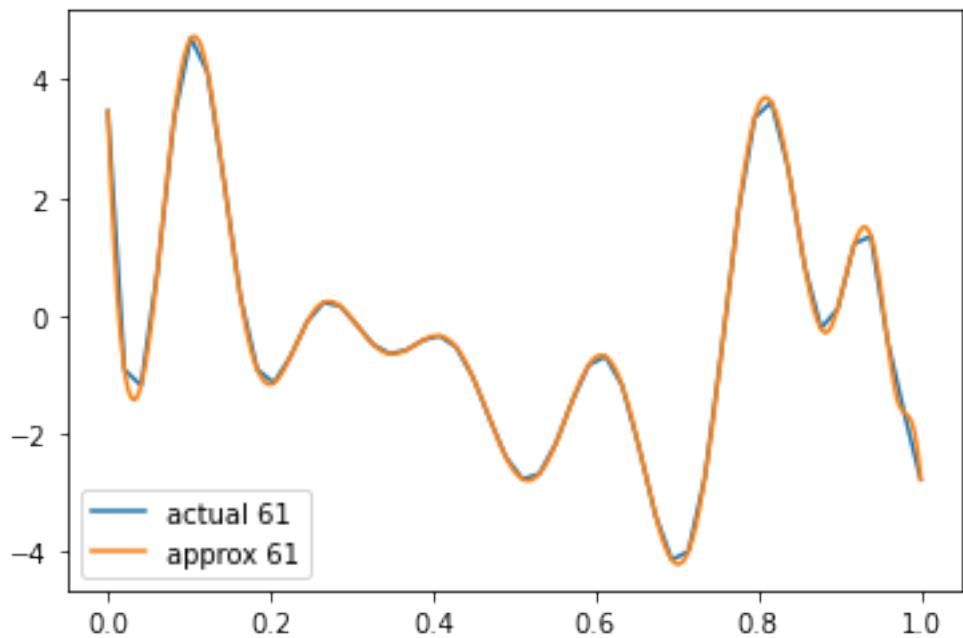
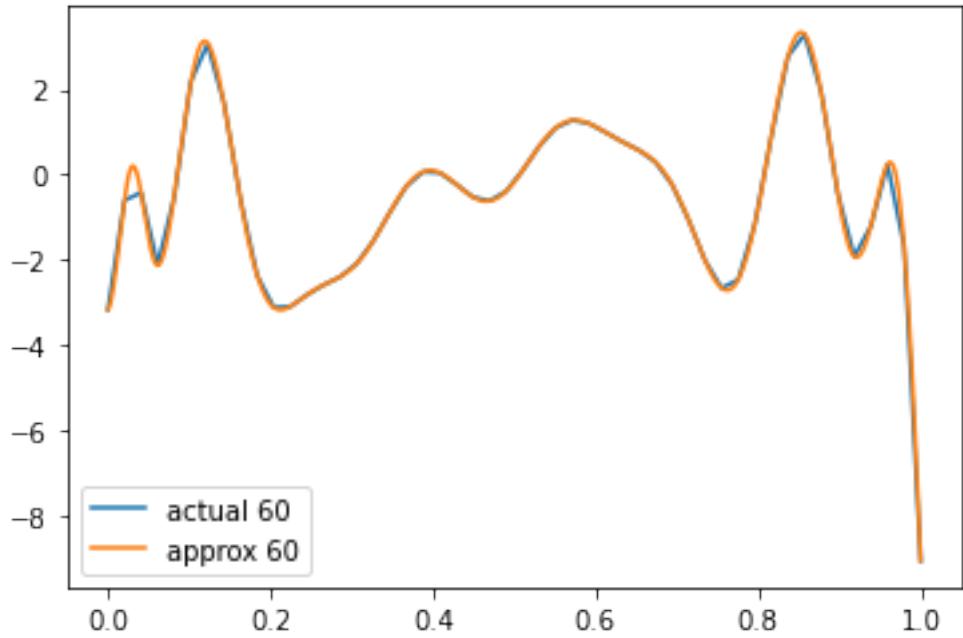


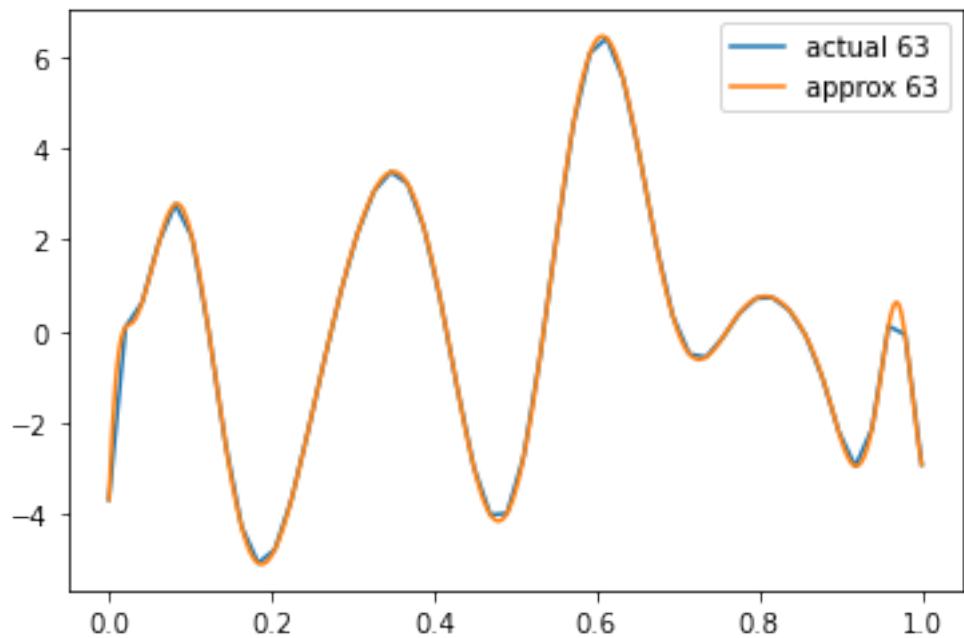
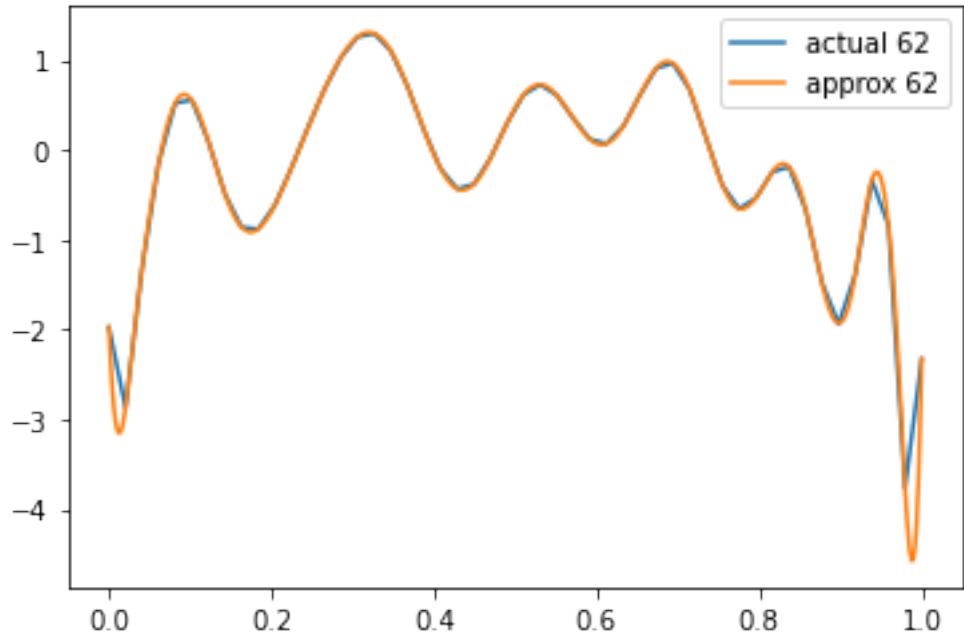


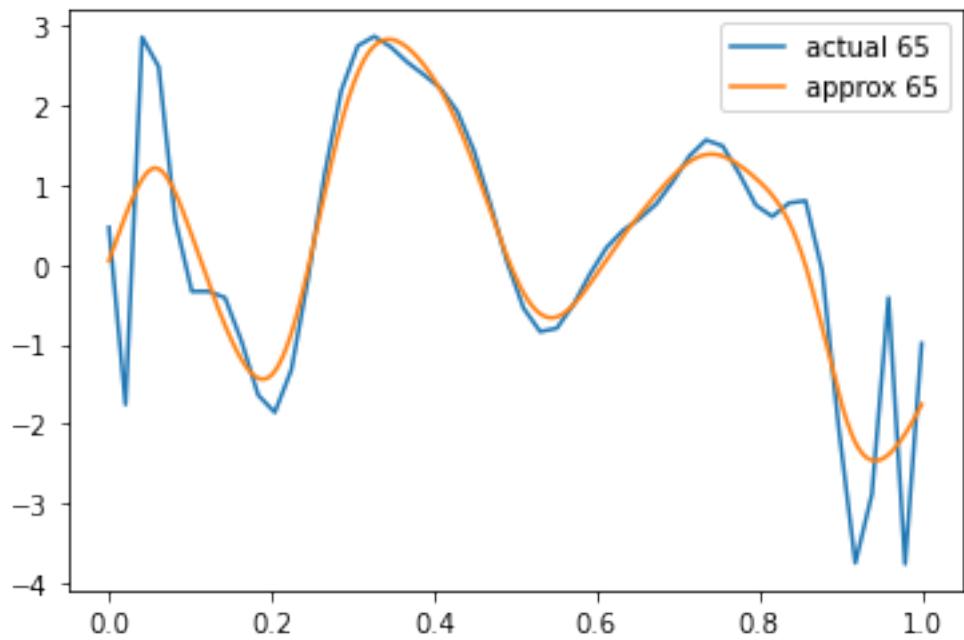
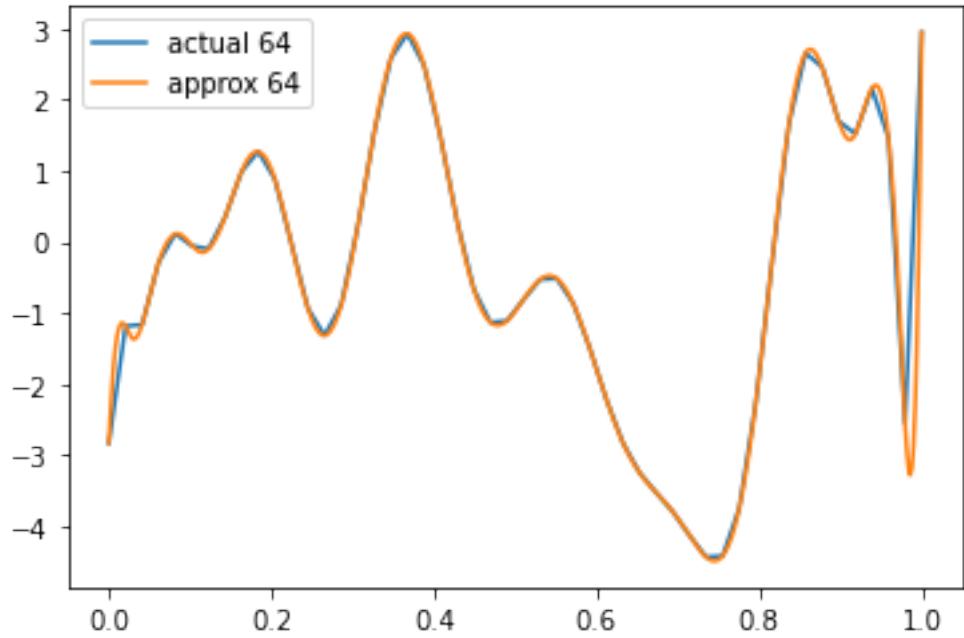


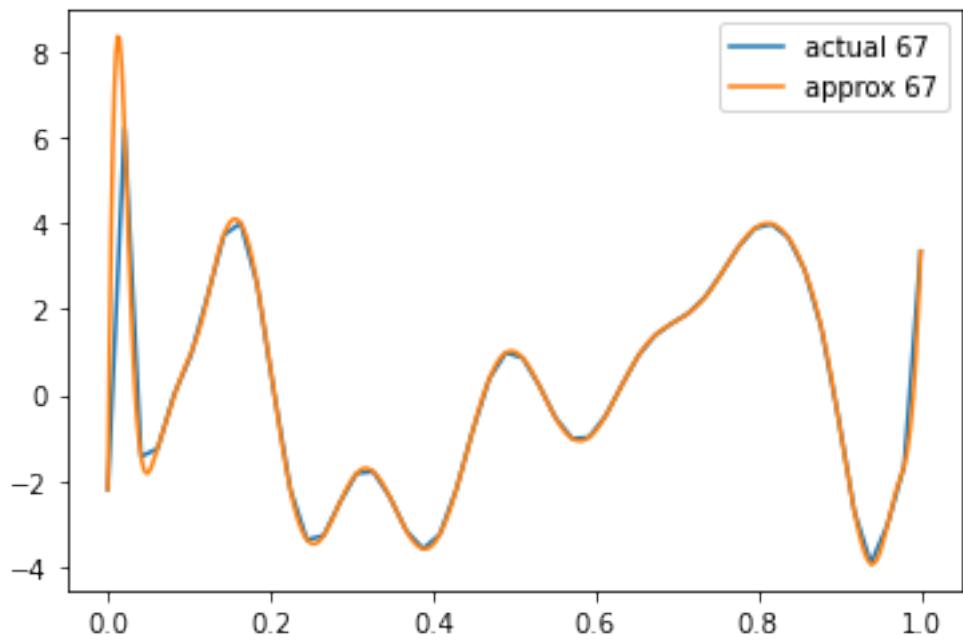
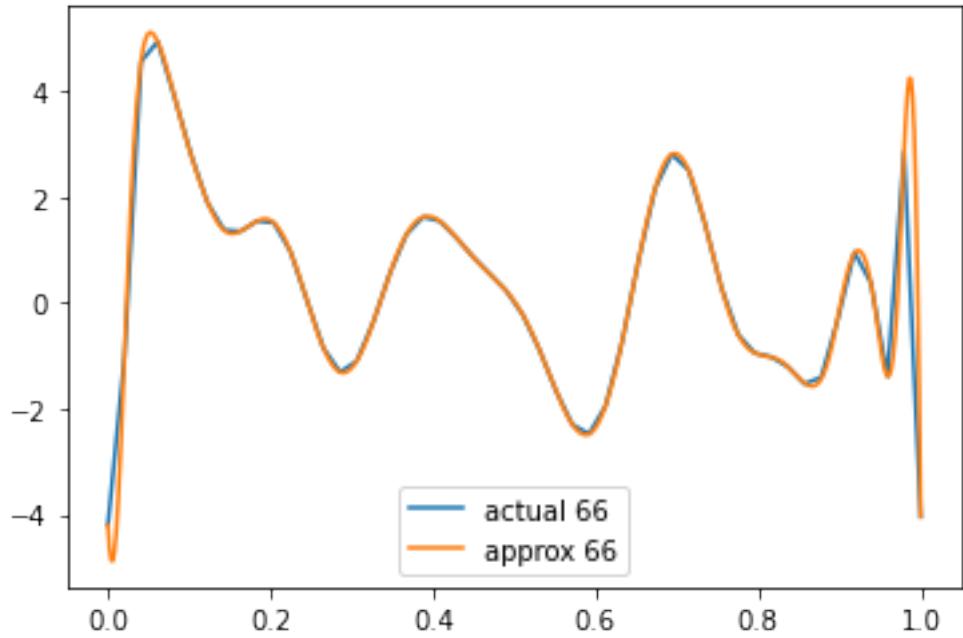


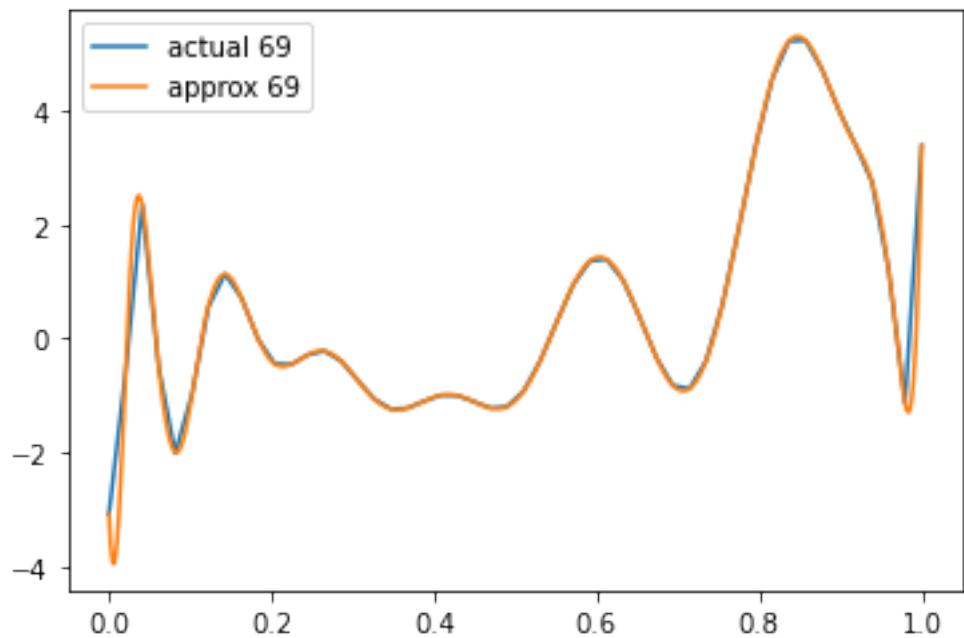
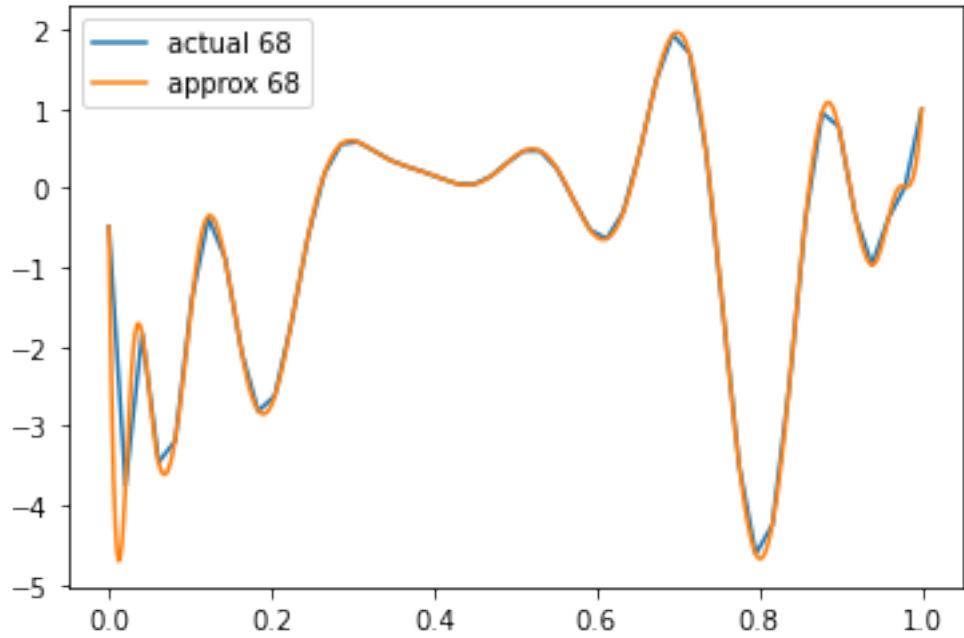


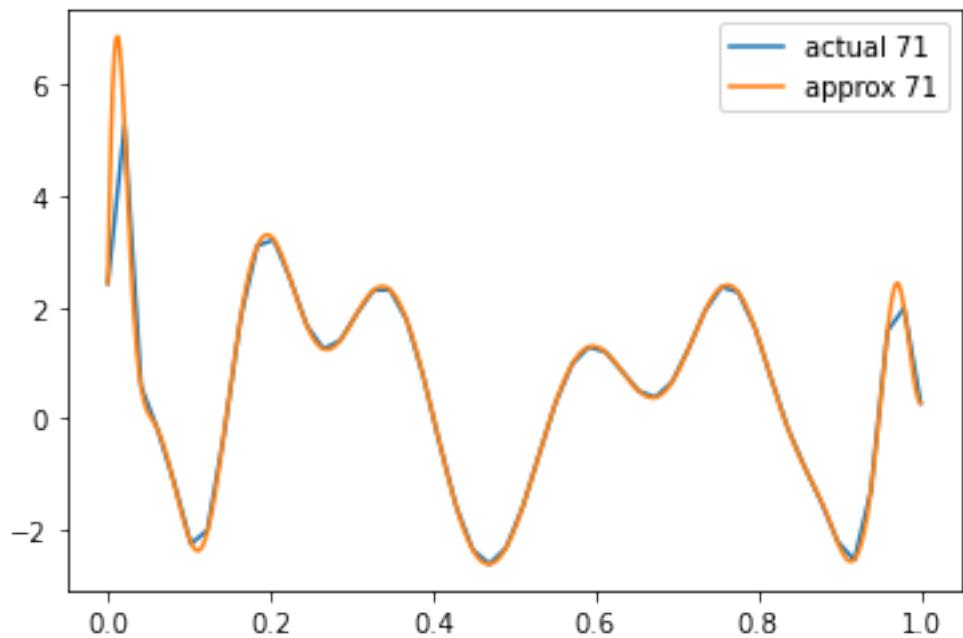
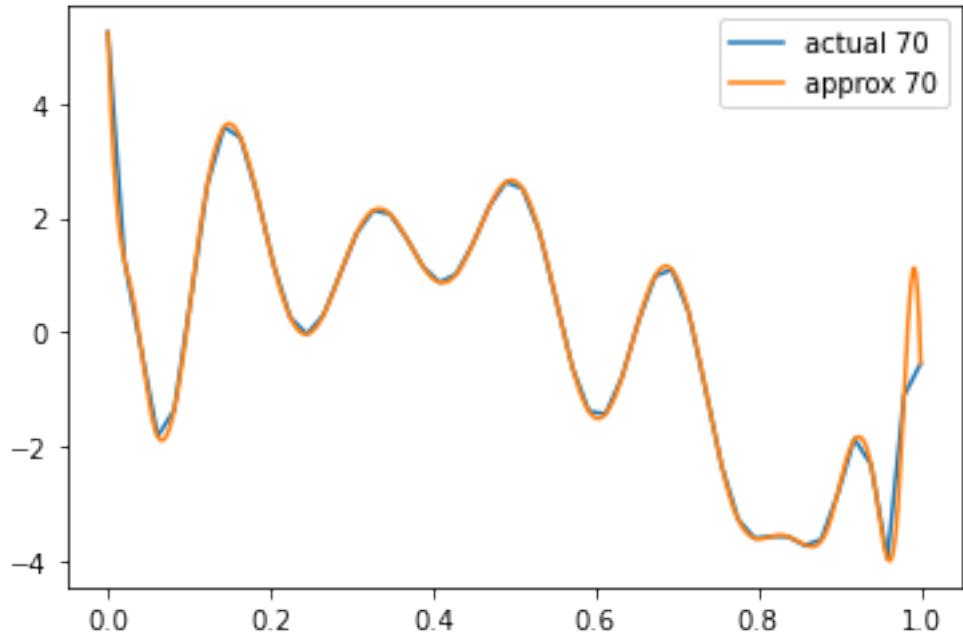


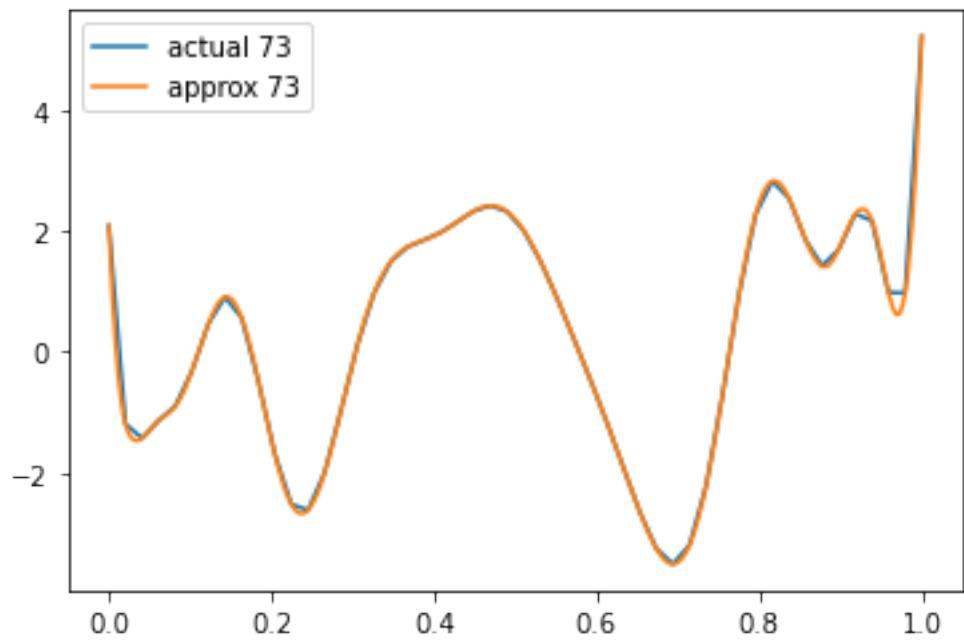
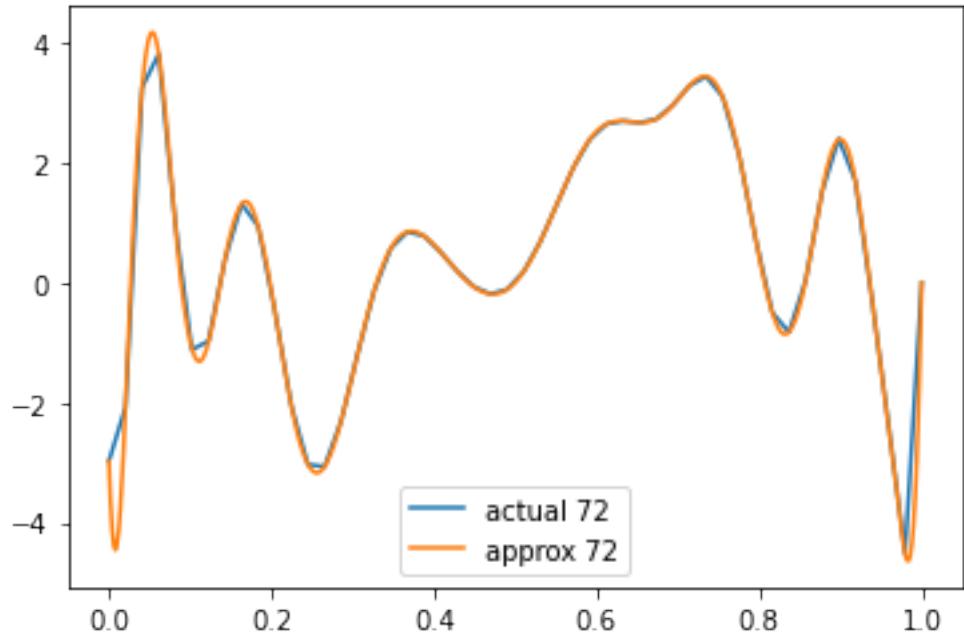


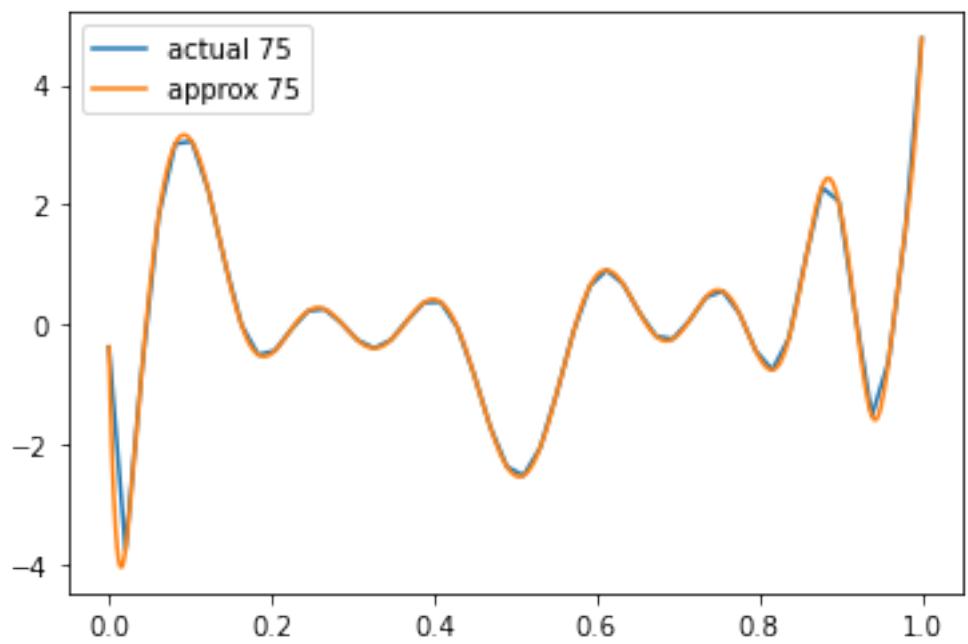
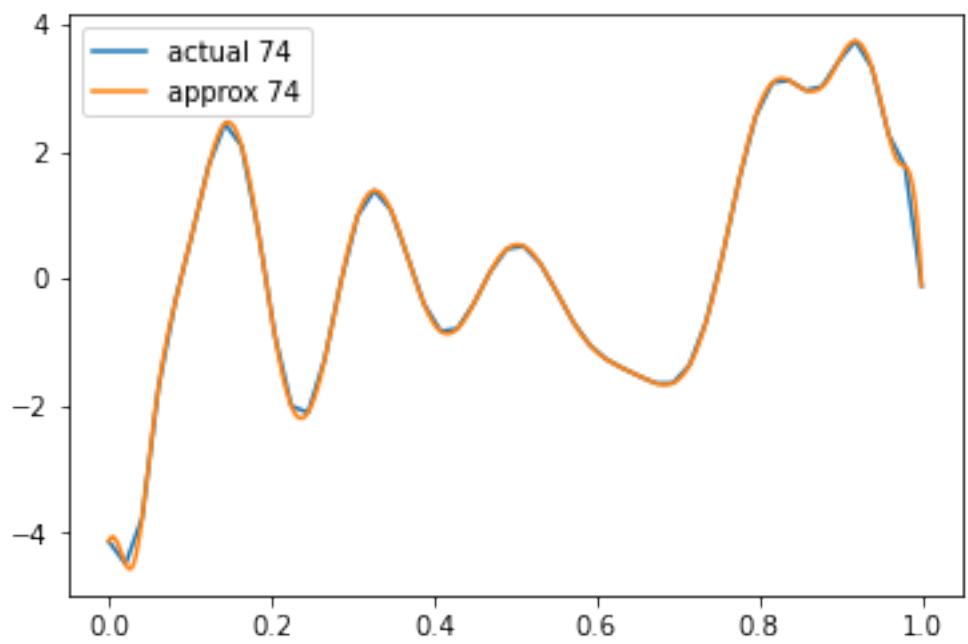


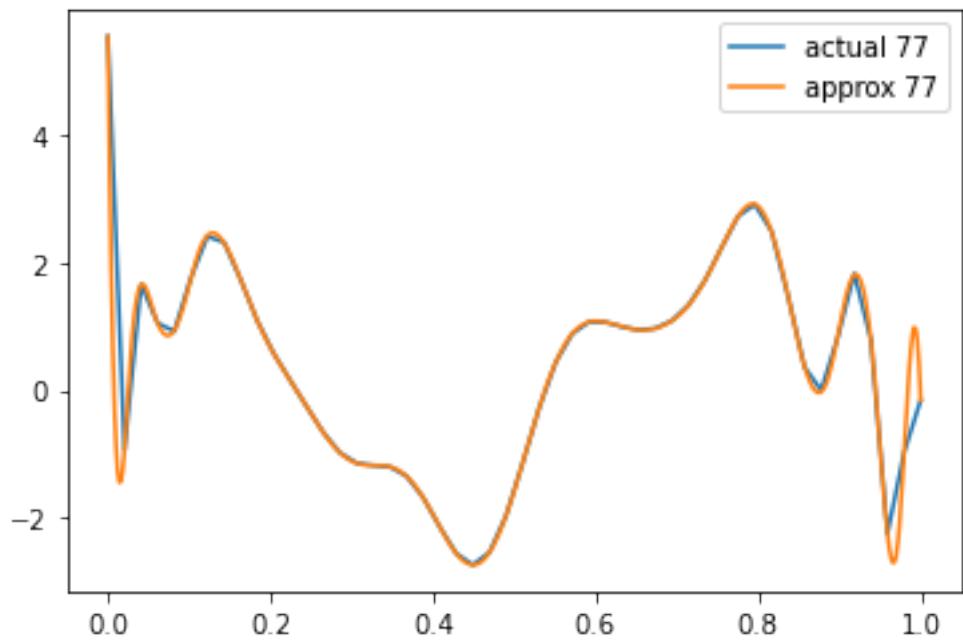
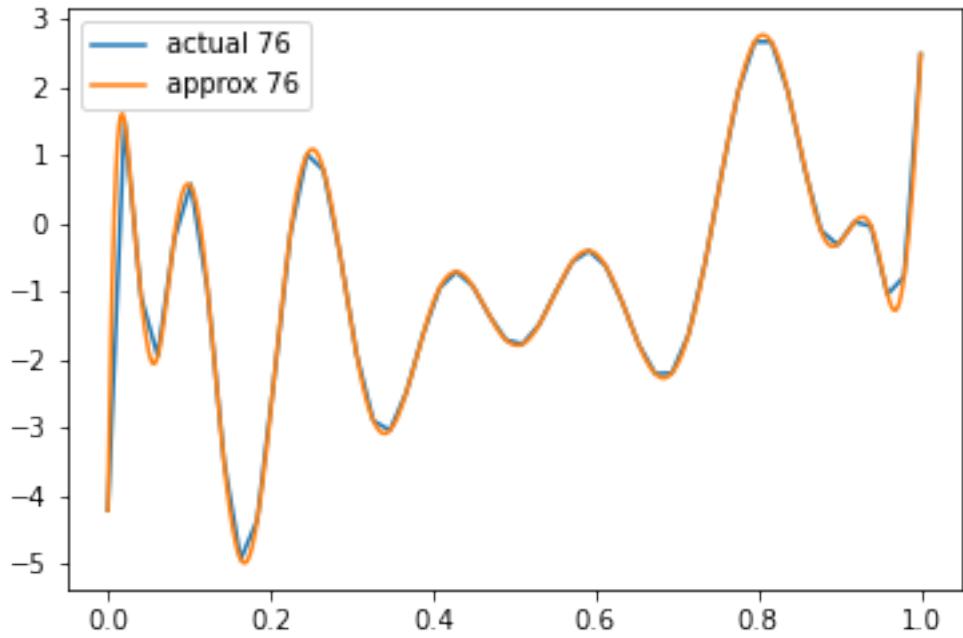


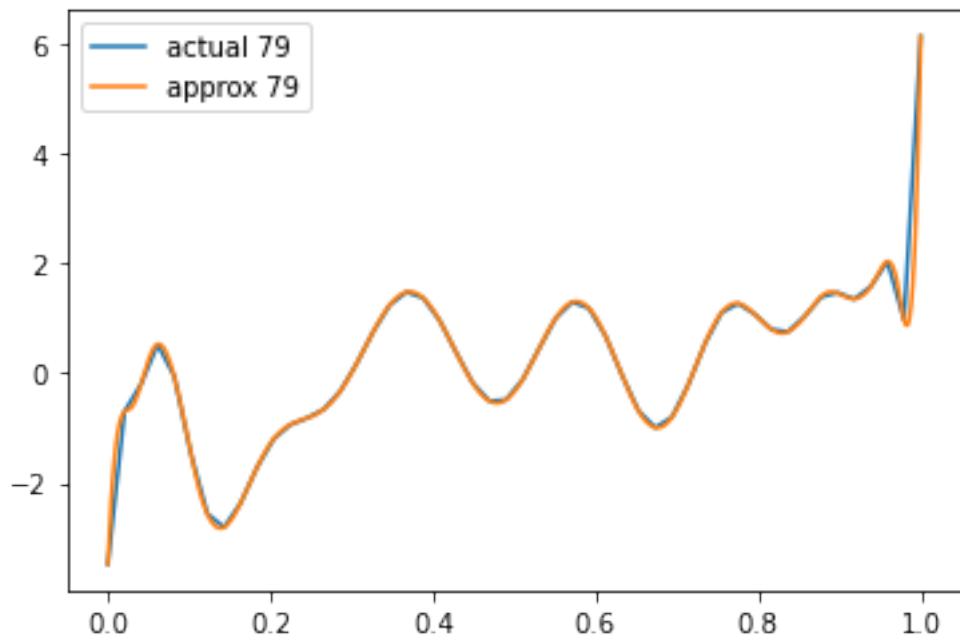
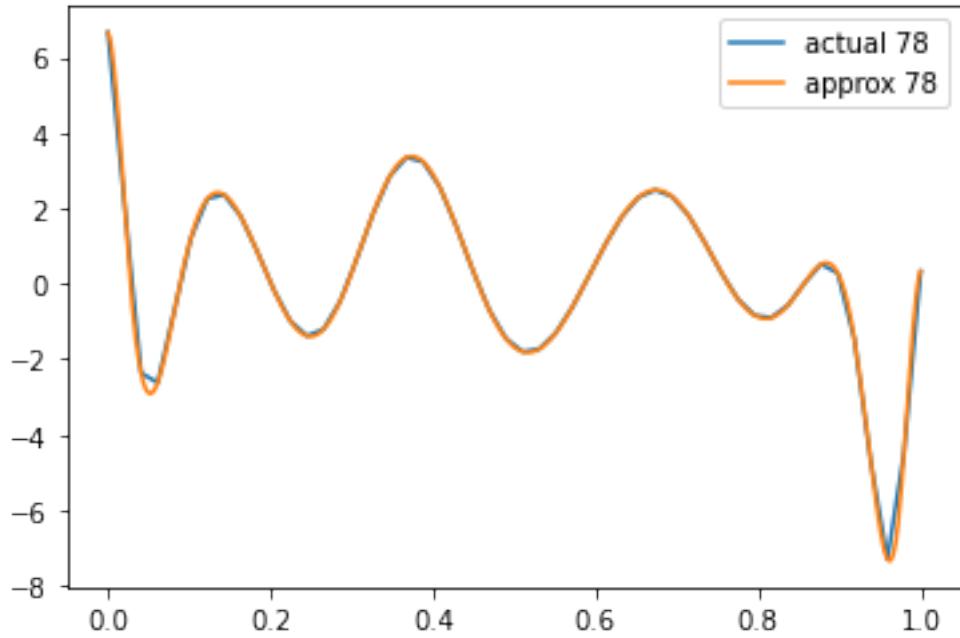


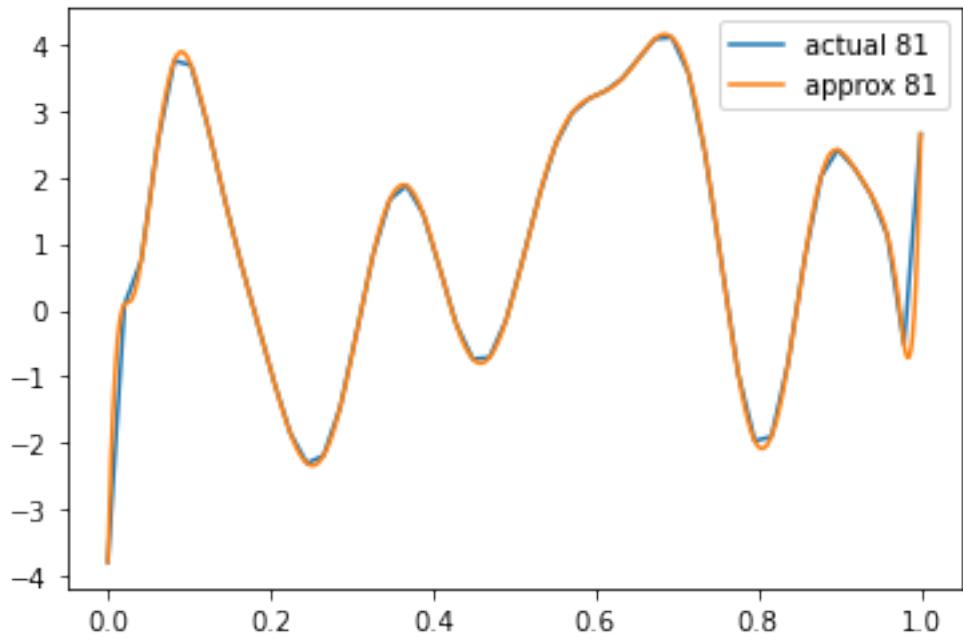
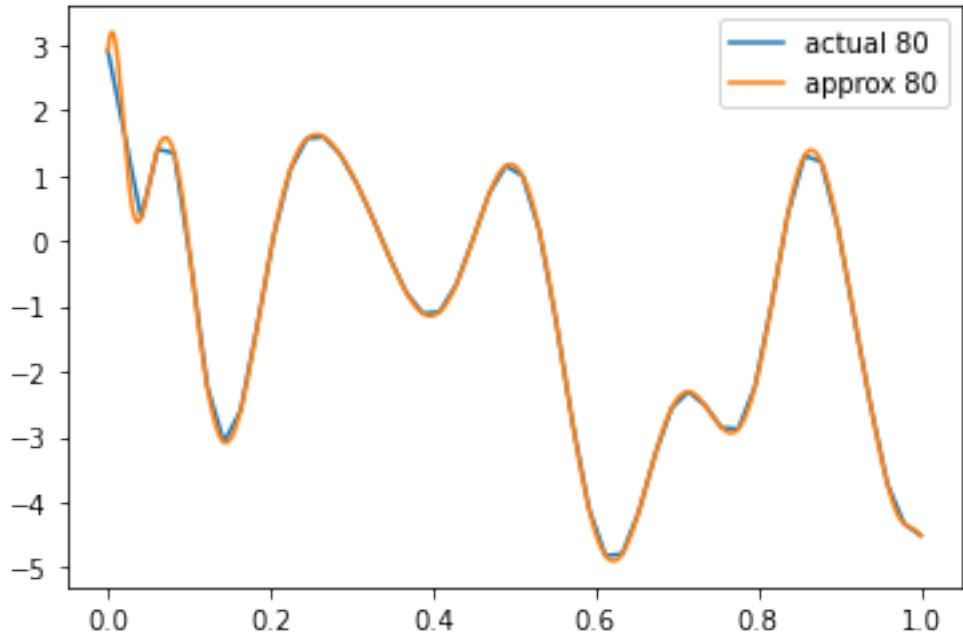


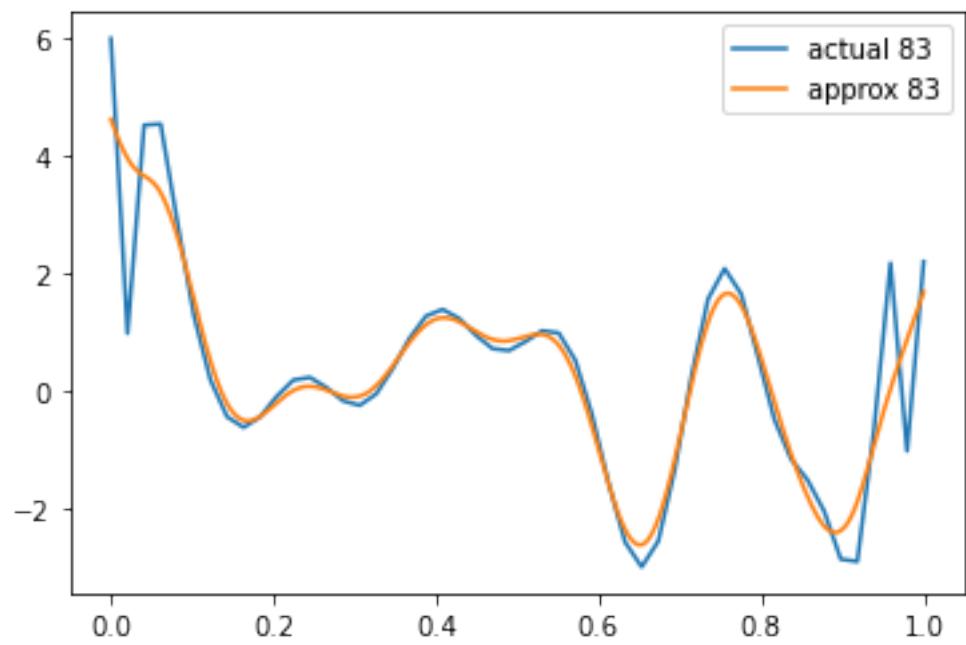
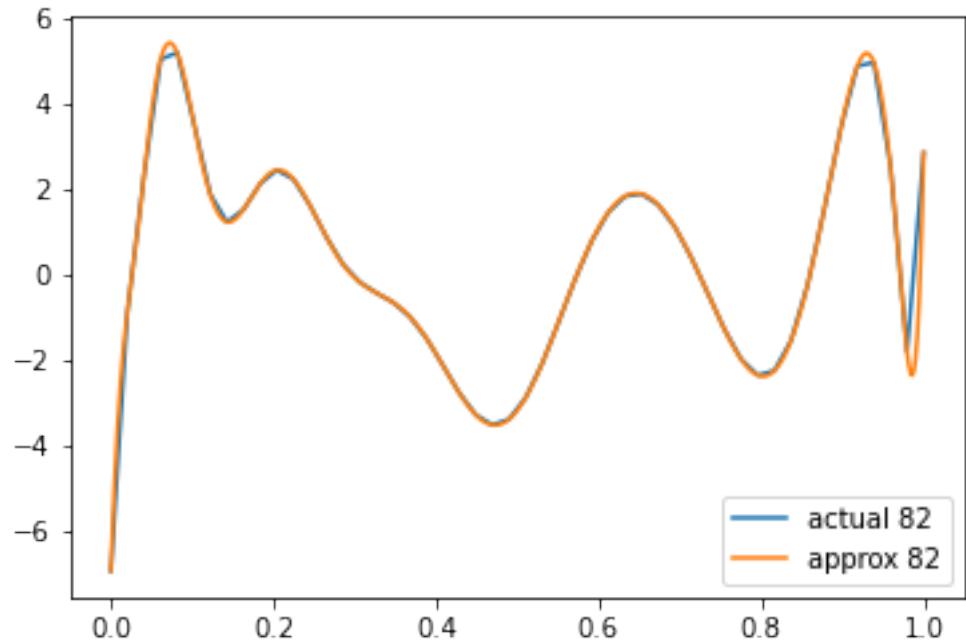


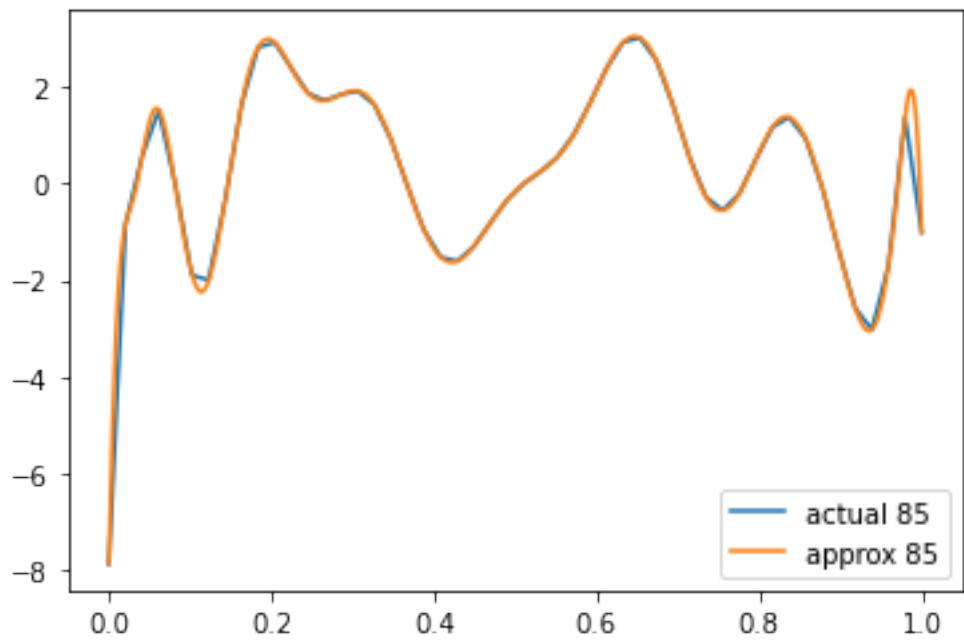
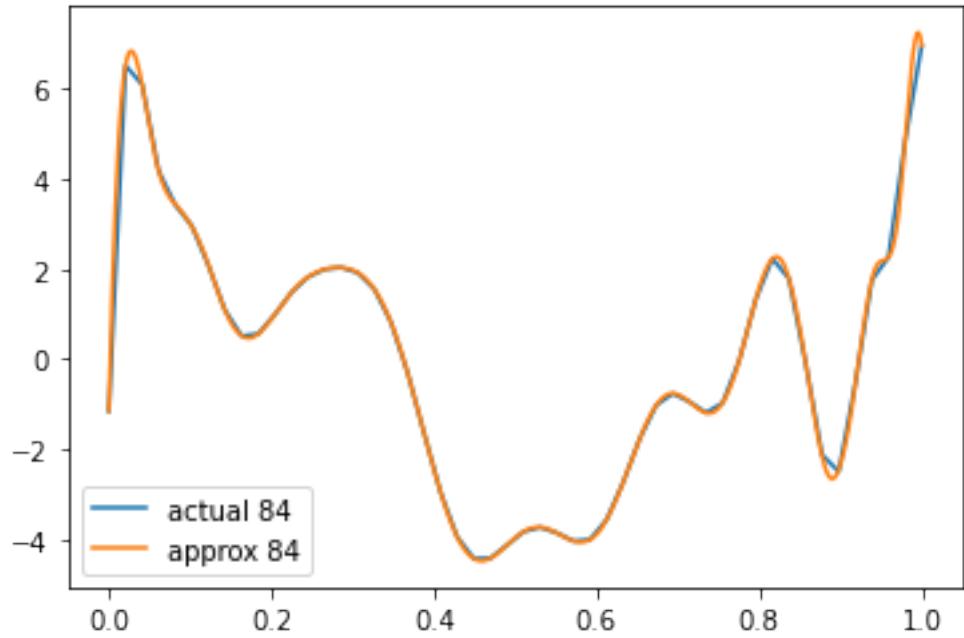


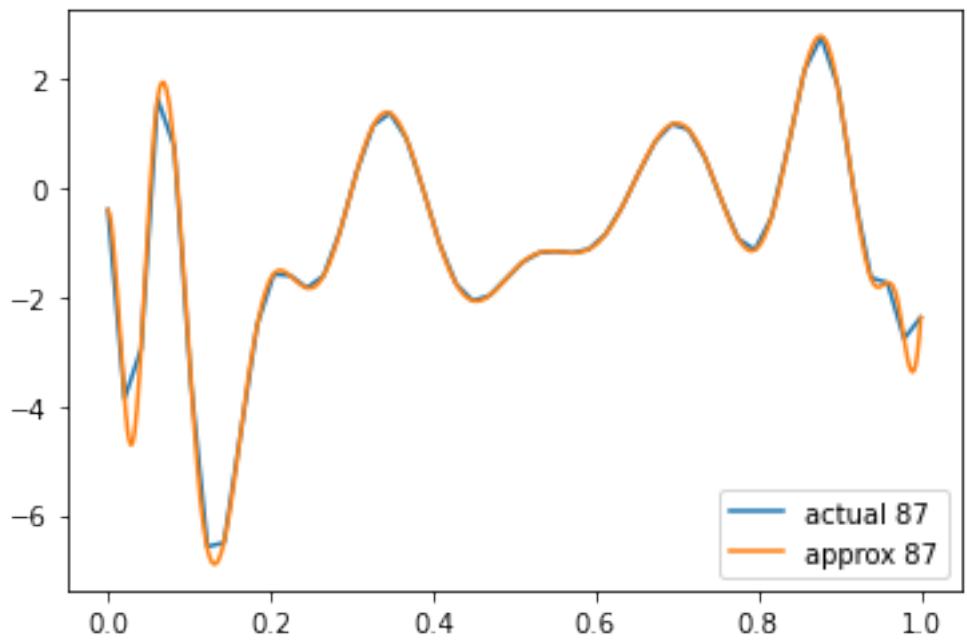
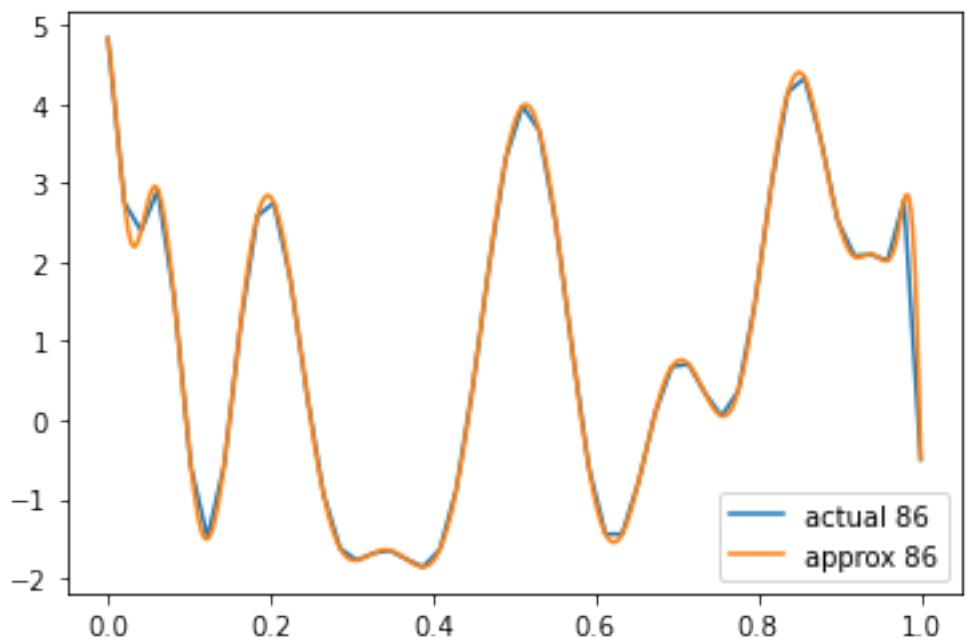


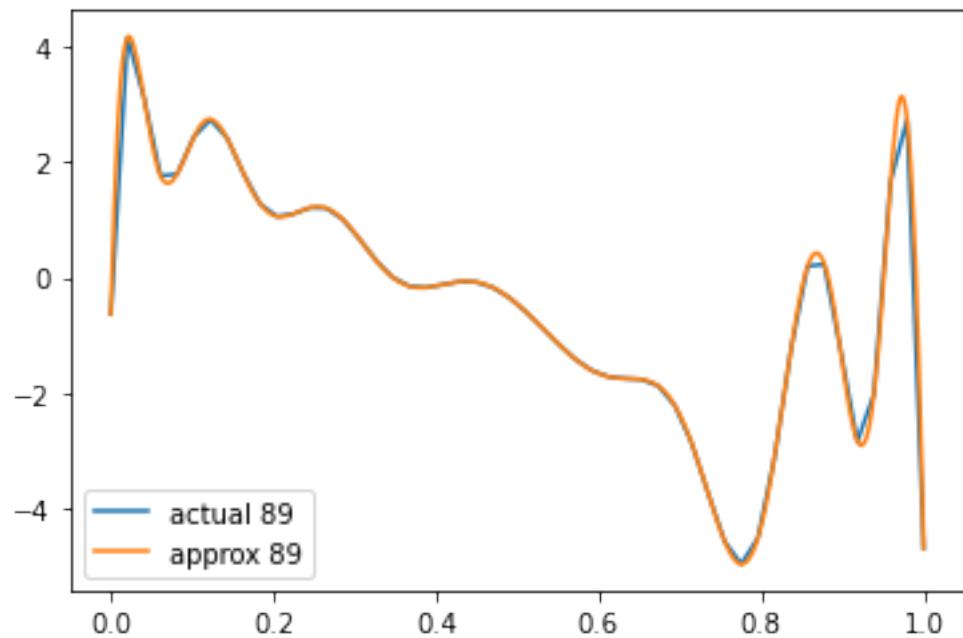
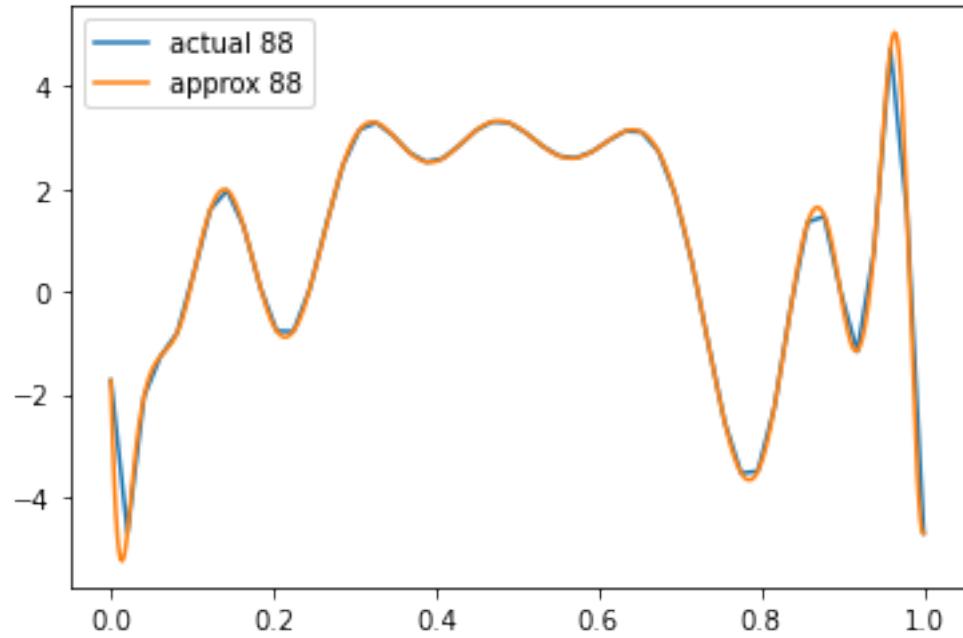




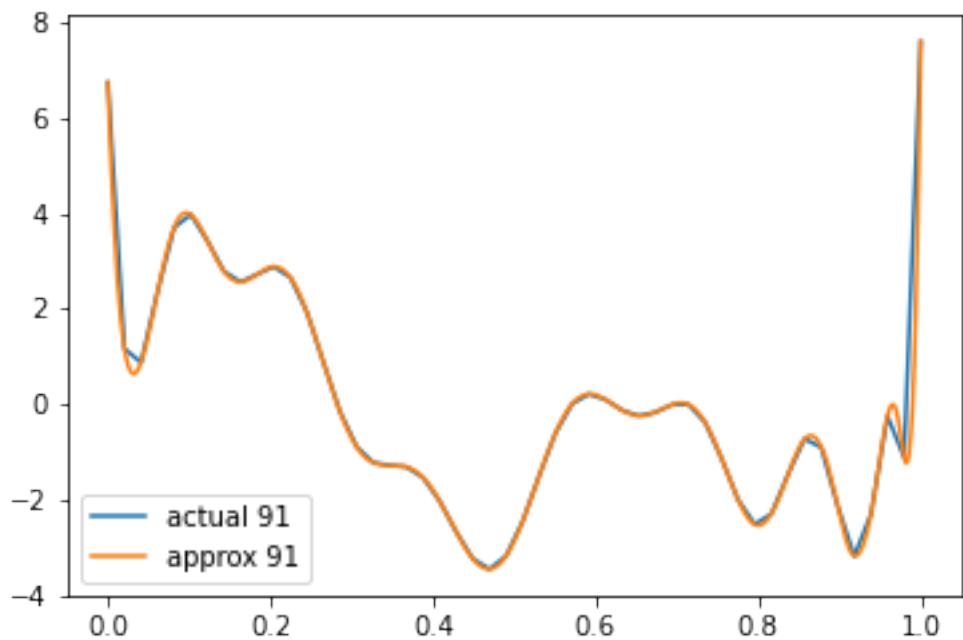
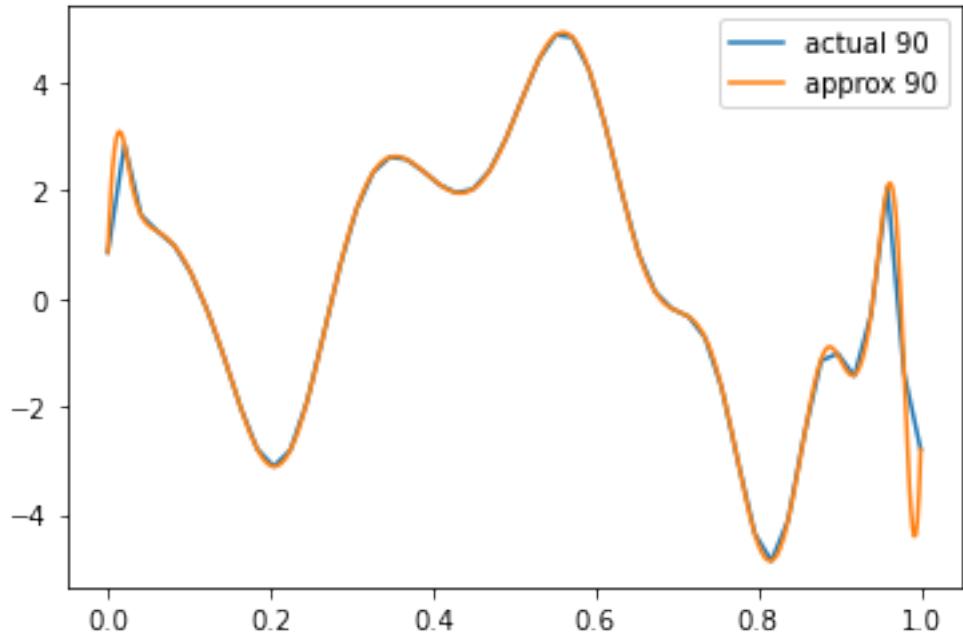


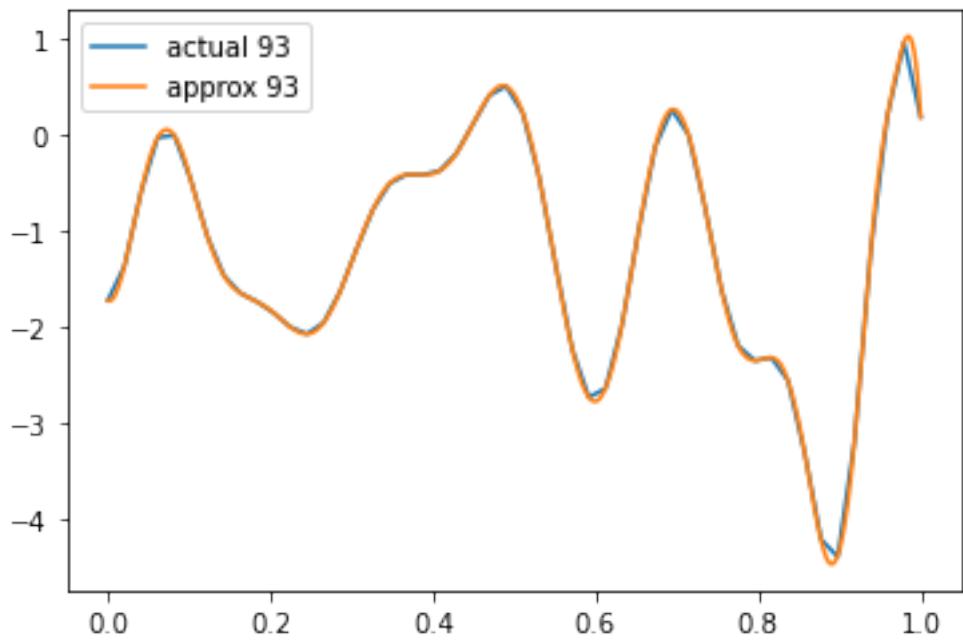
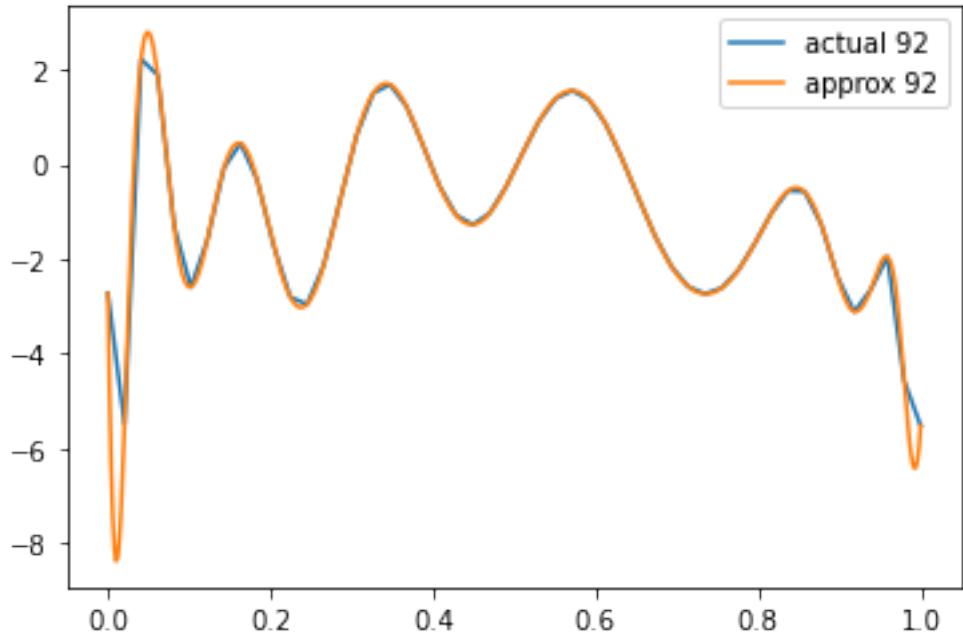


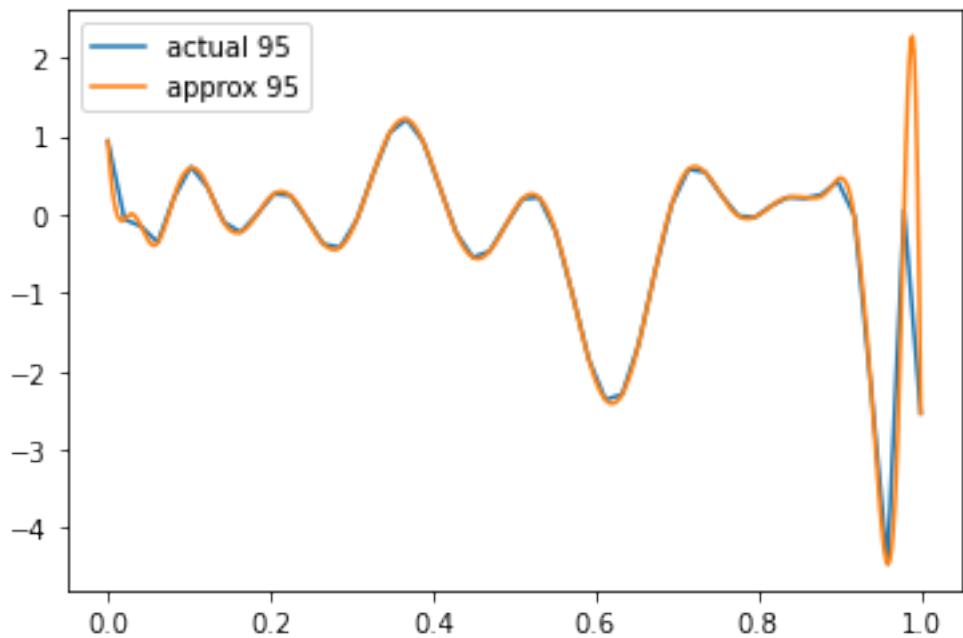
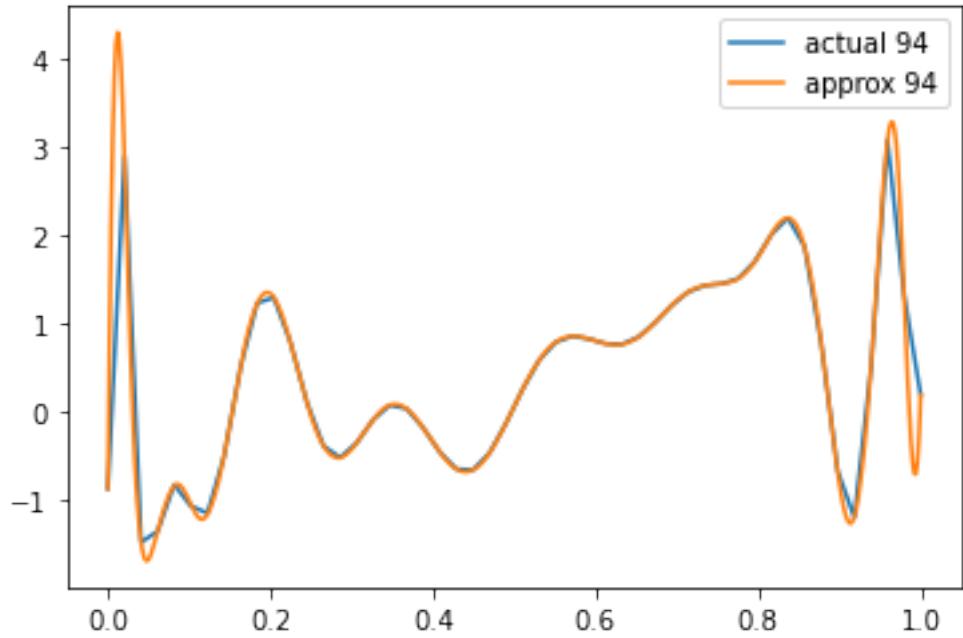


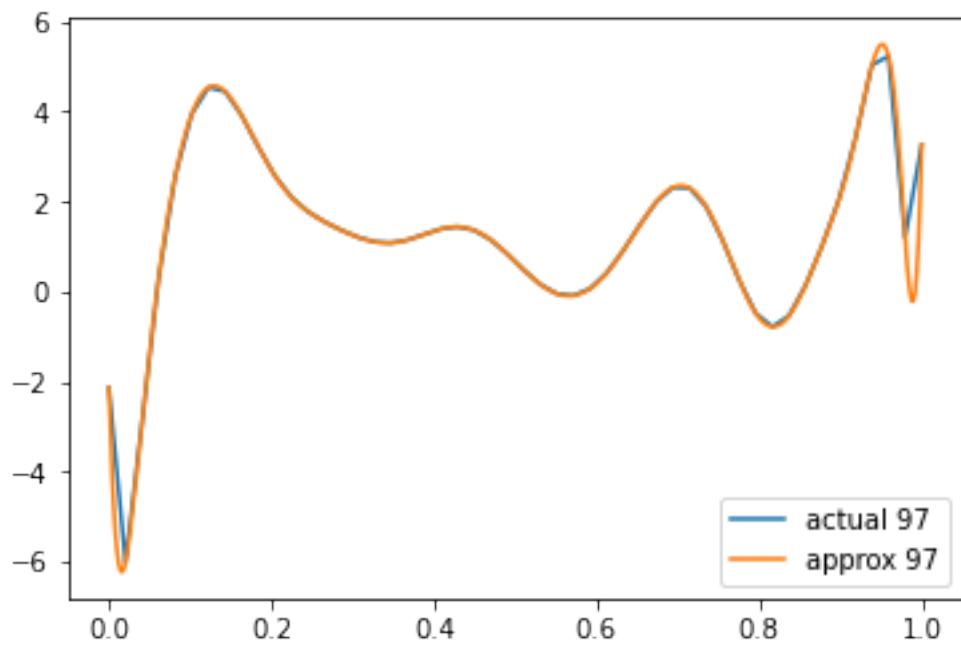
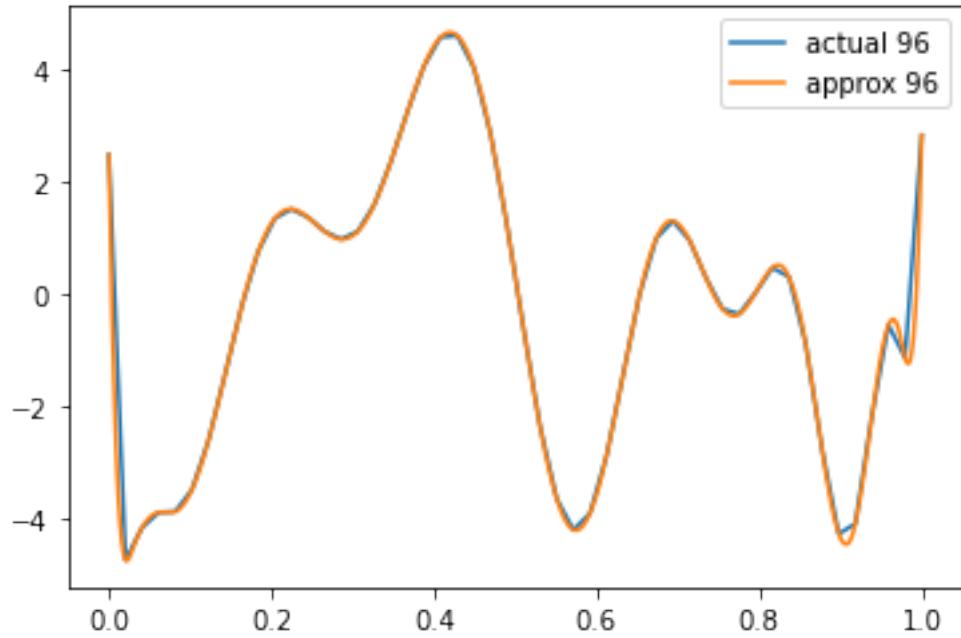


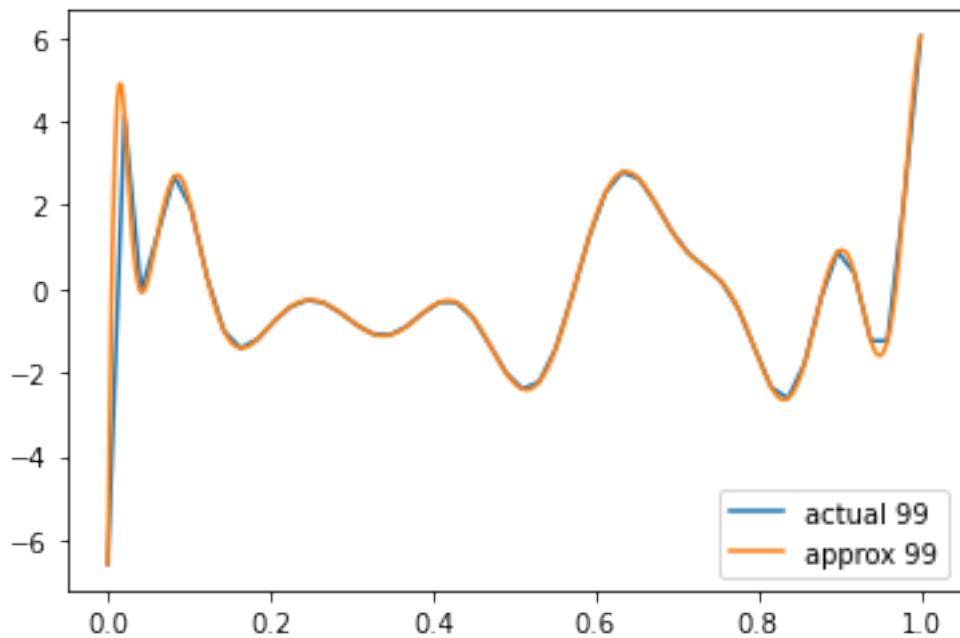
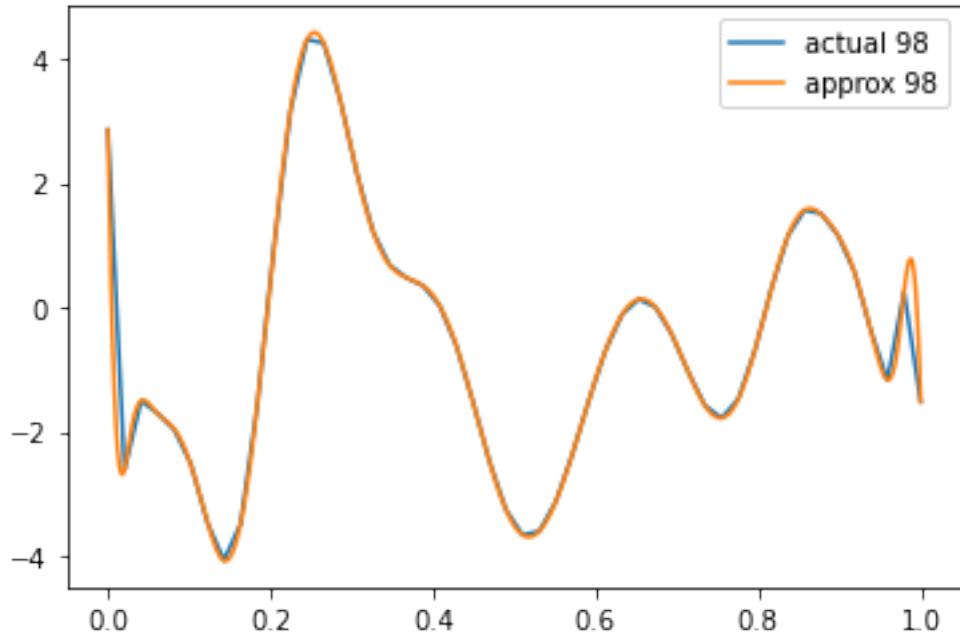
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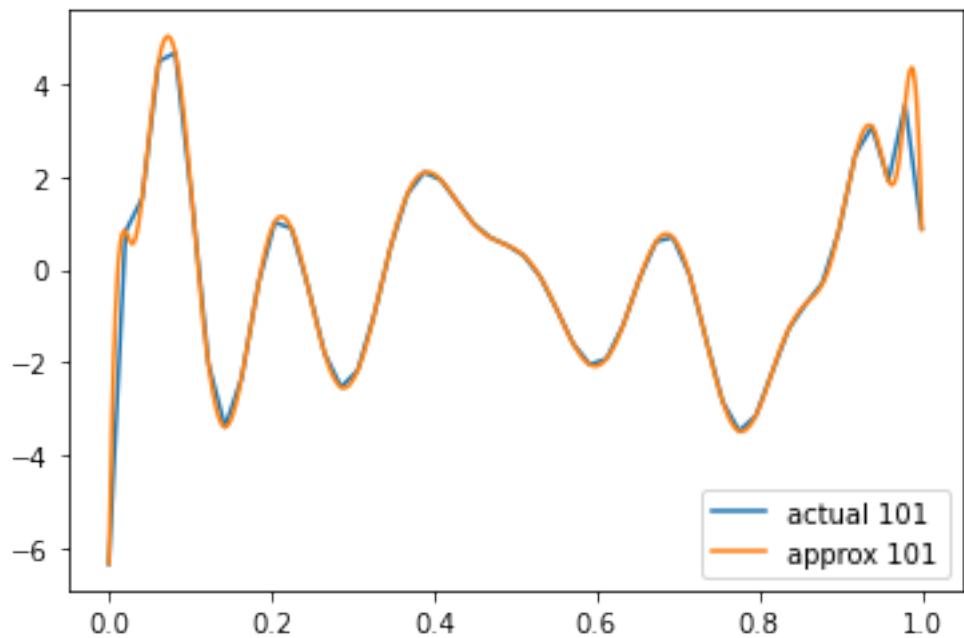
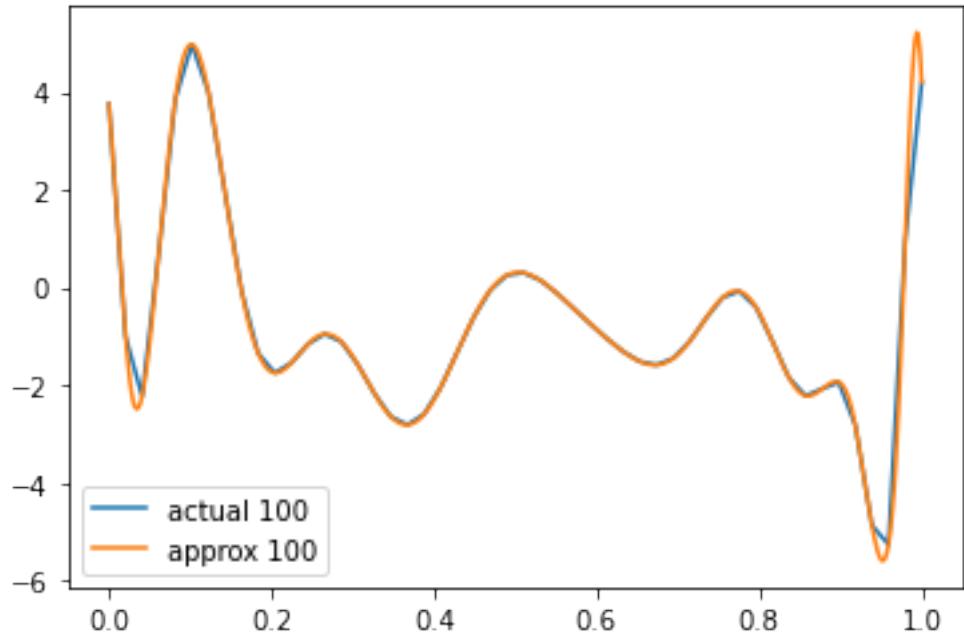


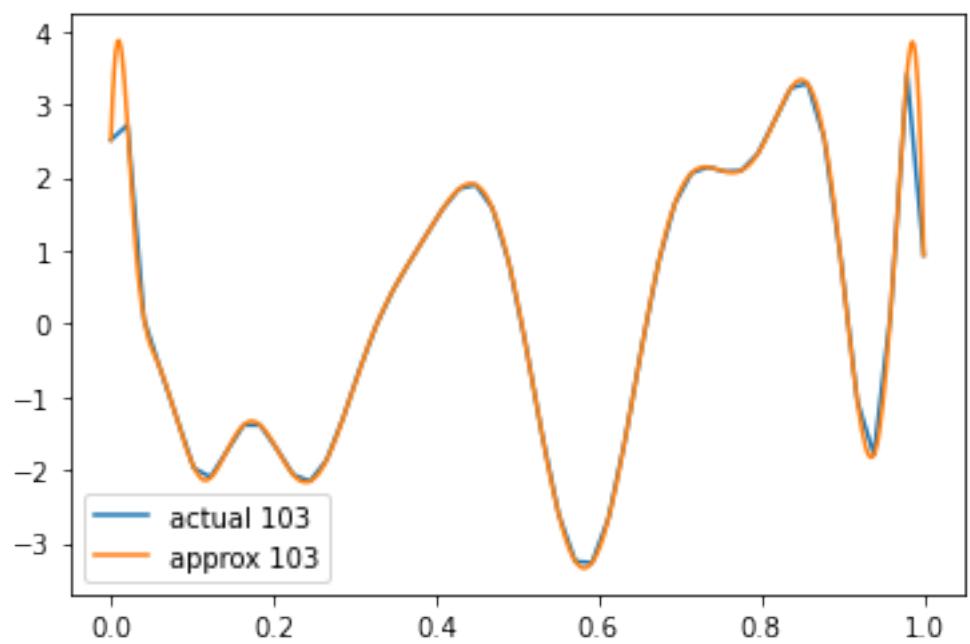
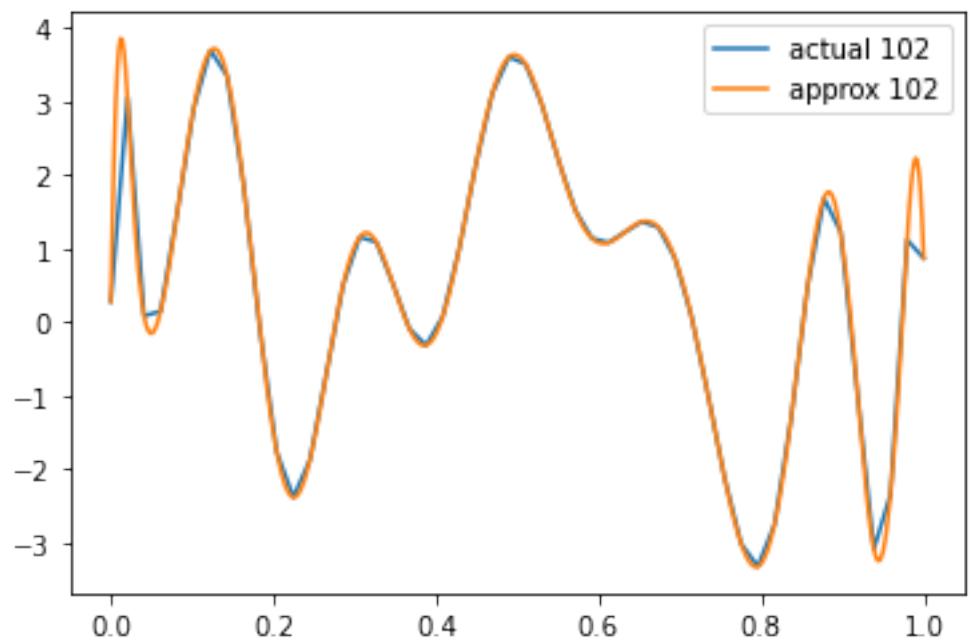


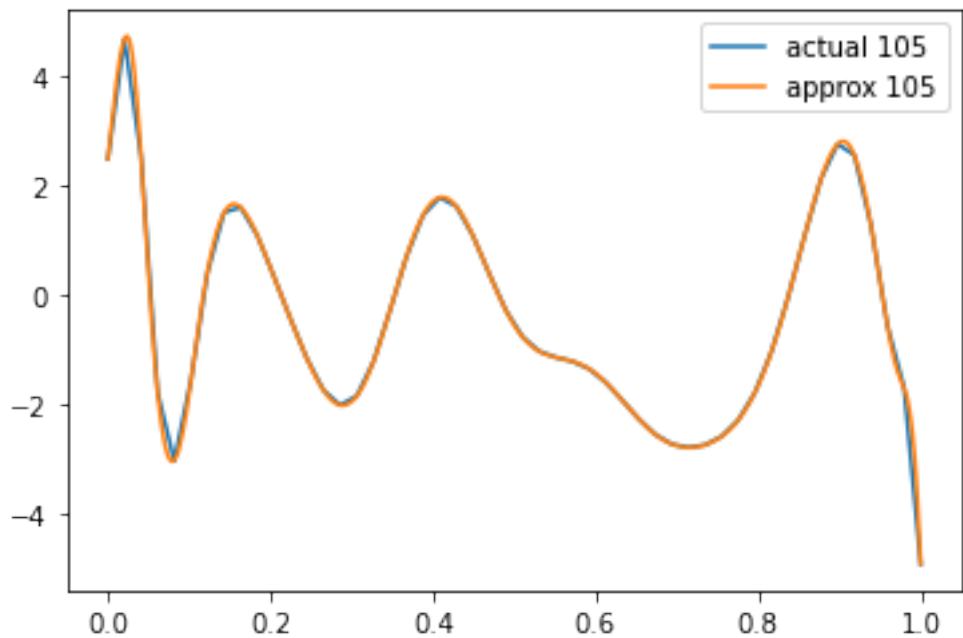
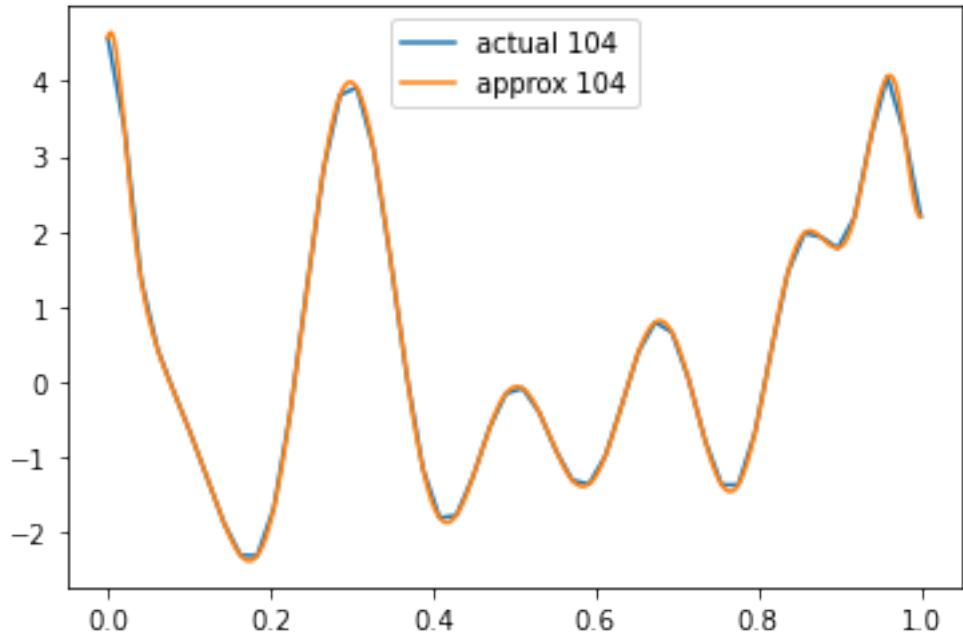


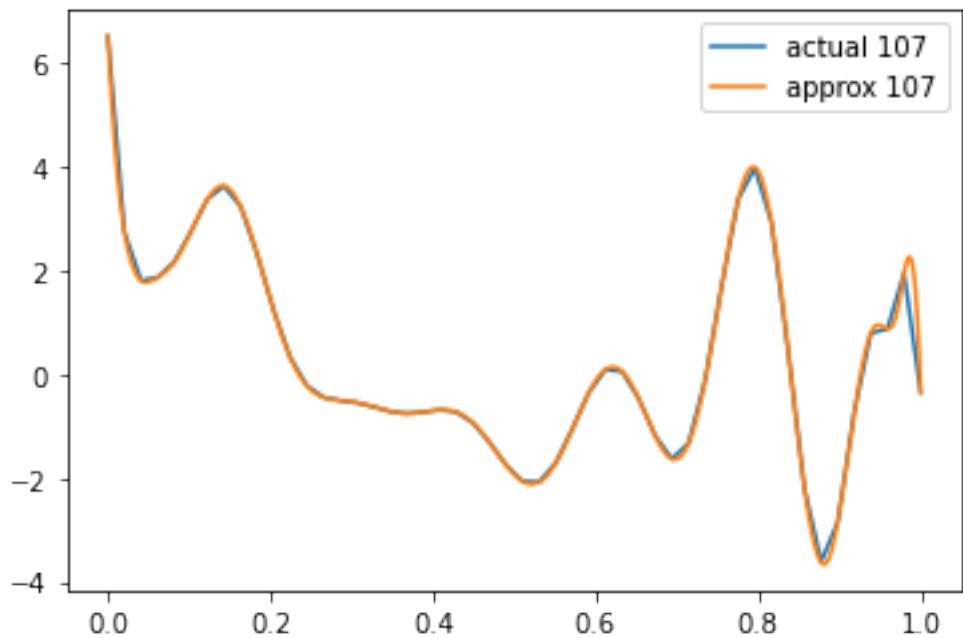
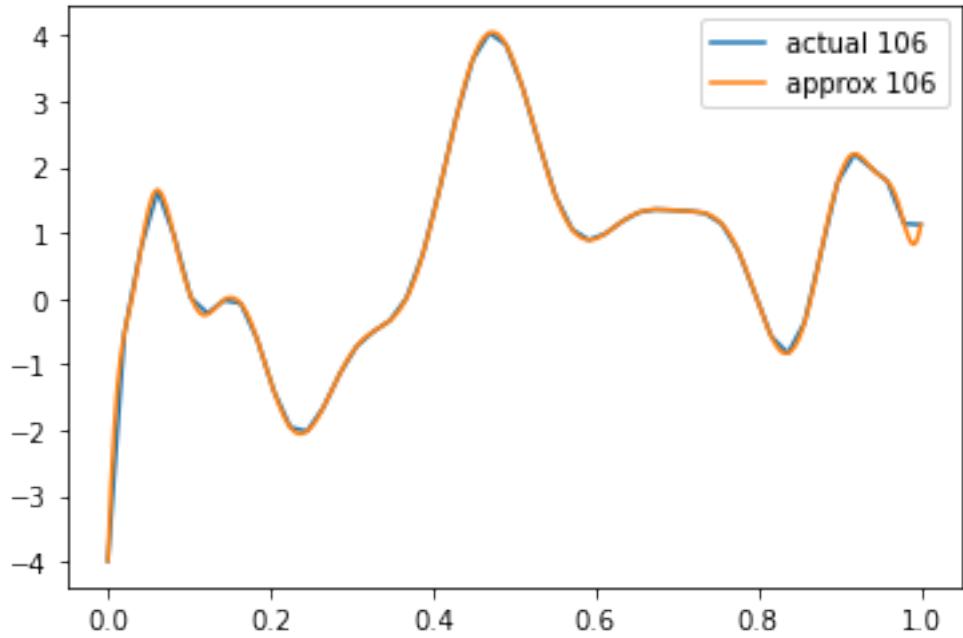


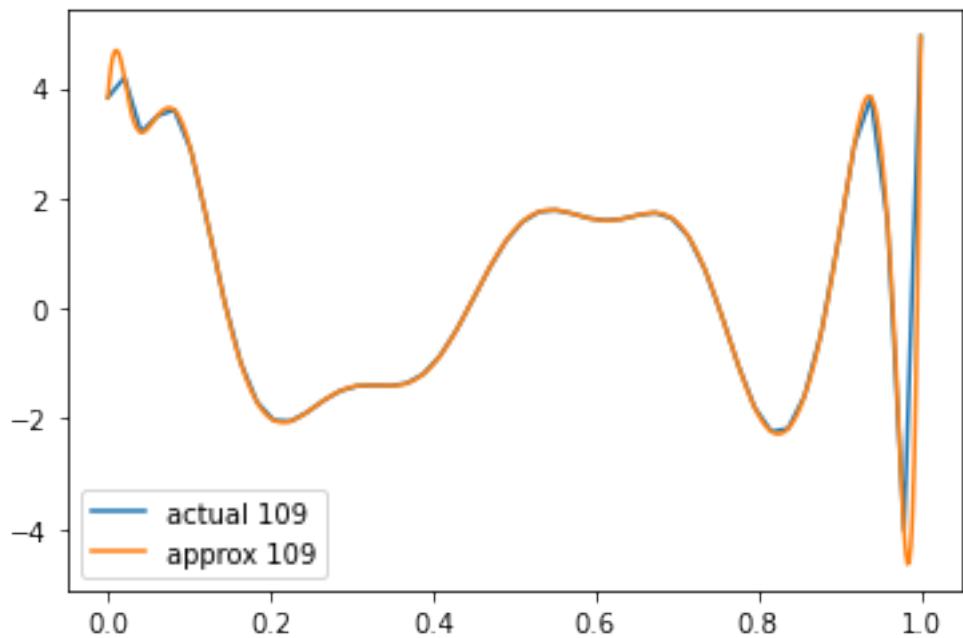
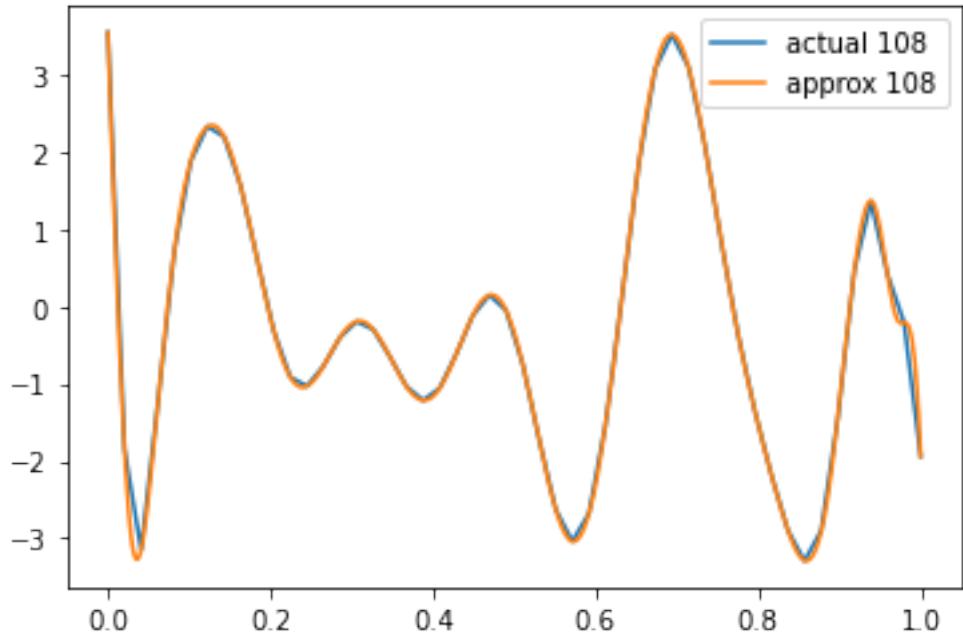


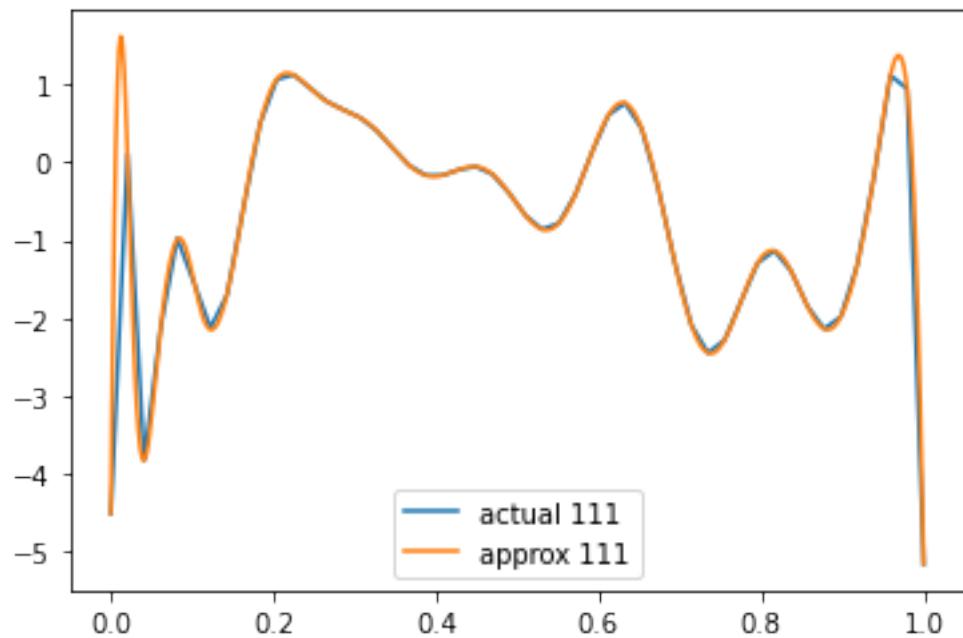
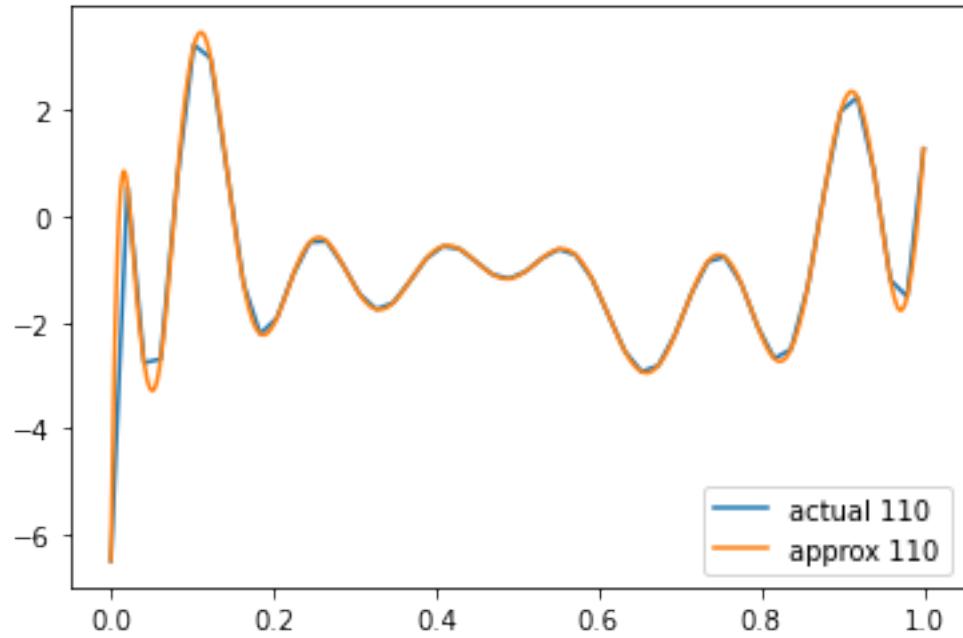




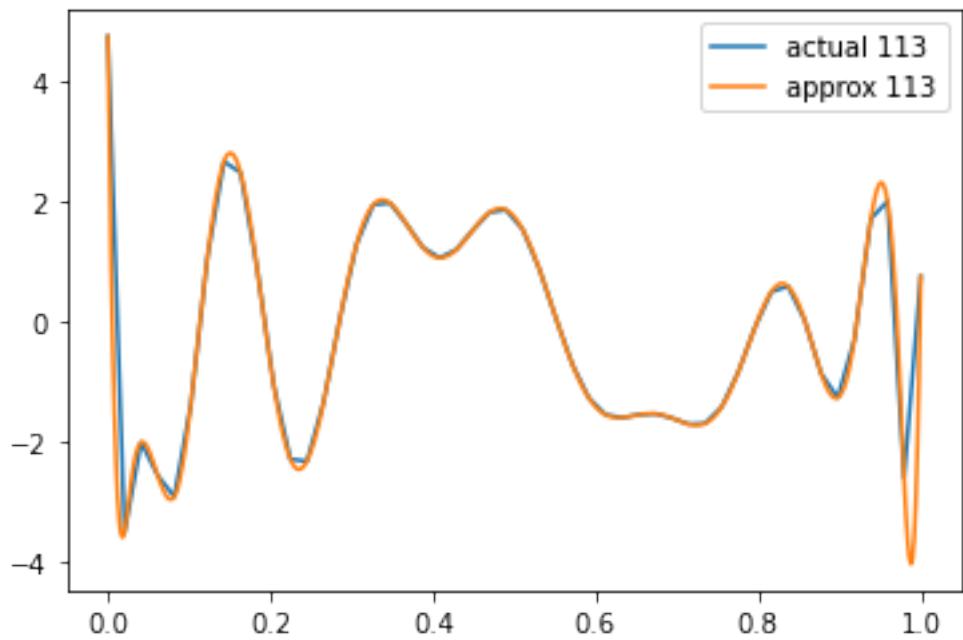
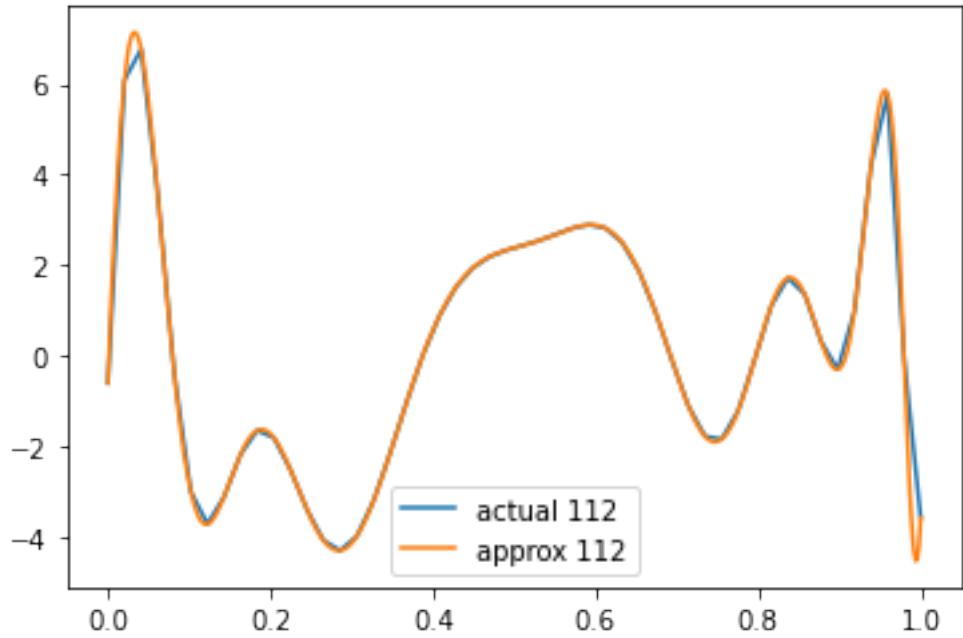


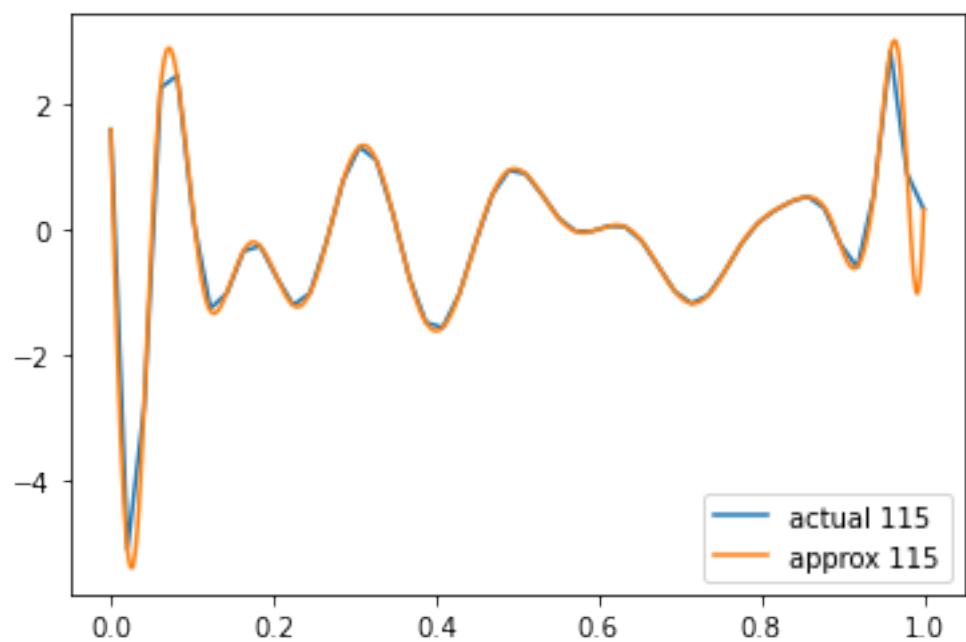
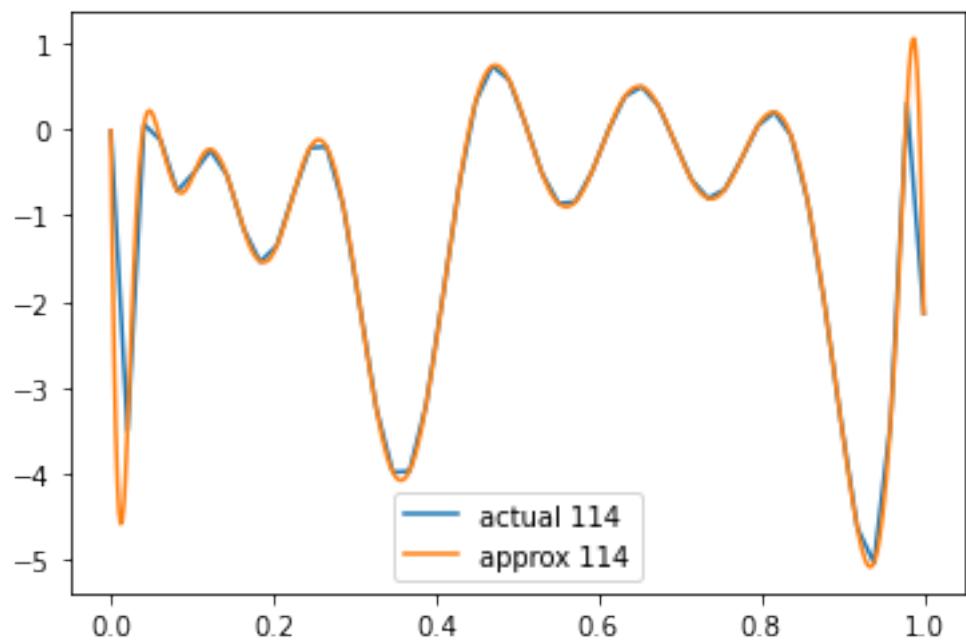


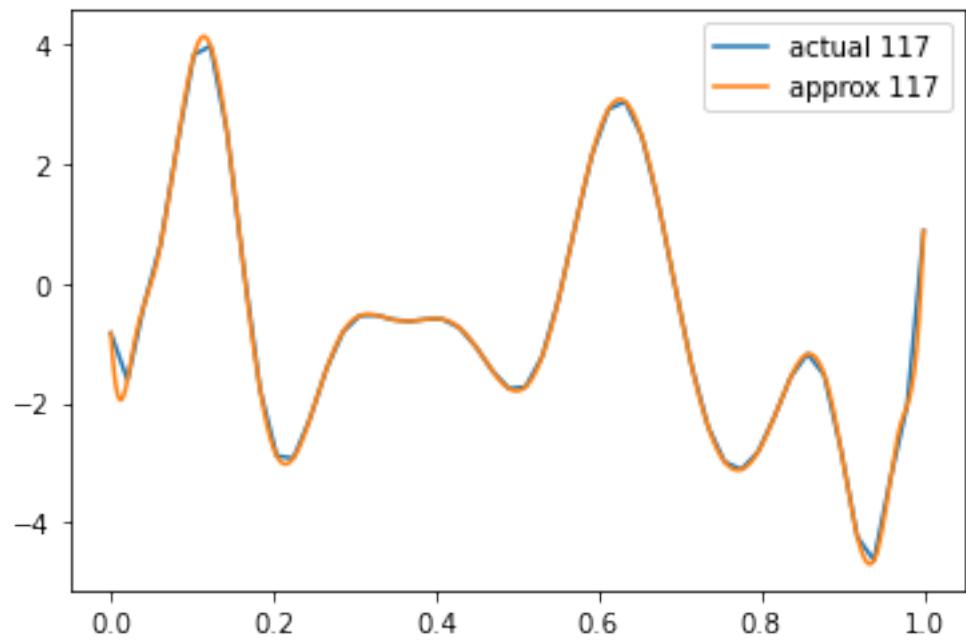
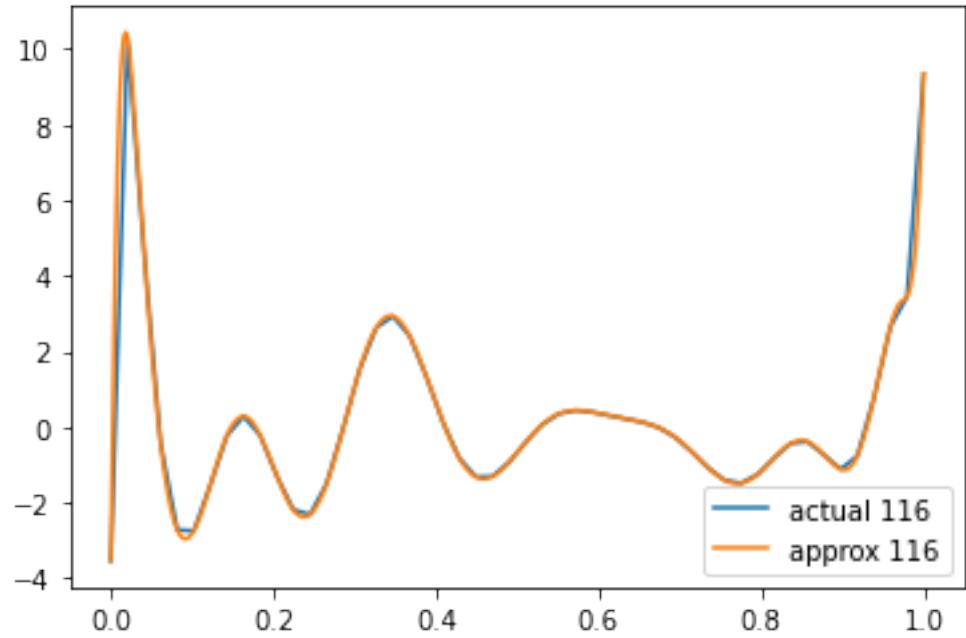


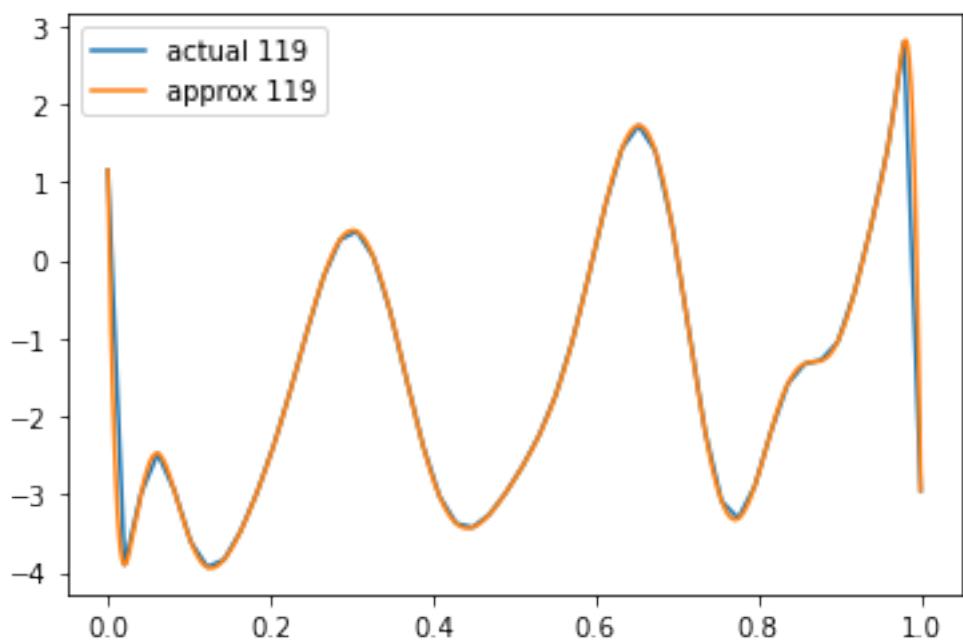
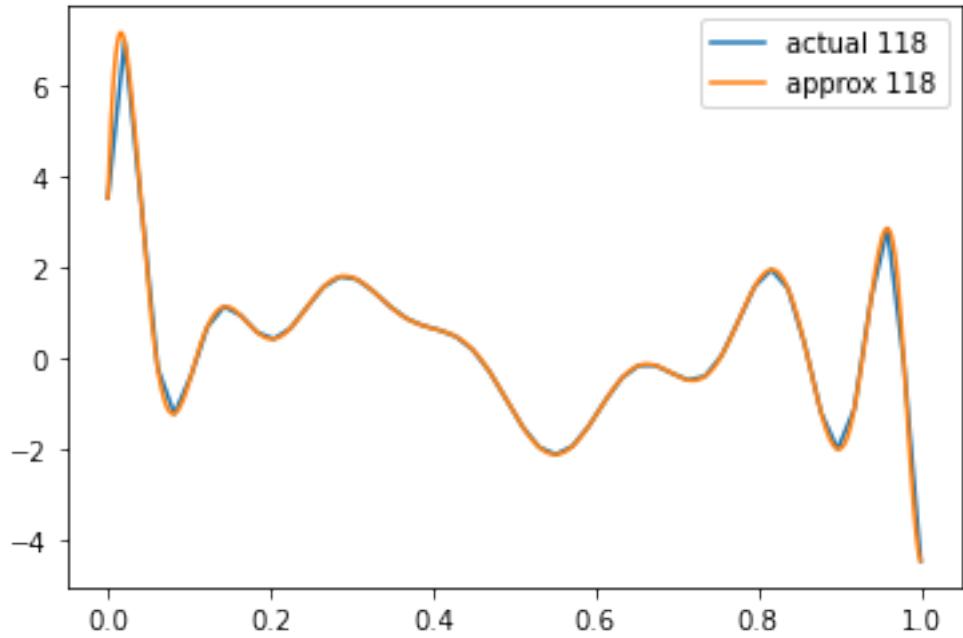


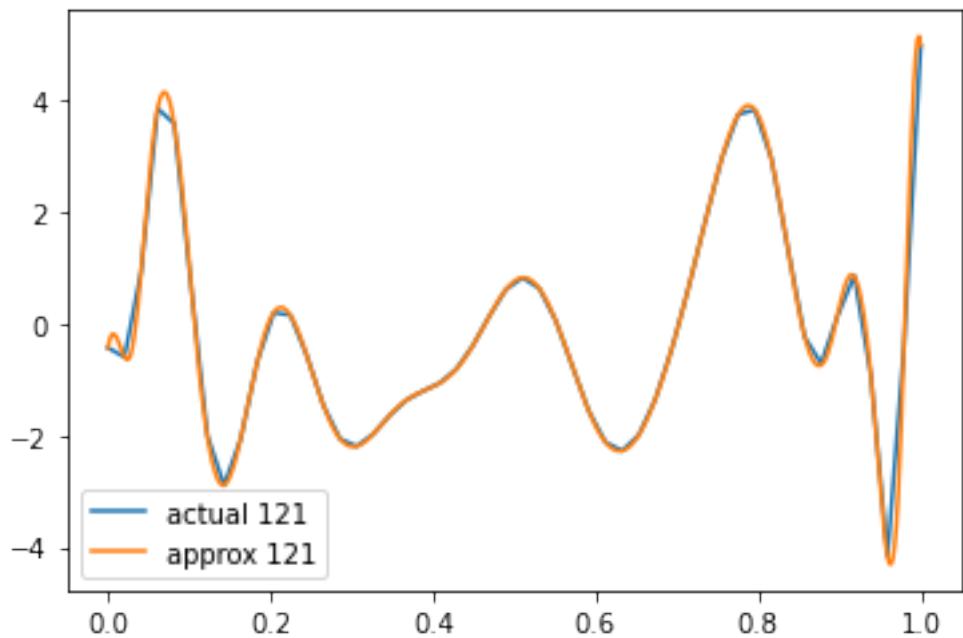
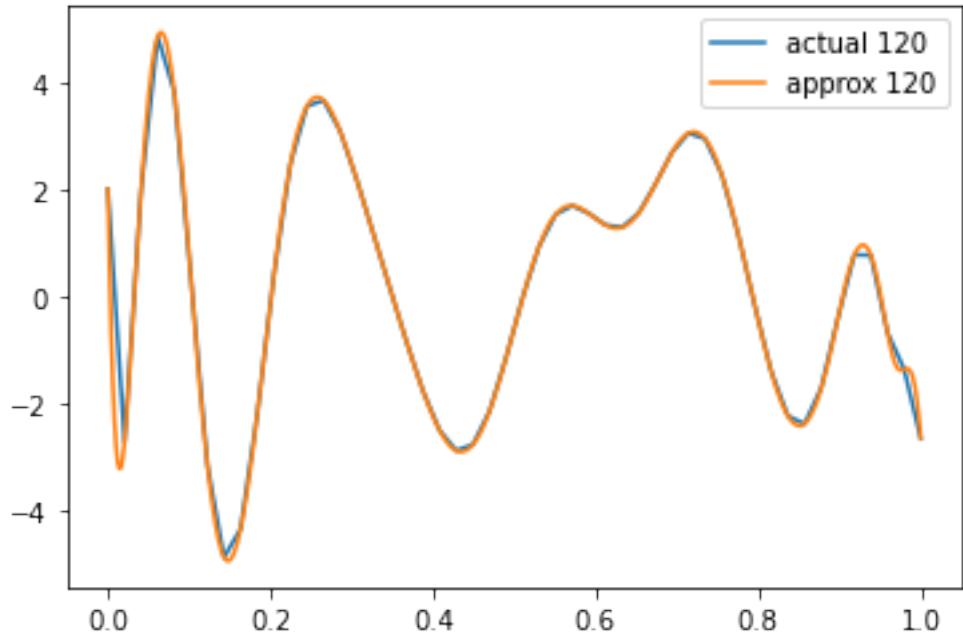
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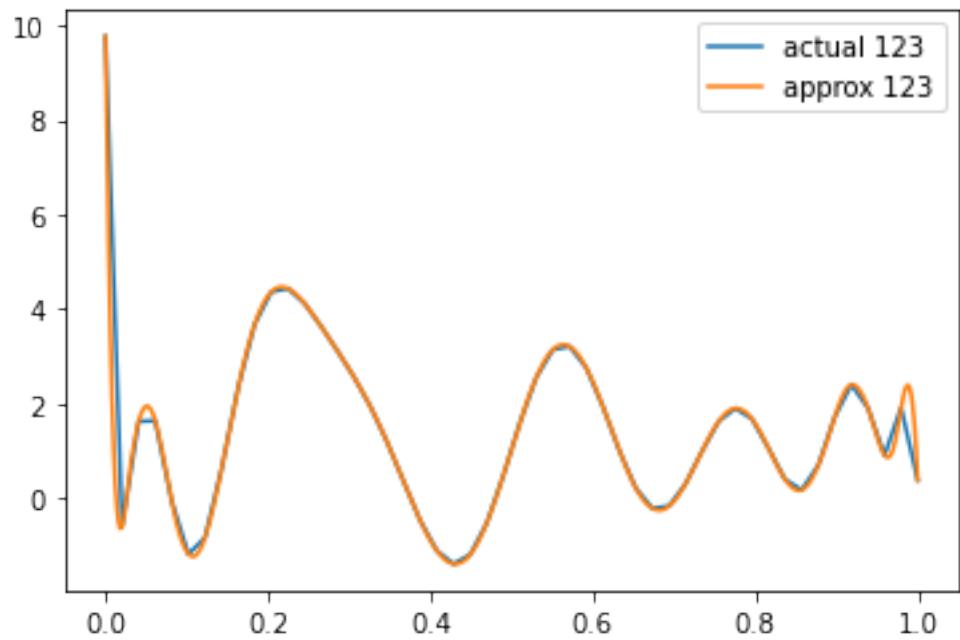
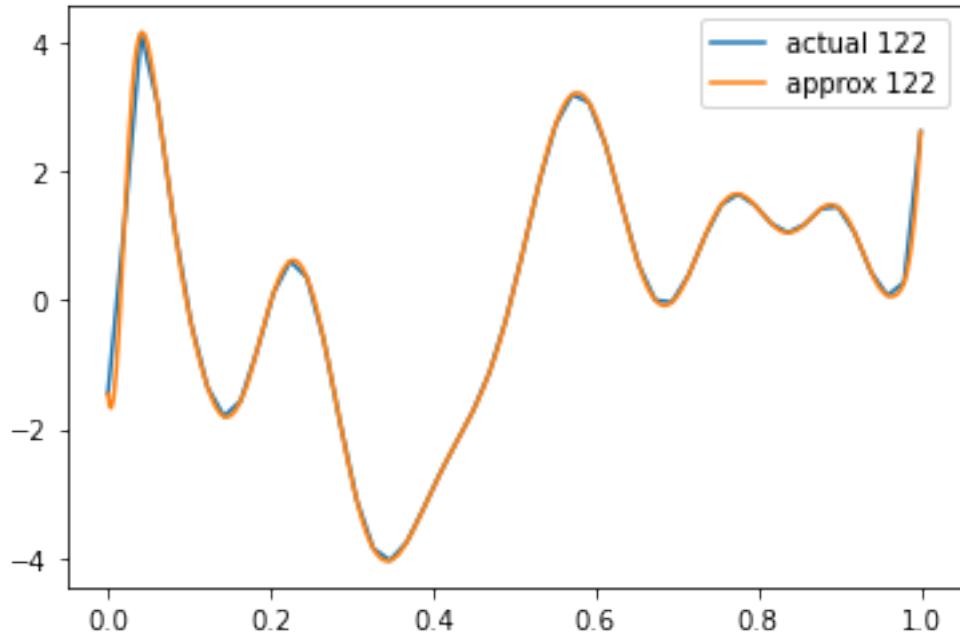


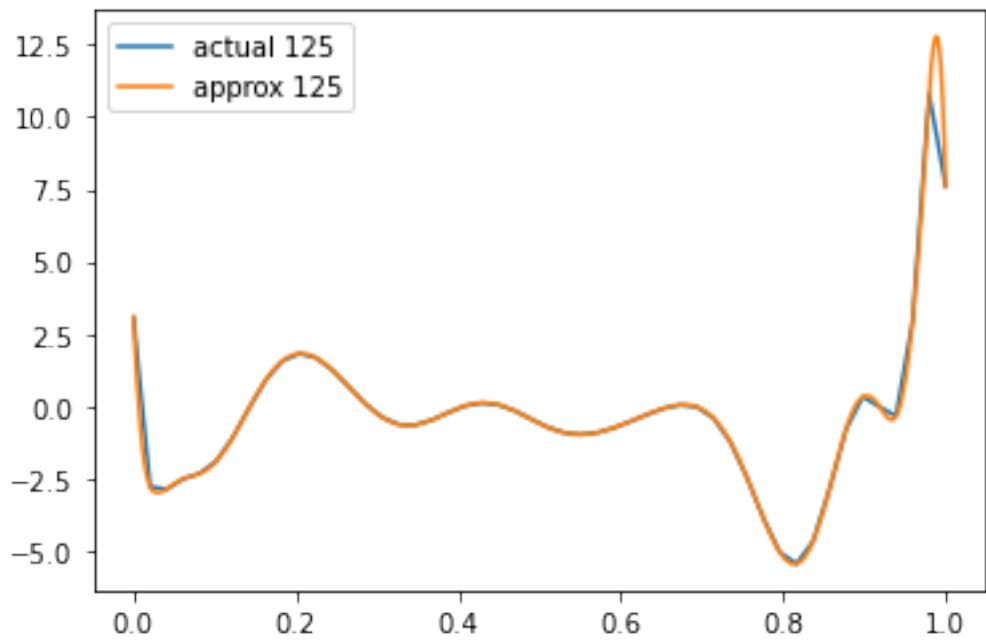
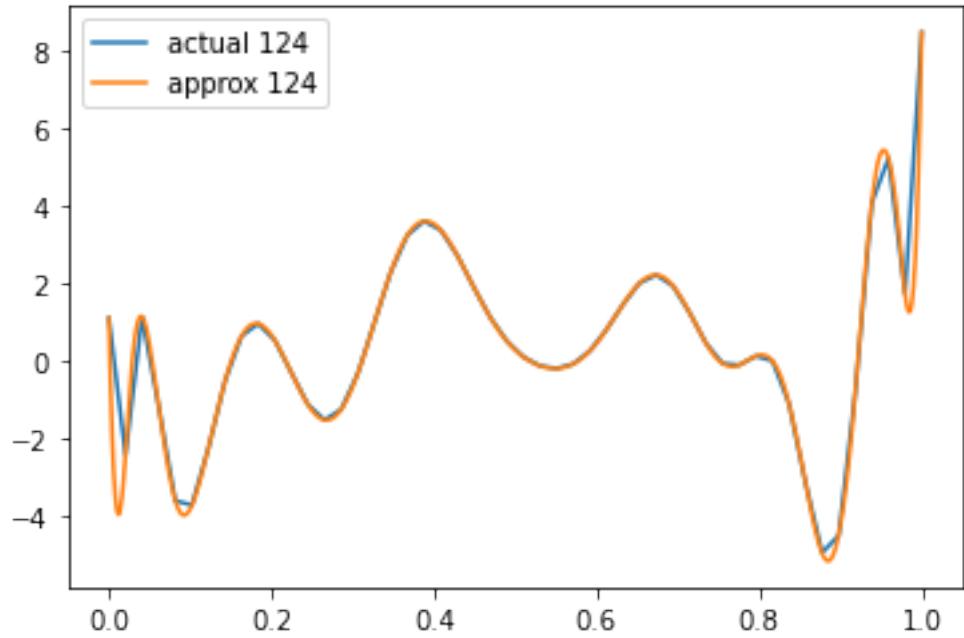


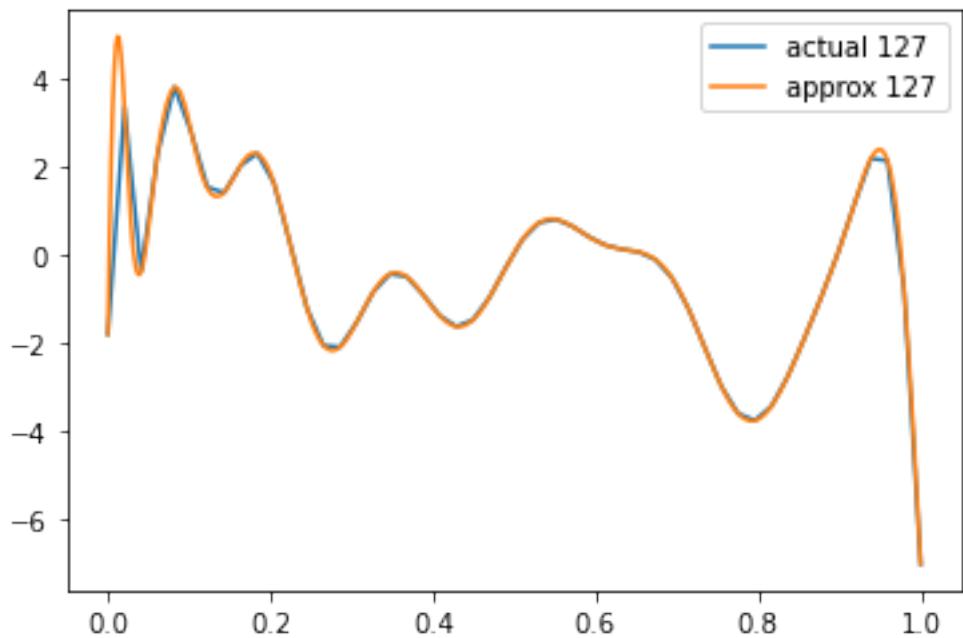
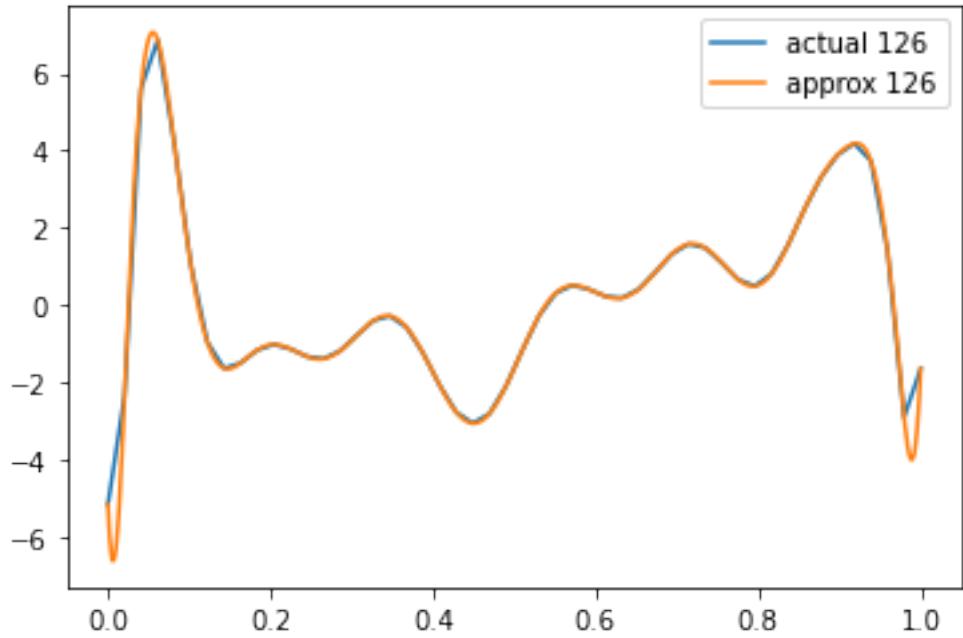


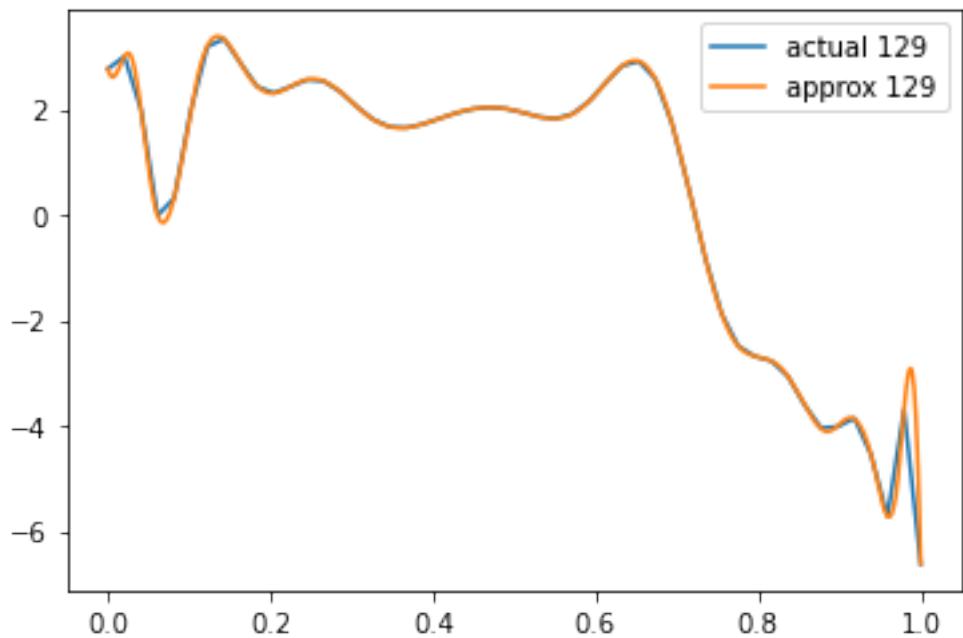
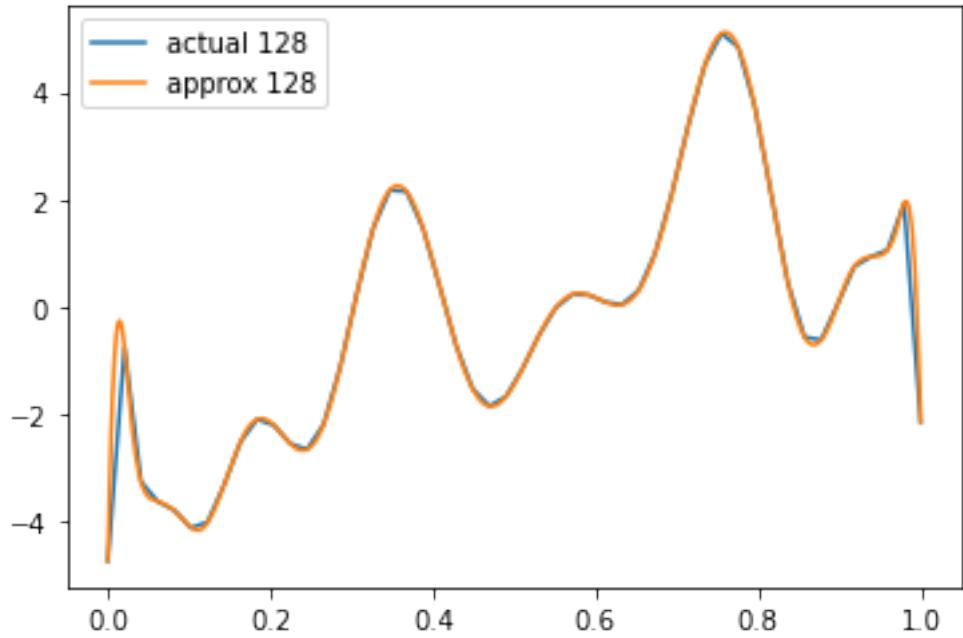


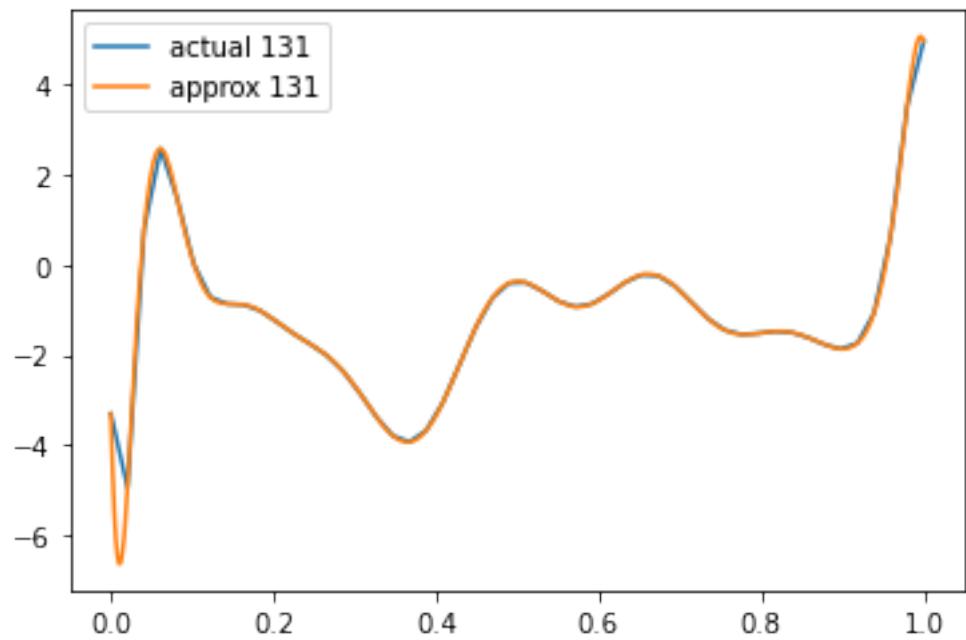
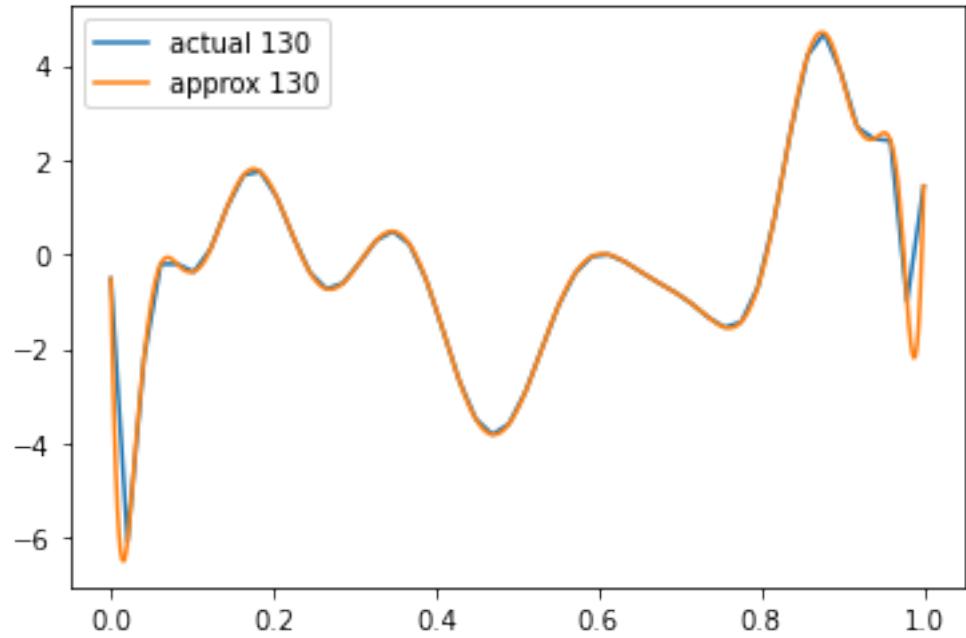


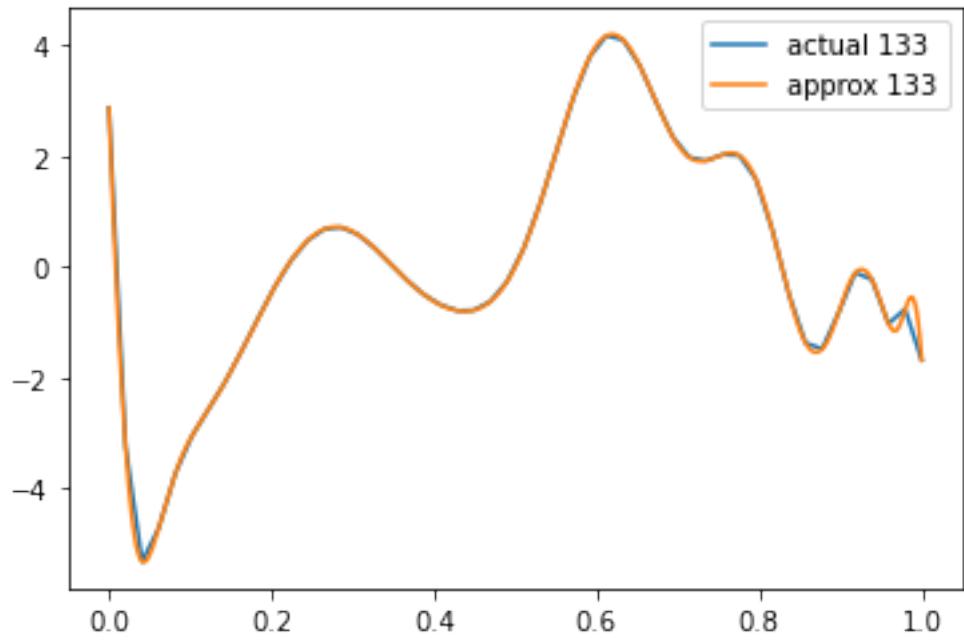
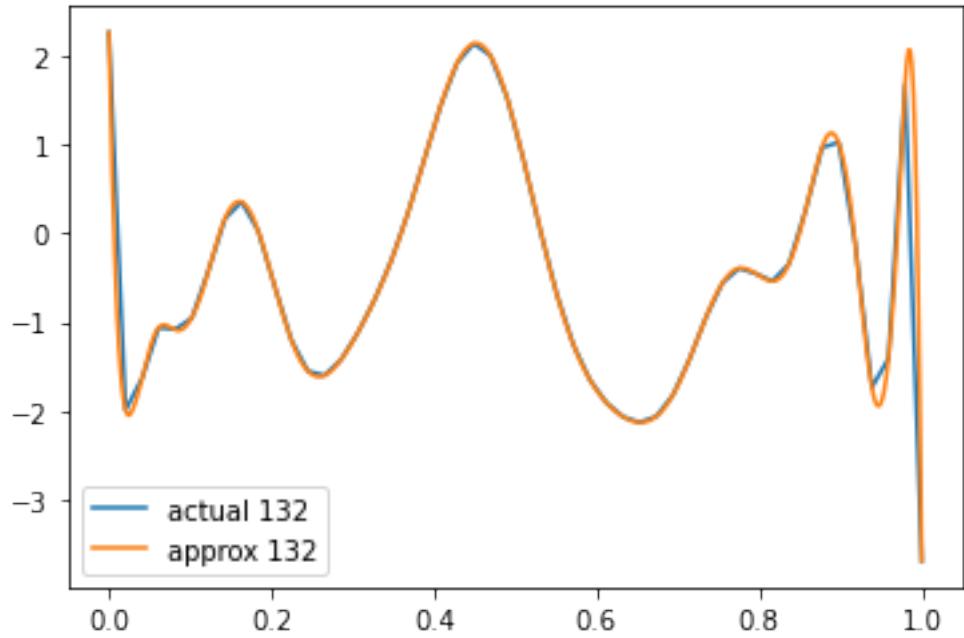


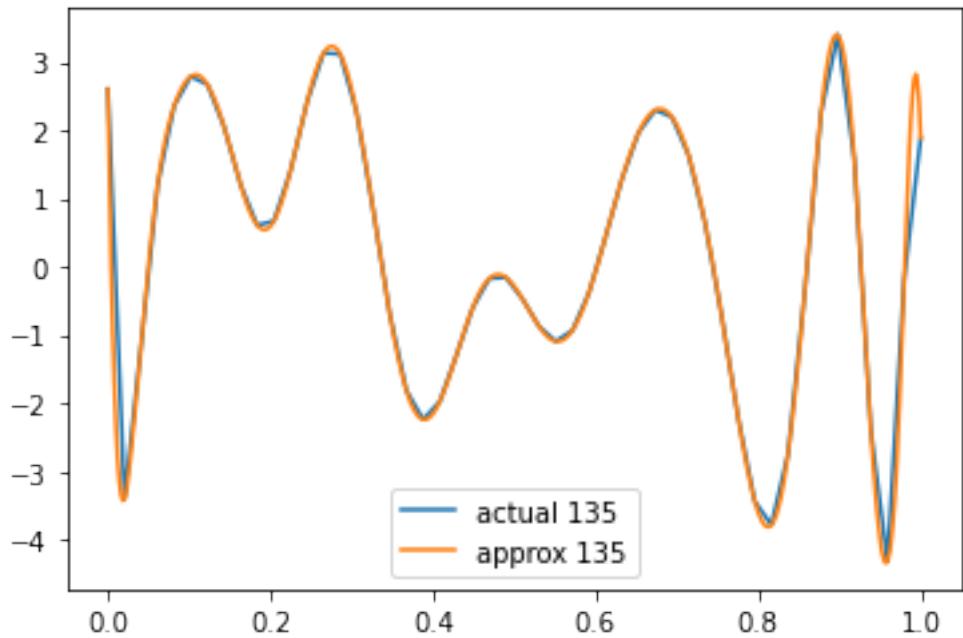
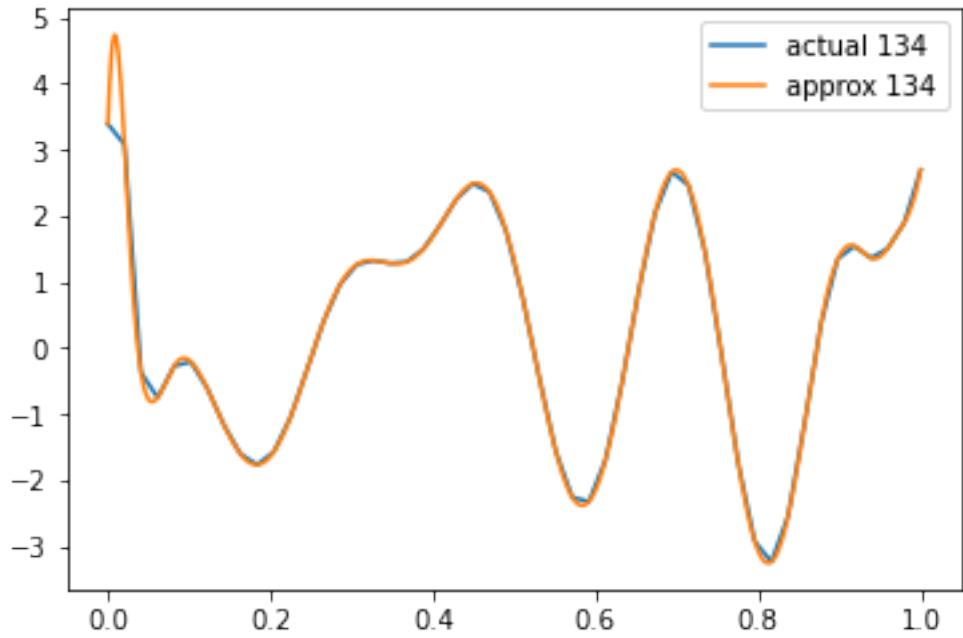


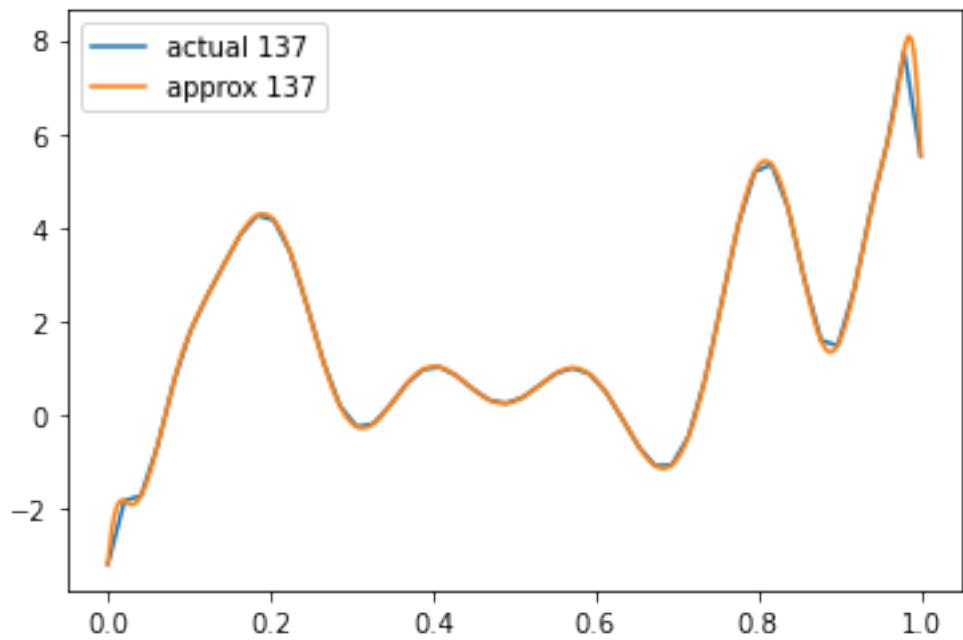
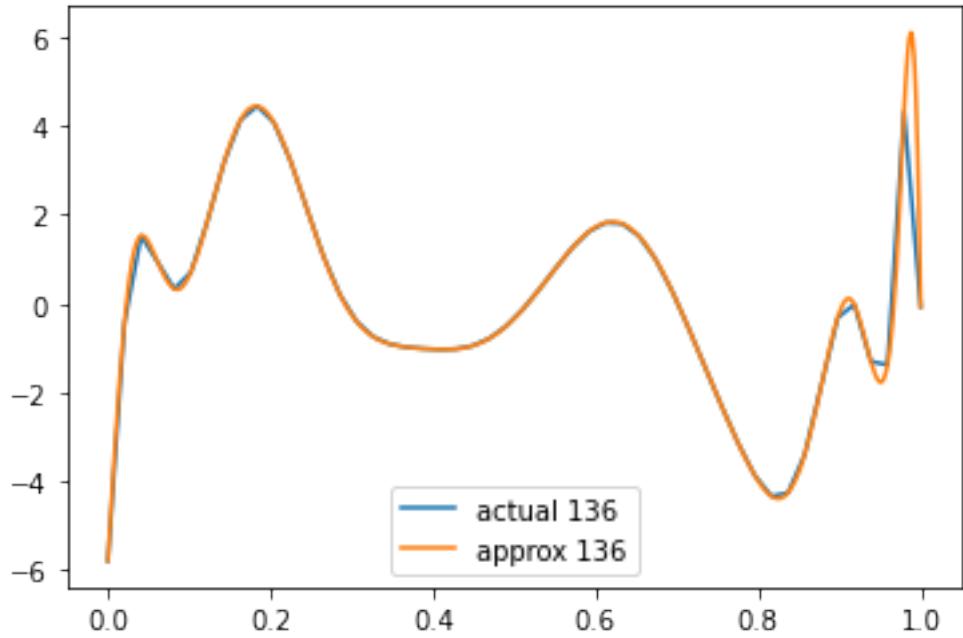


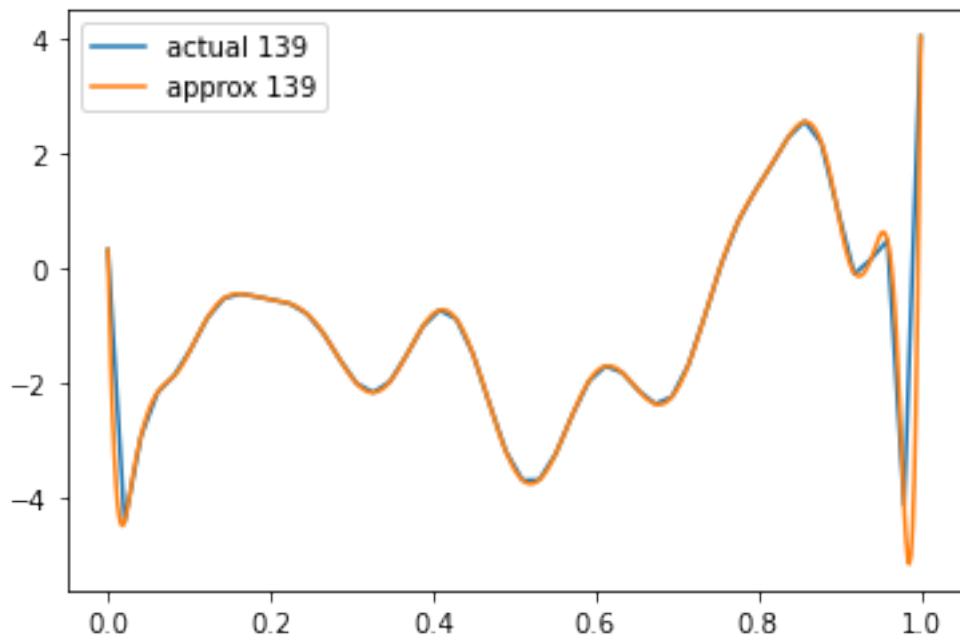
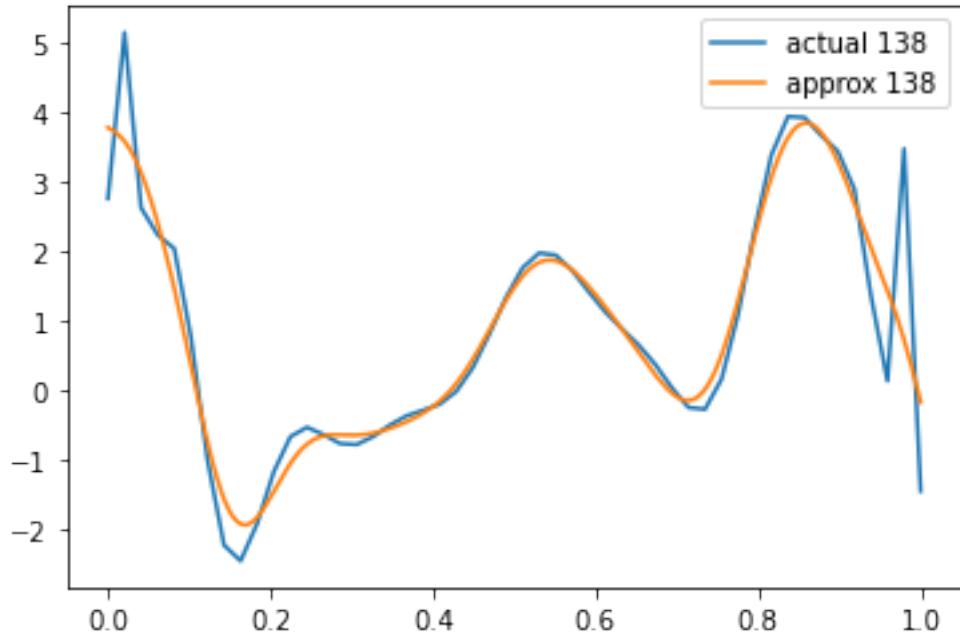


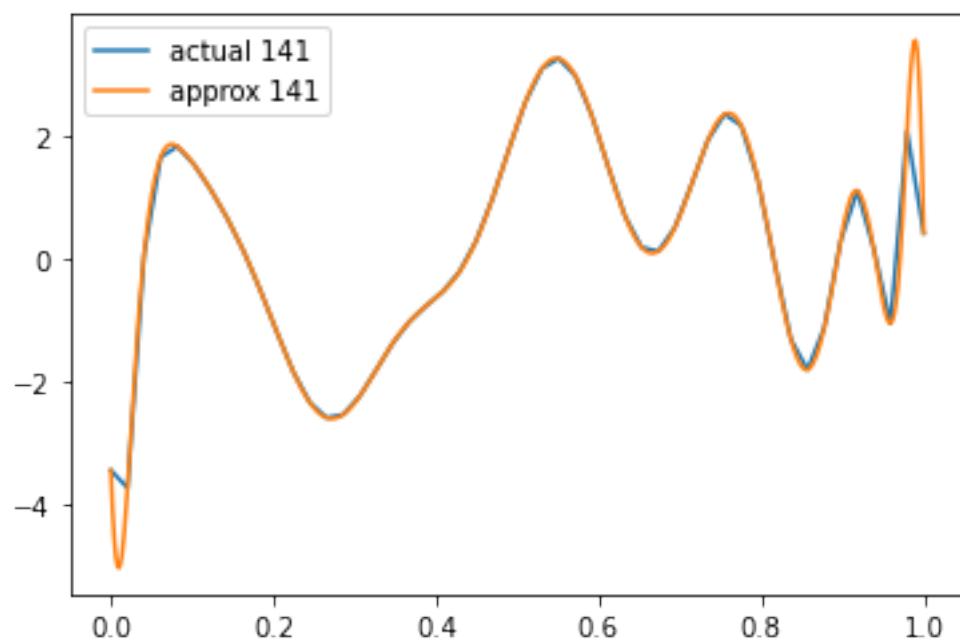
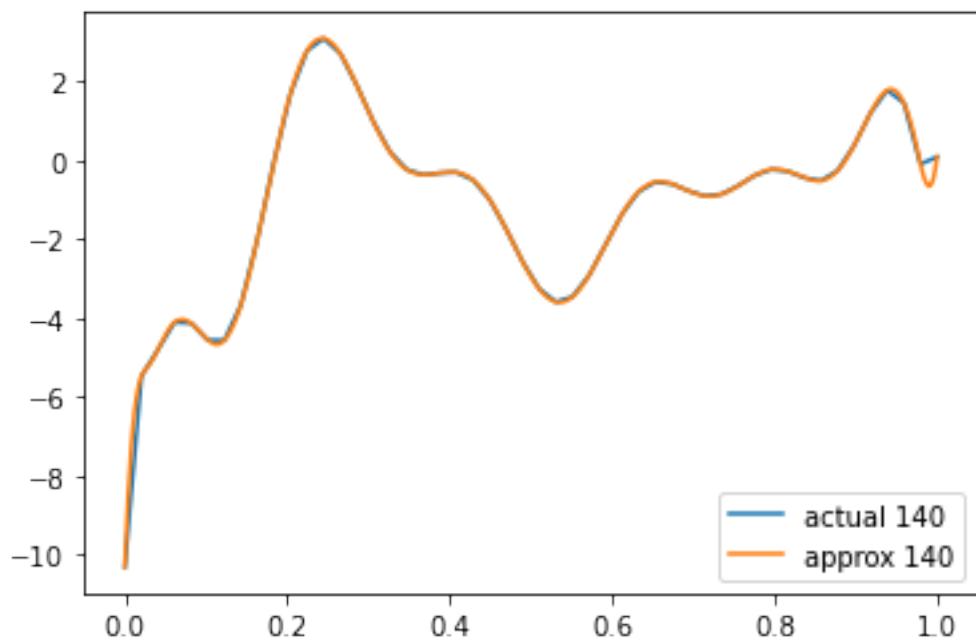




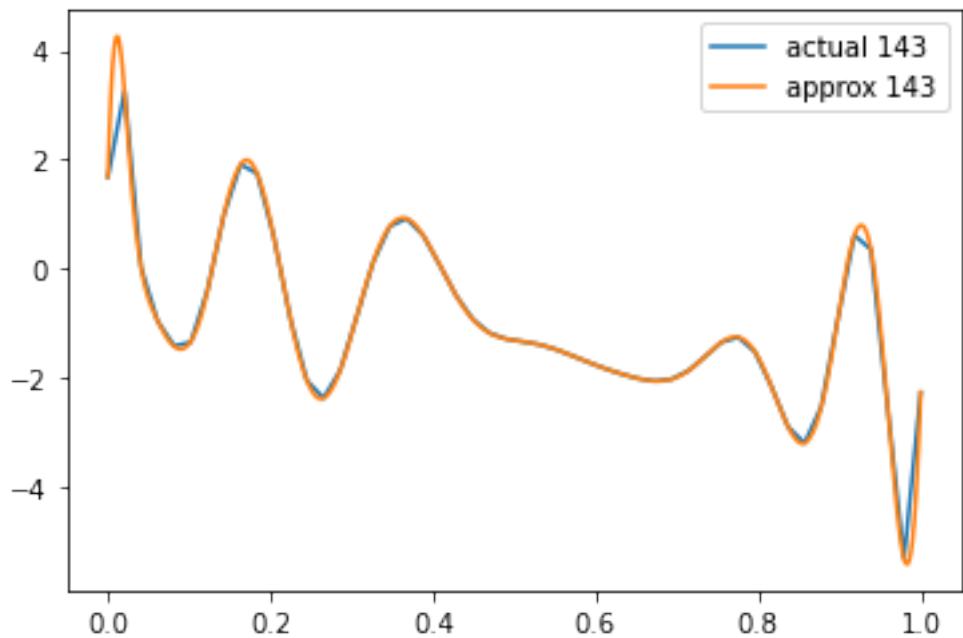
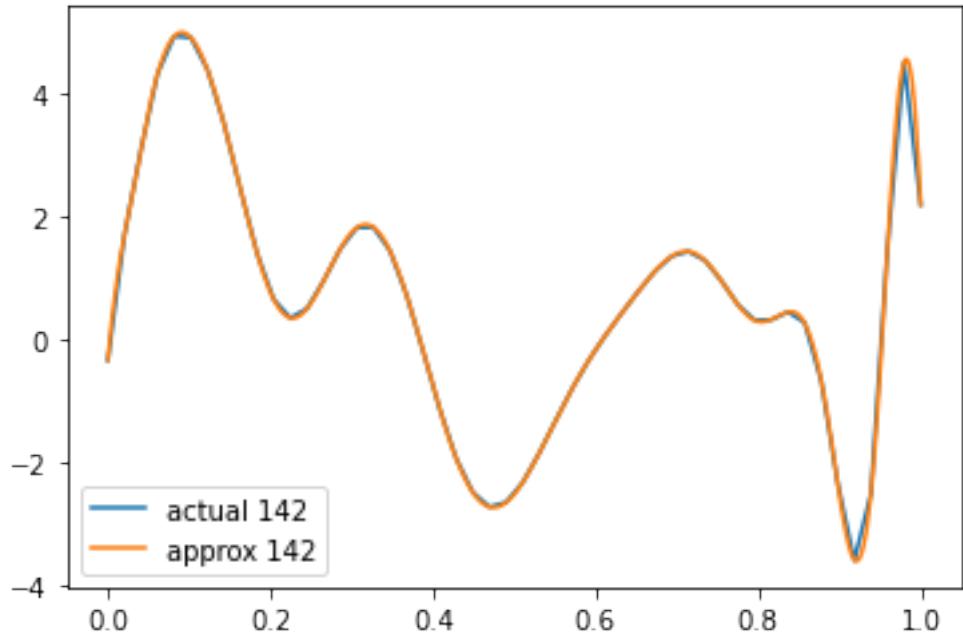


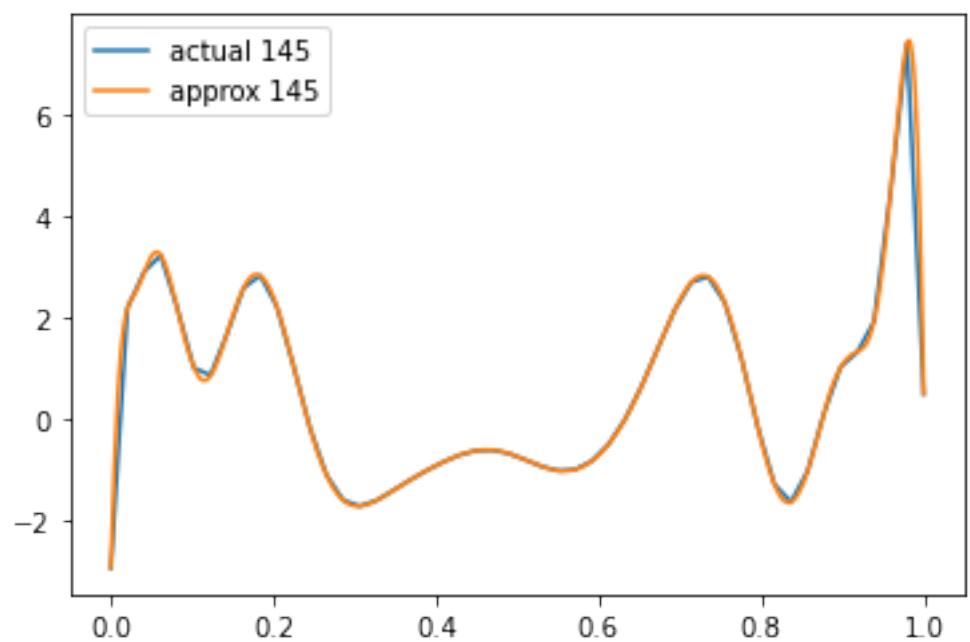
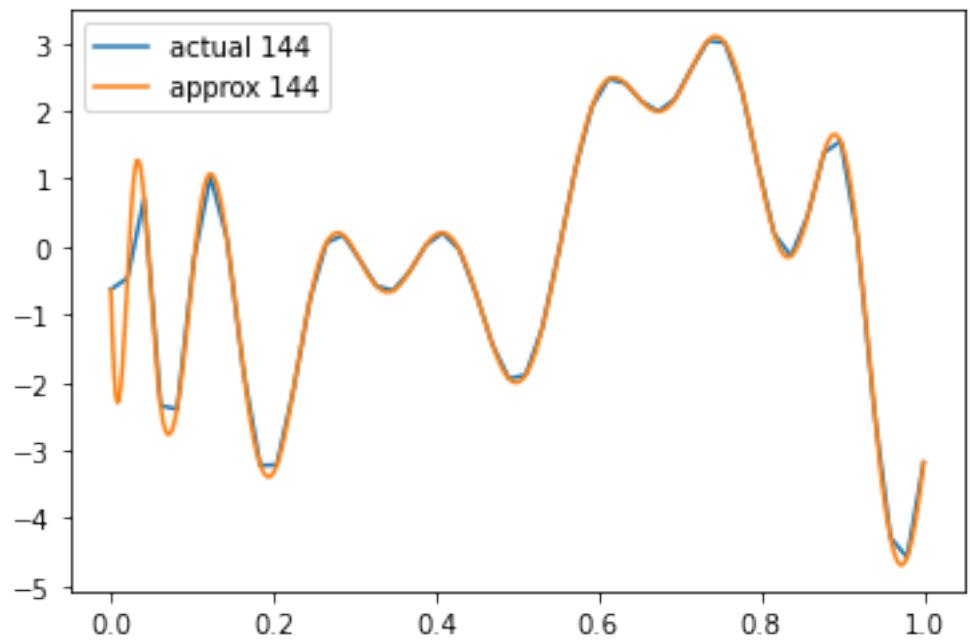


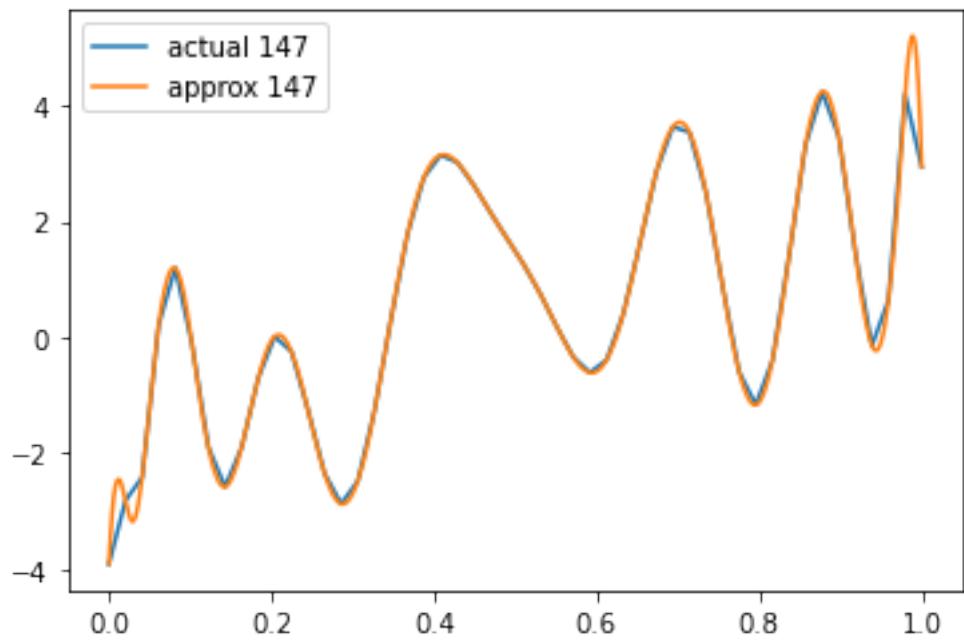
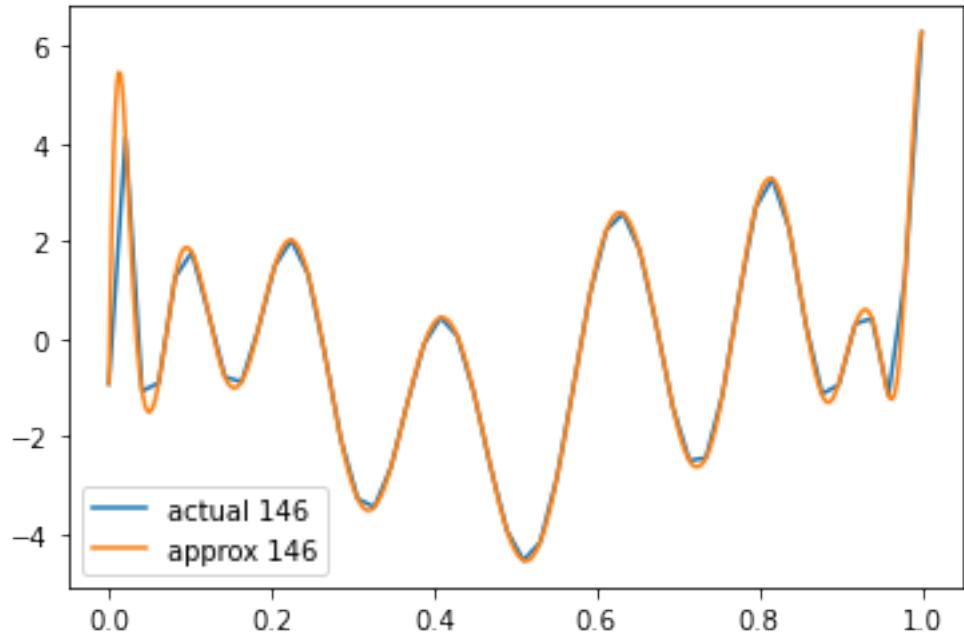


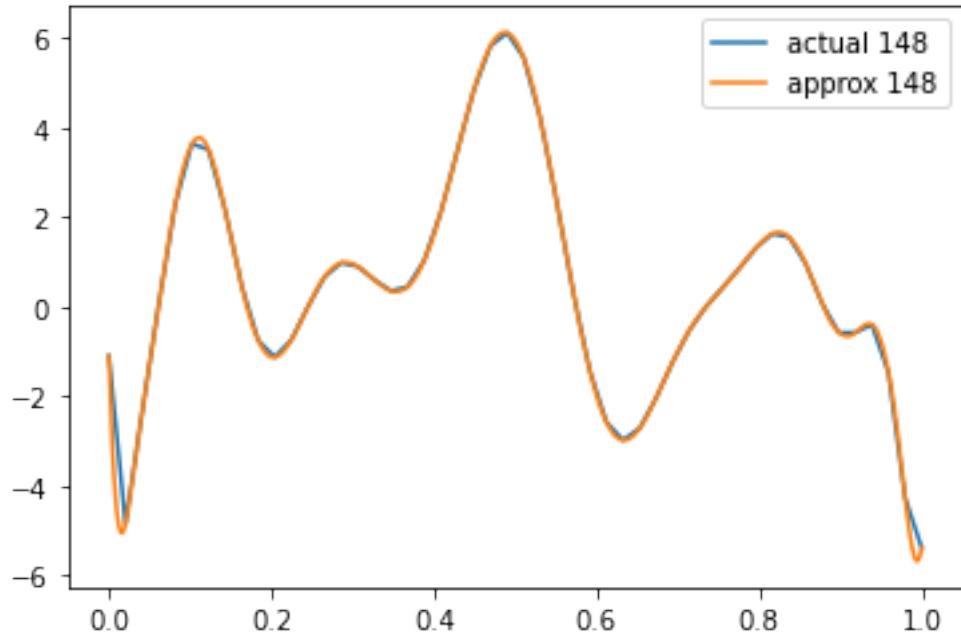


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to bounds  
    warnings.warn("Values in x were outside bounds during a "
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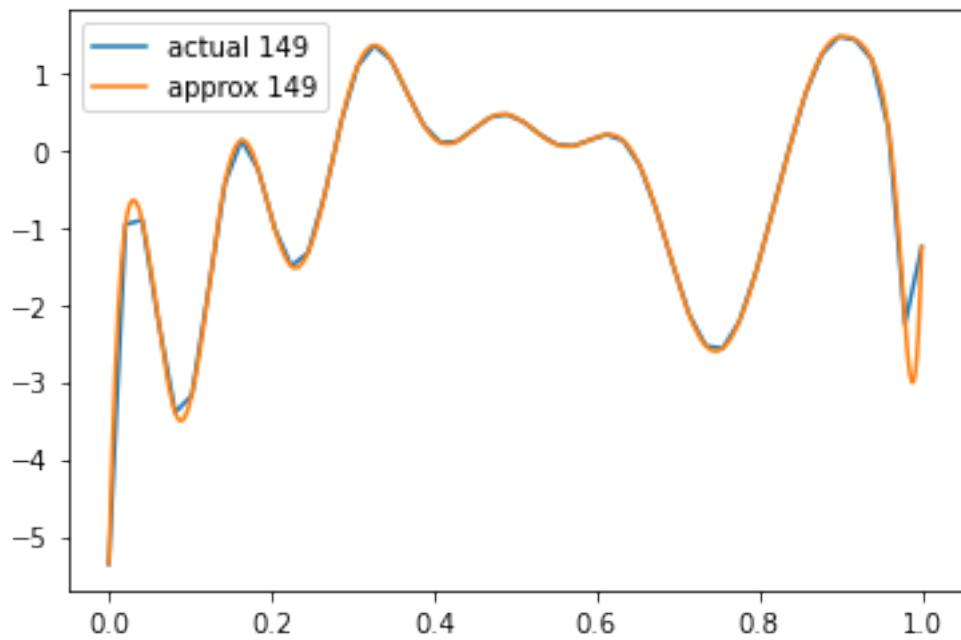


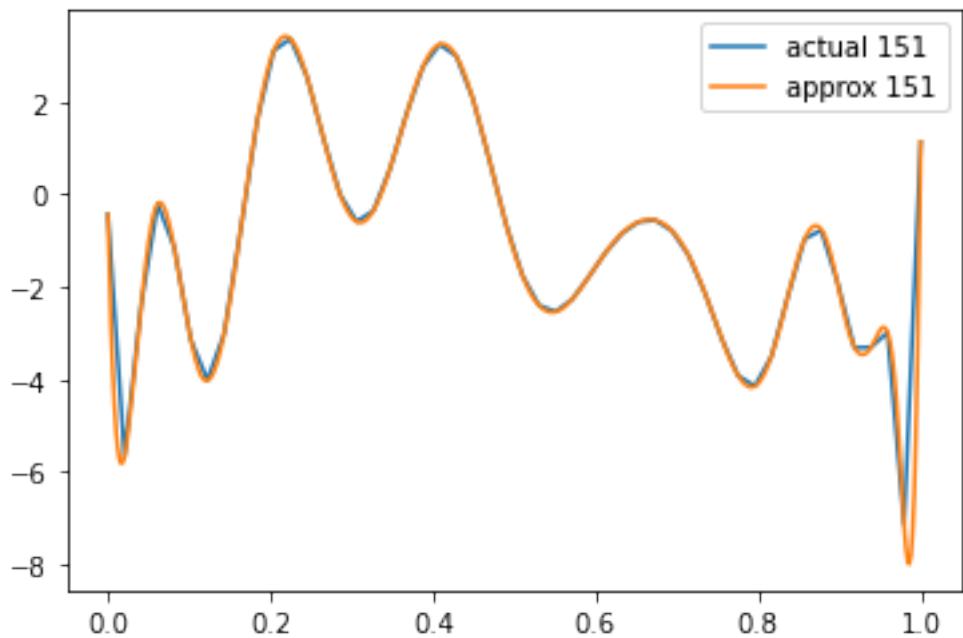
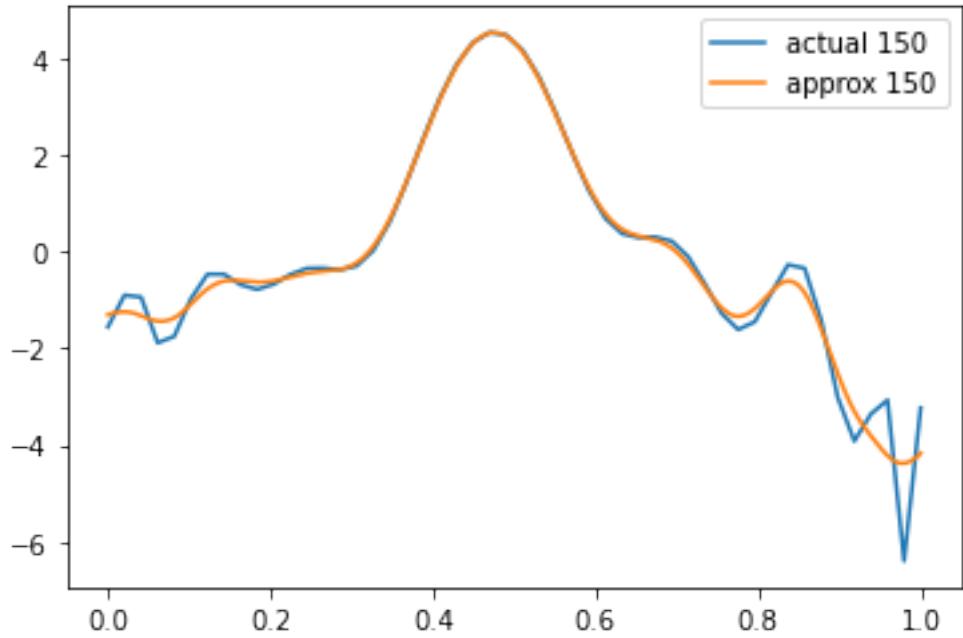


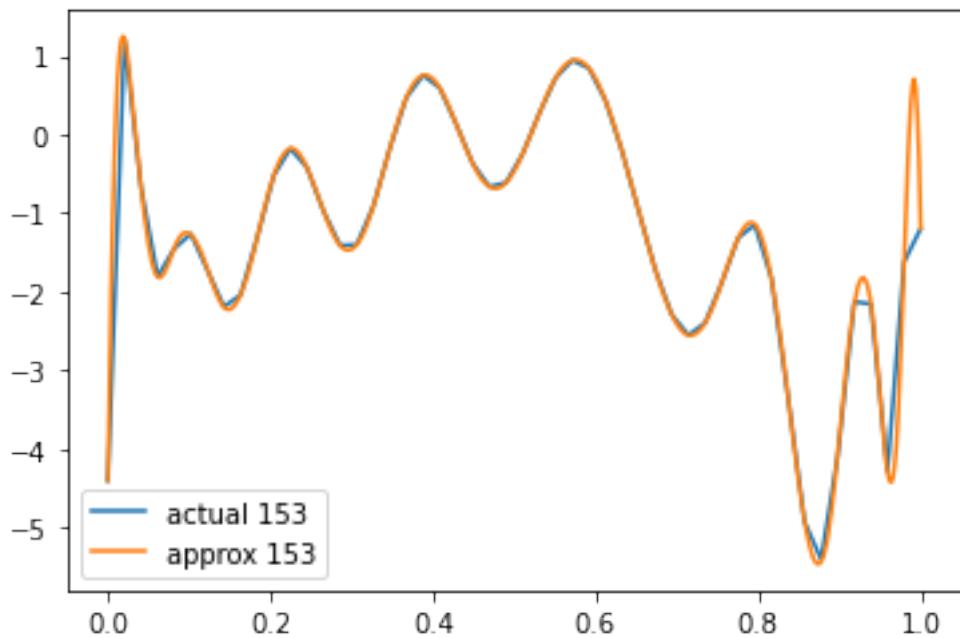
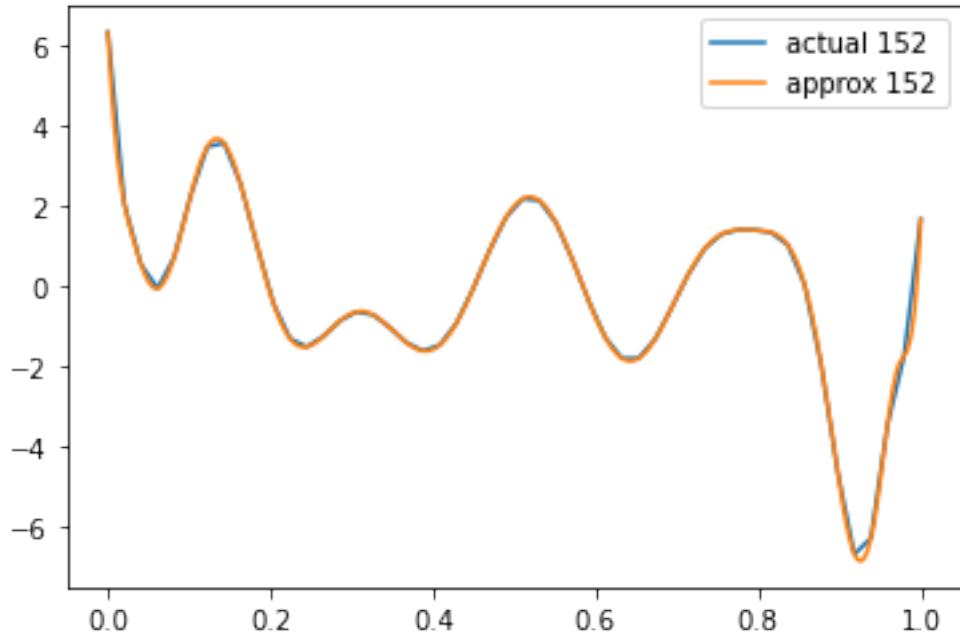


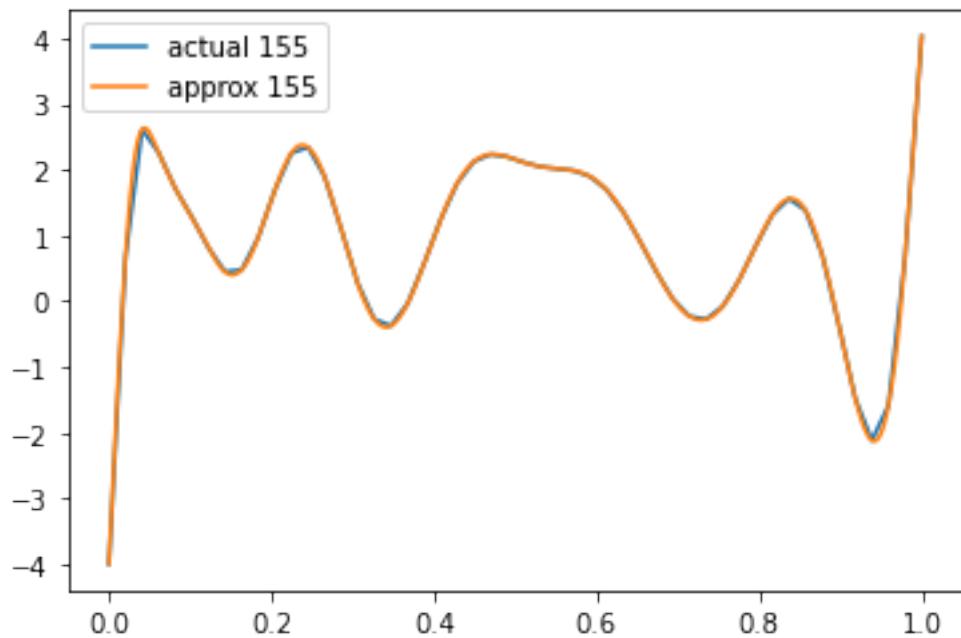
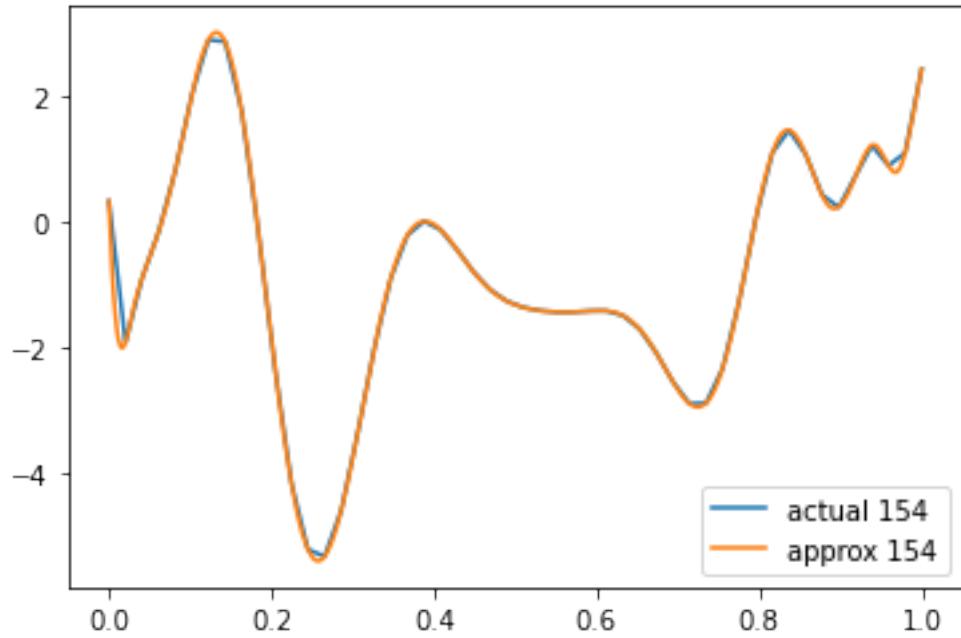


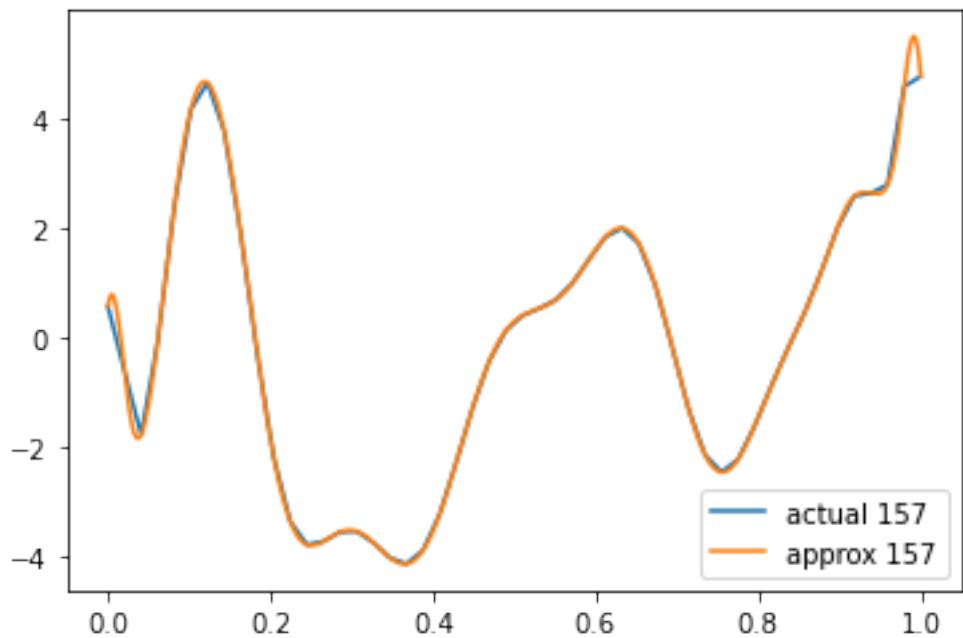
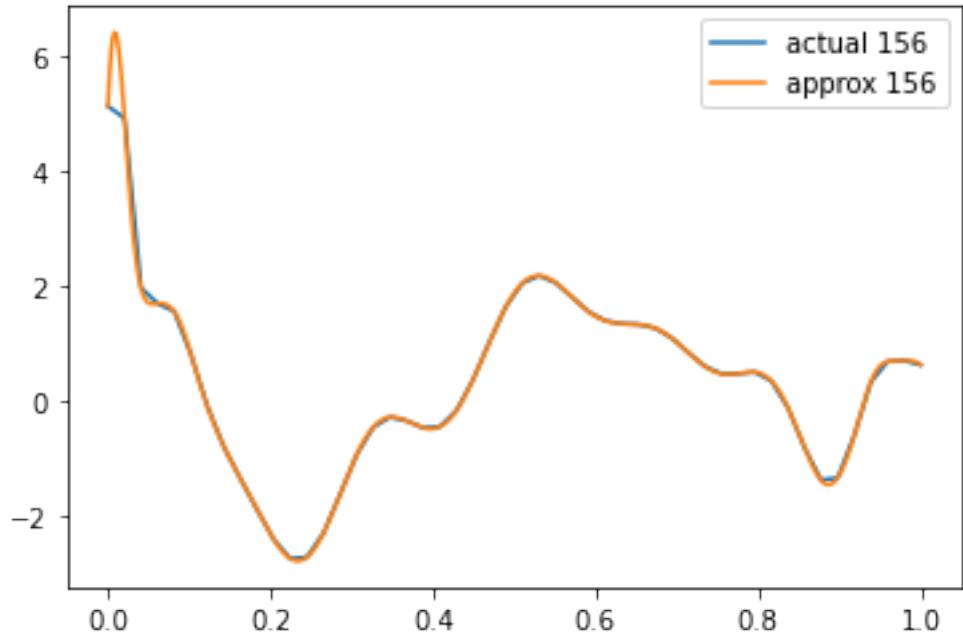
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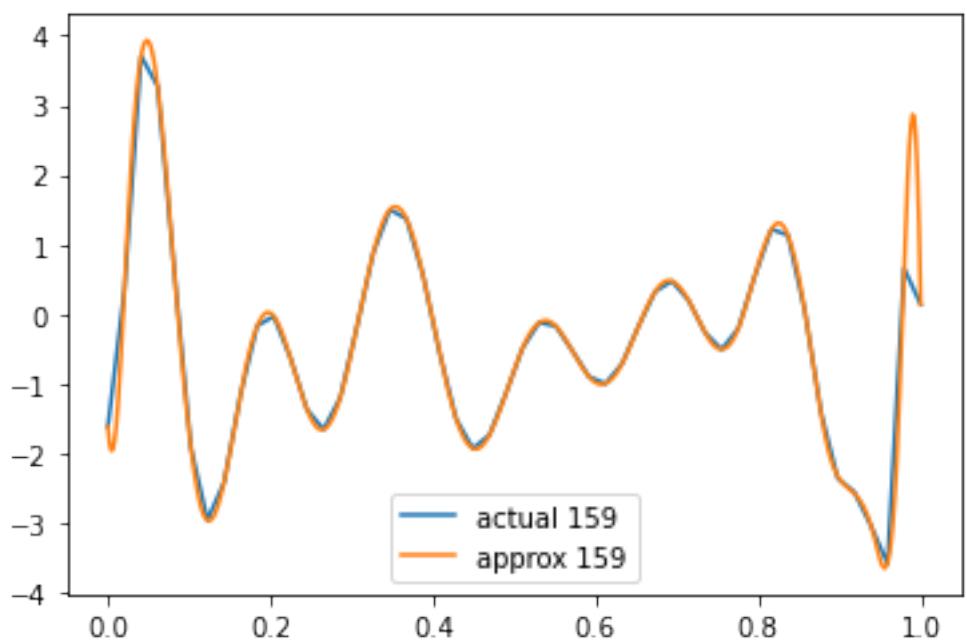
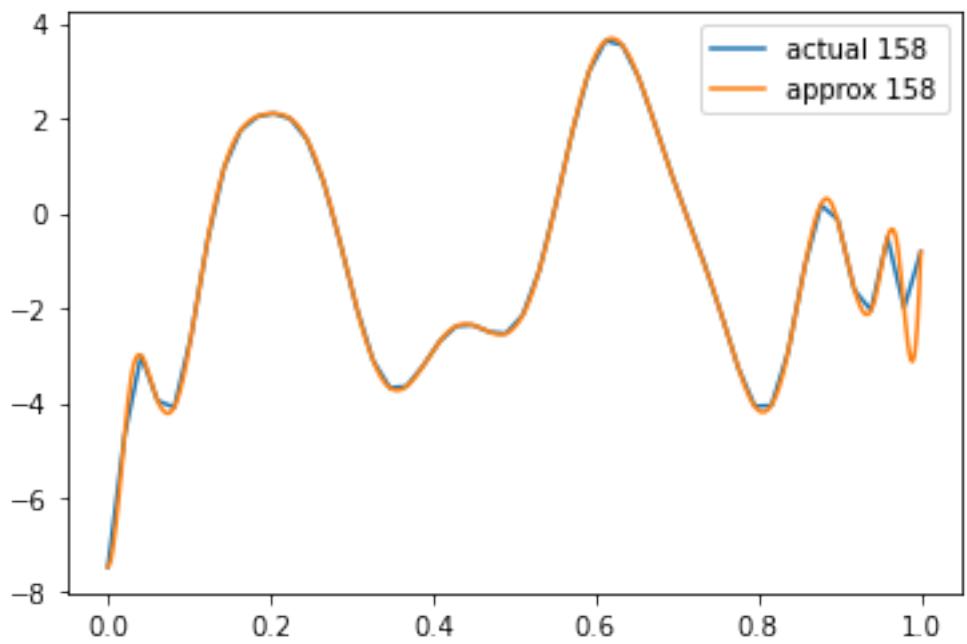


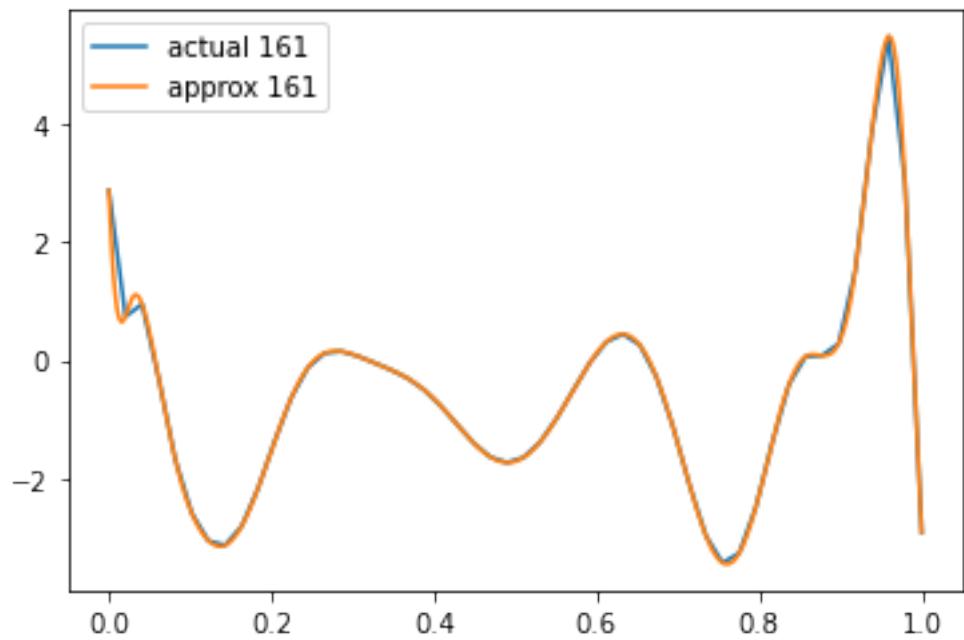
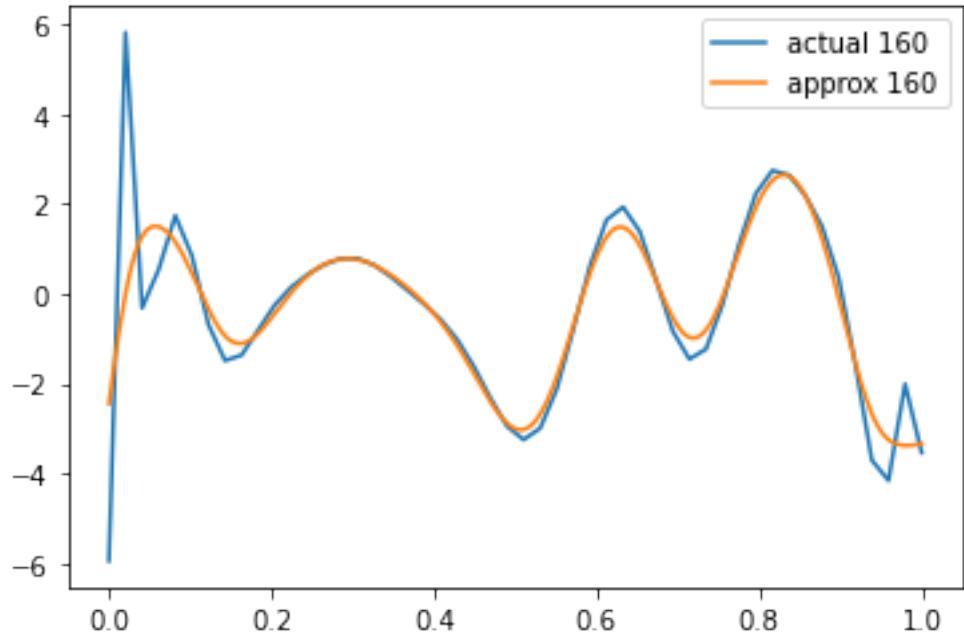


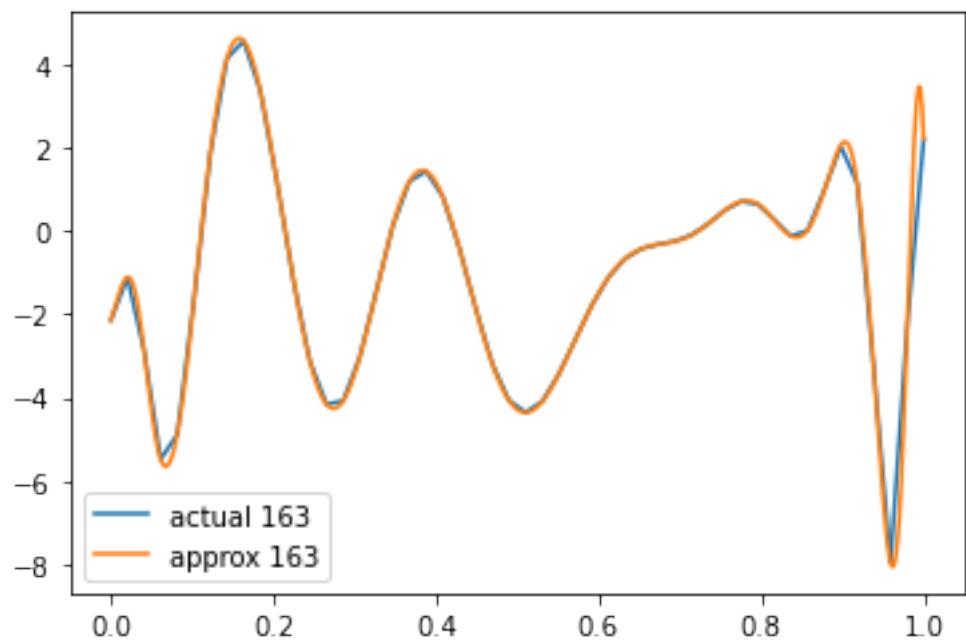
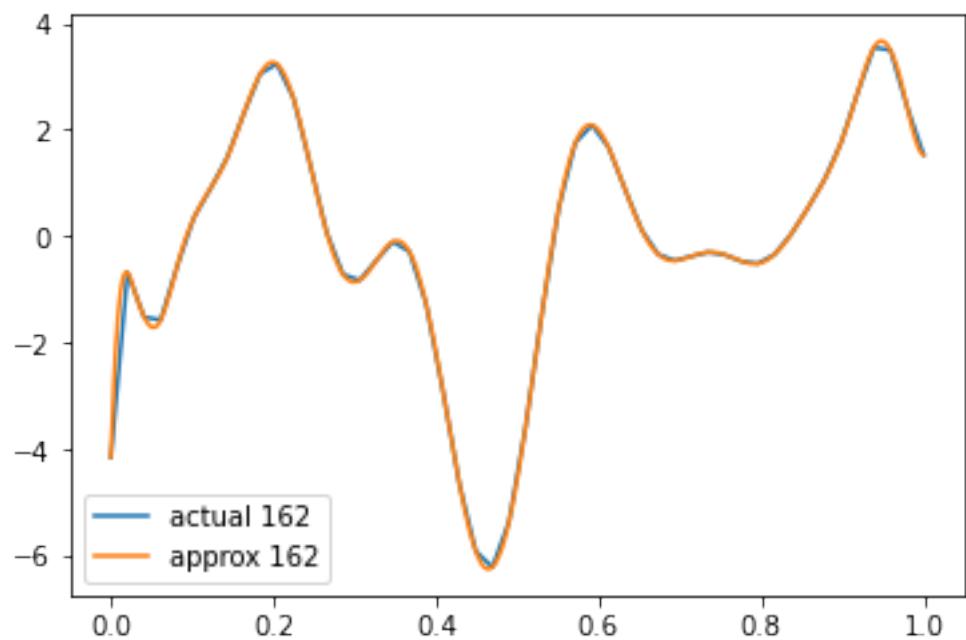


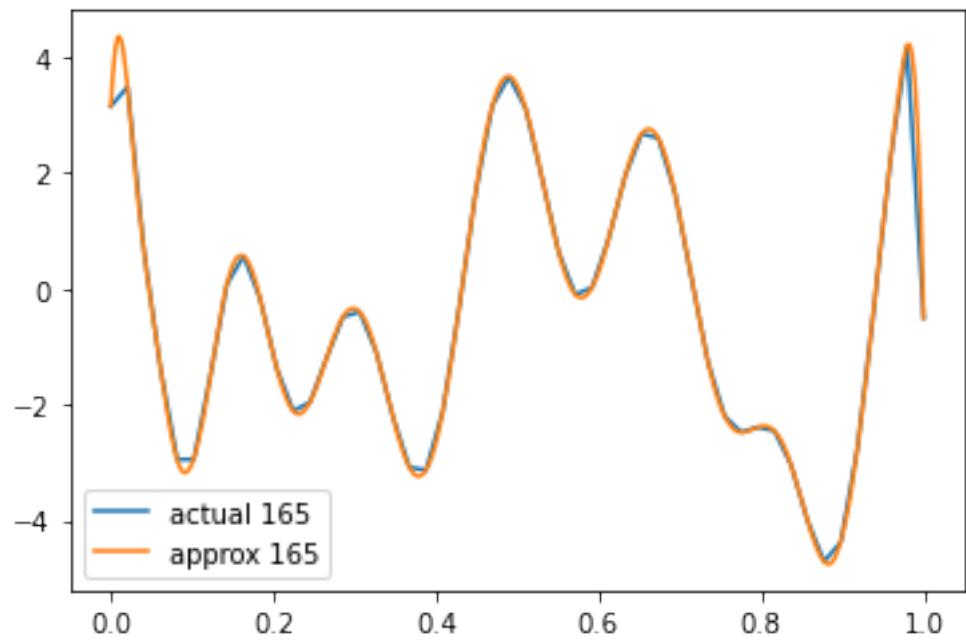
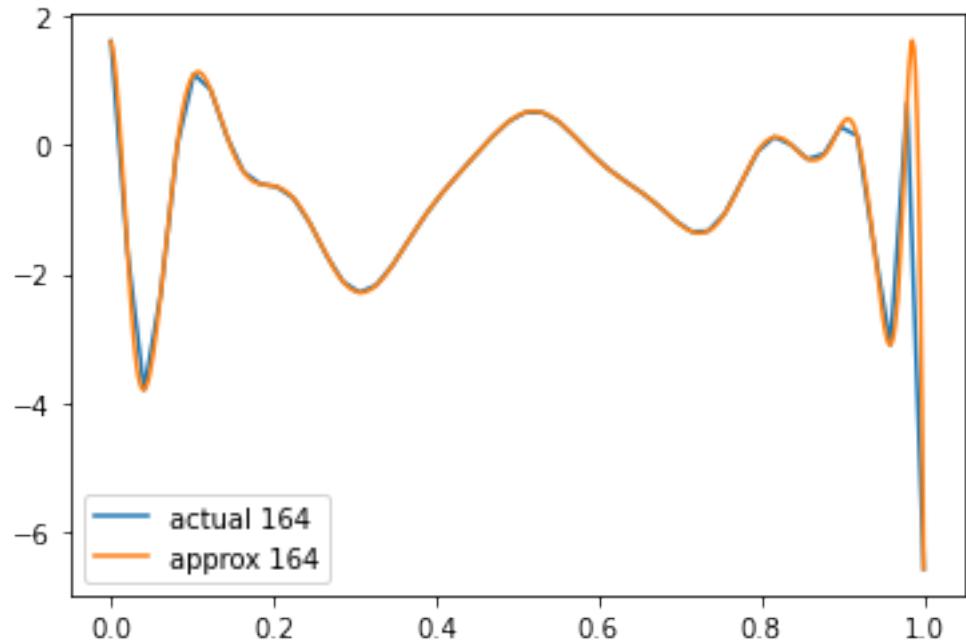


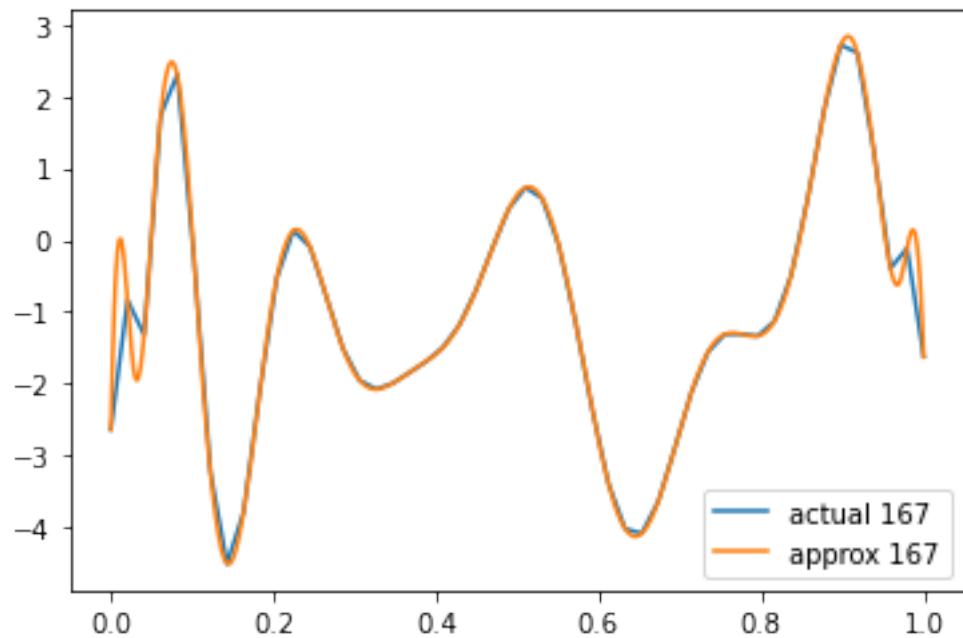
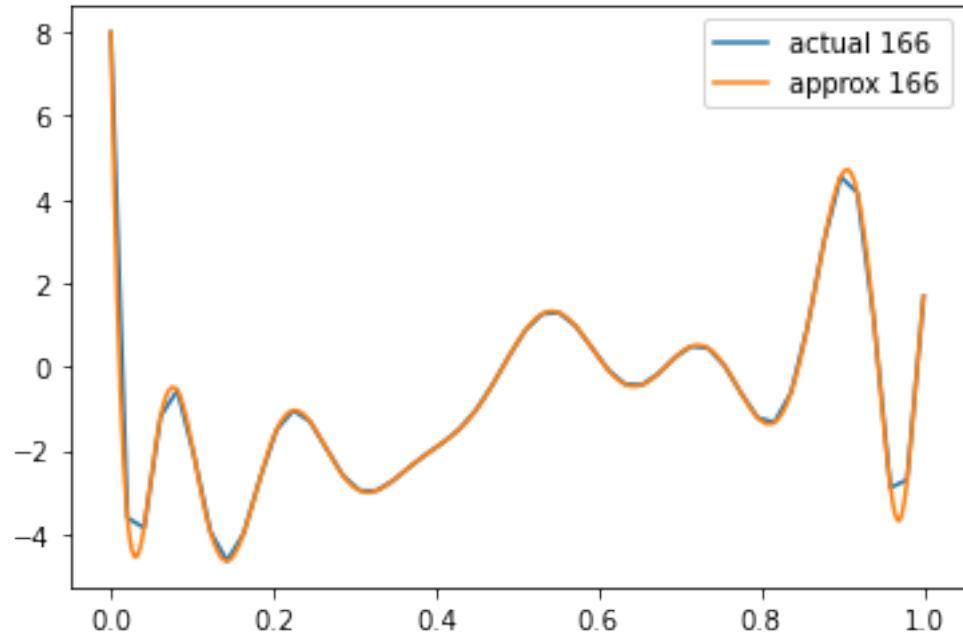


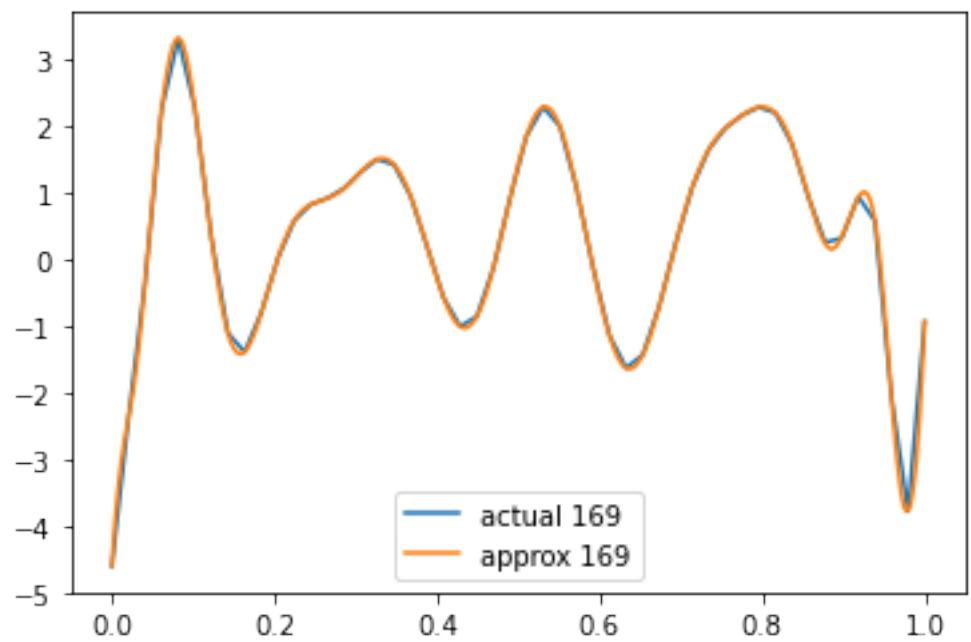
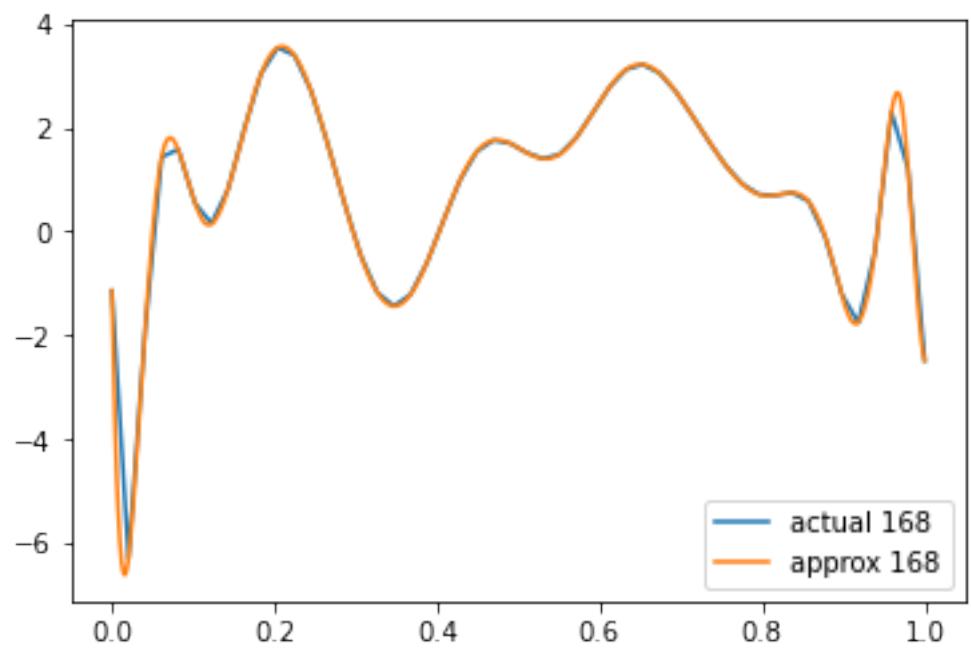


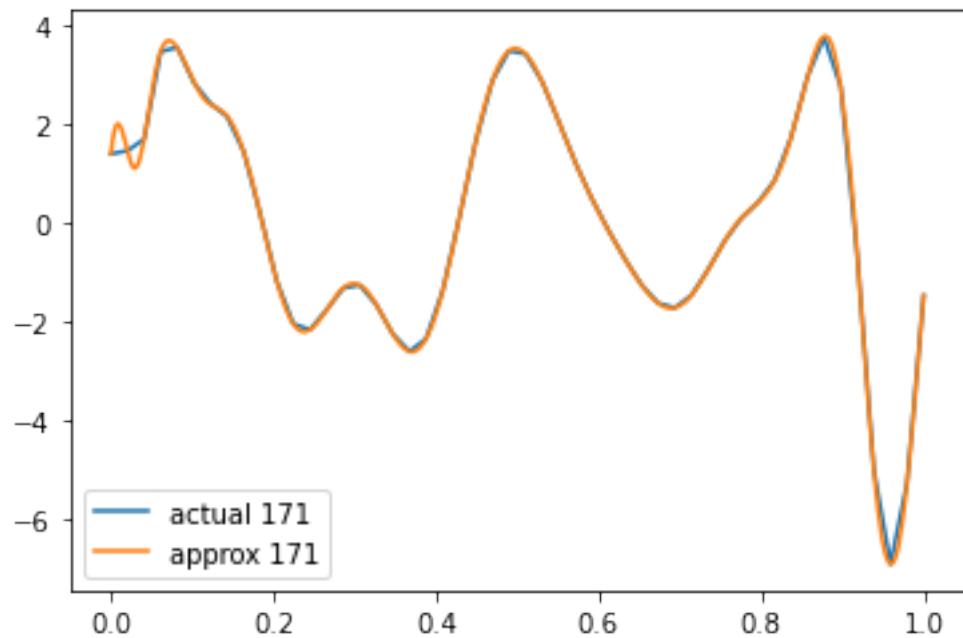
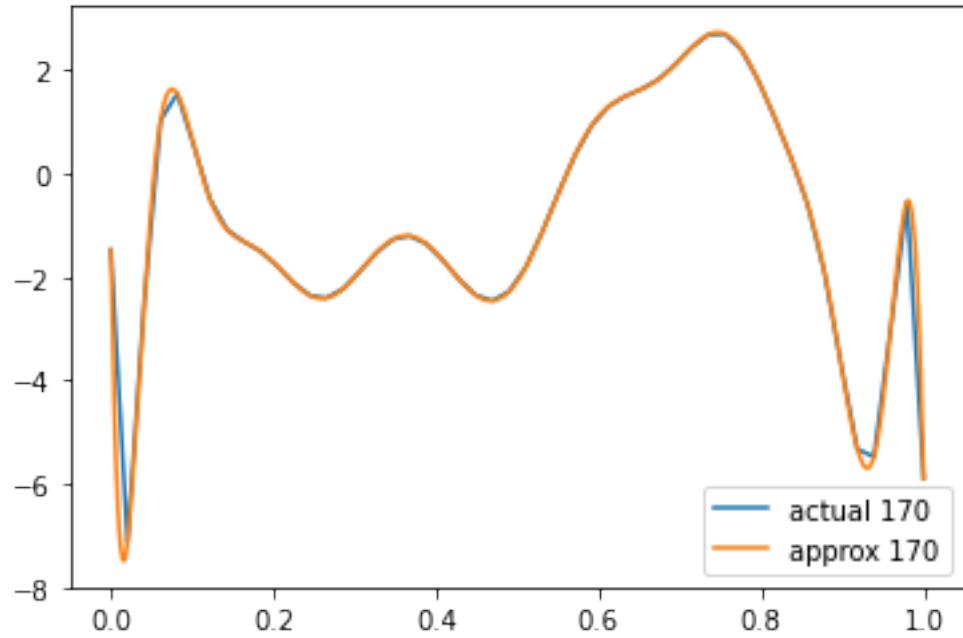




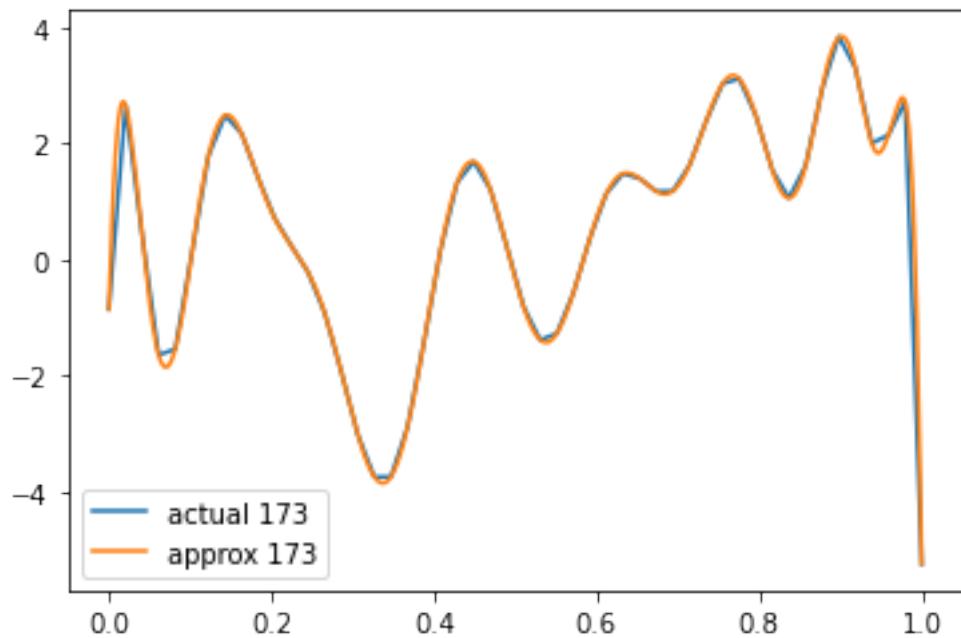
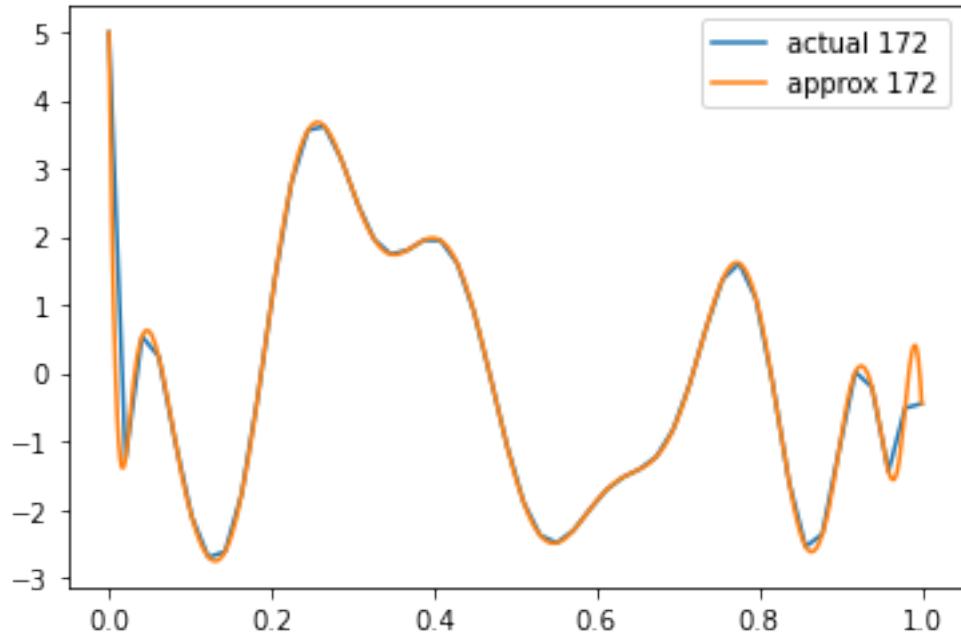


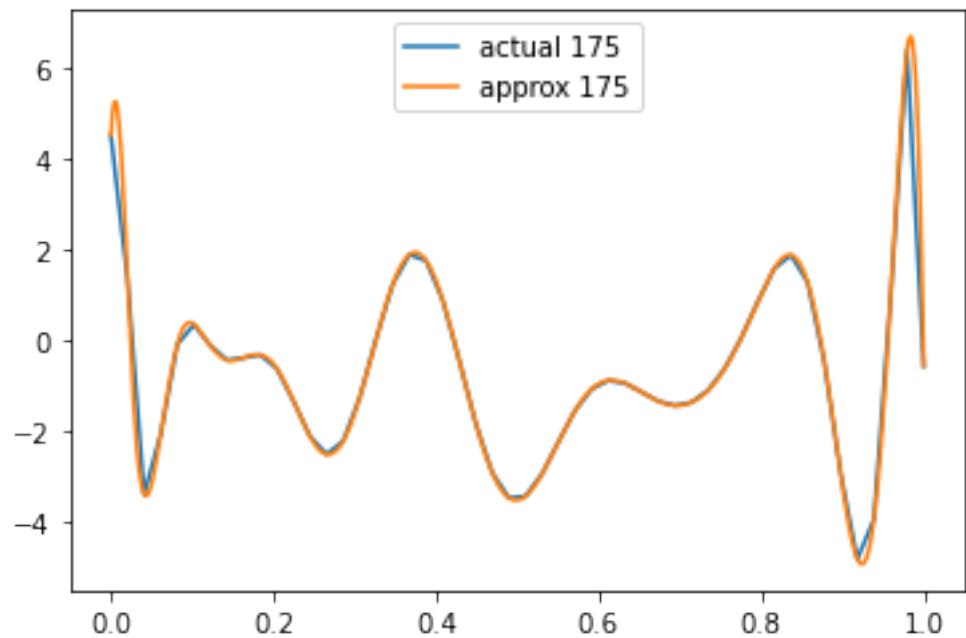
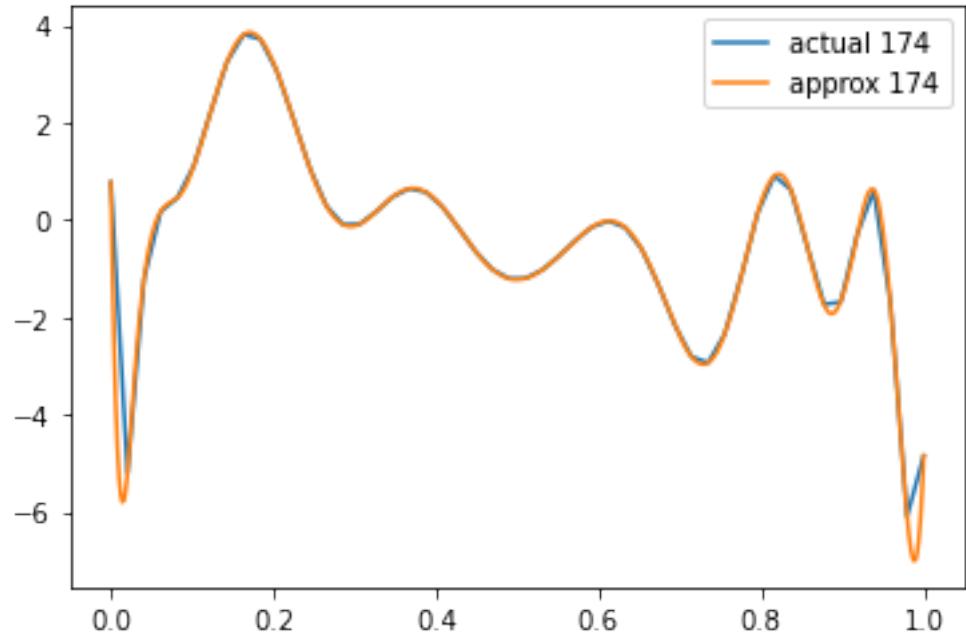


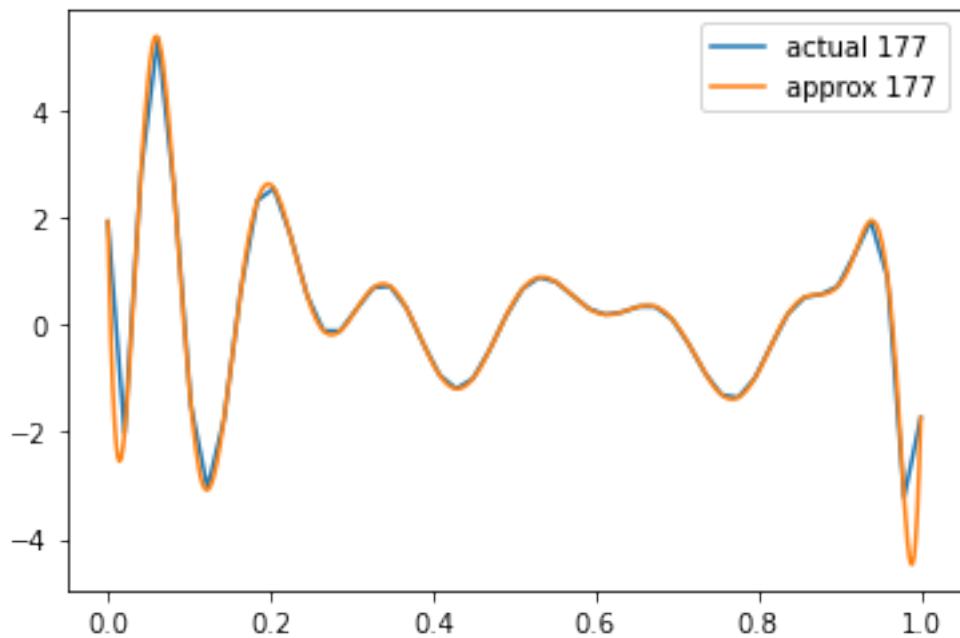
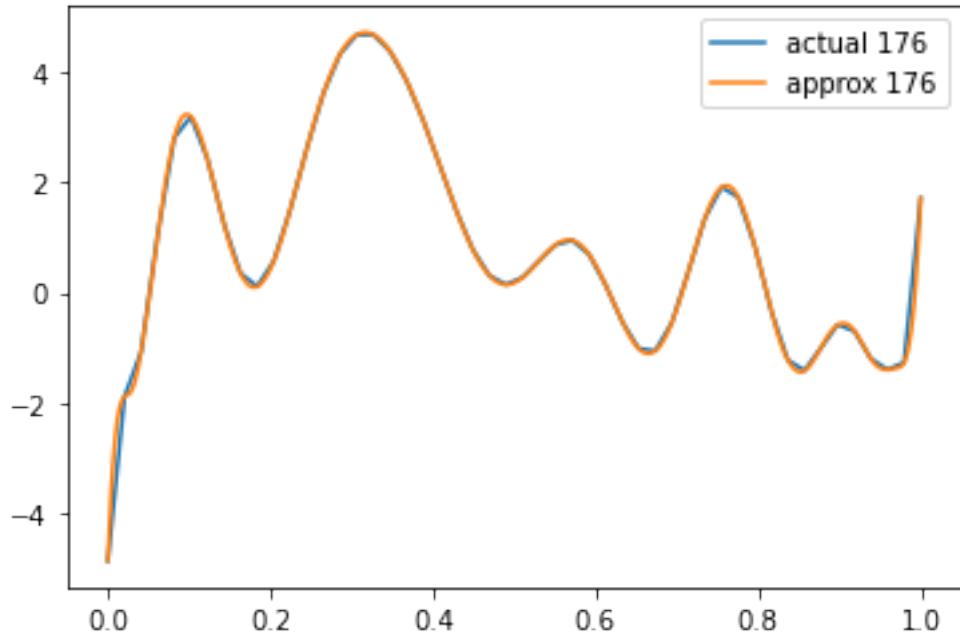


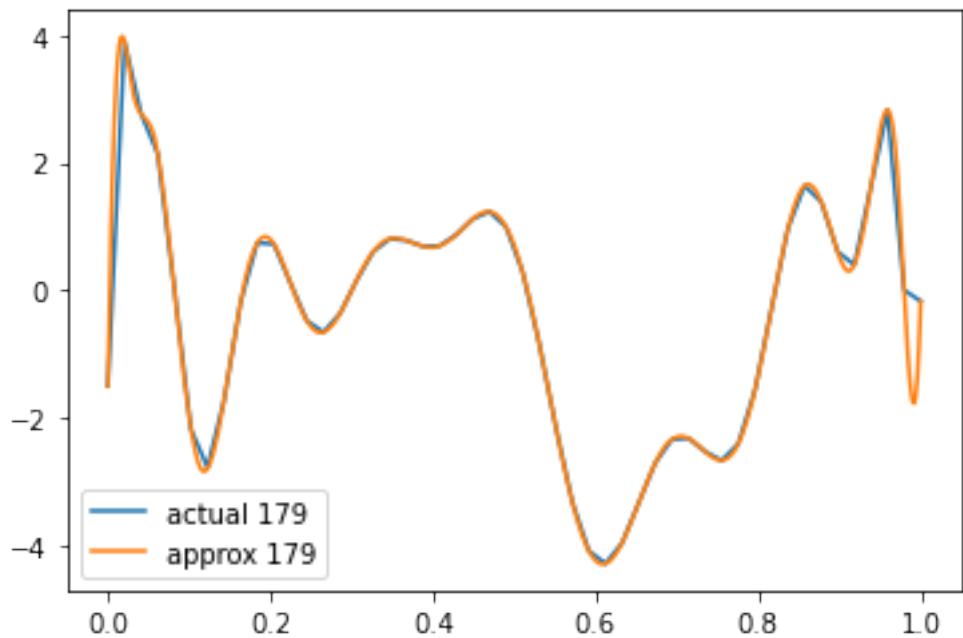
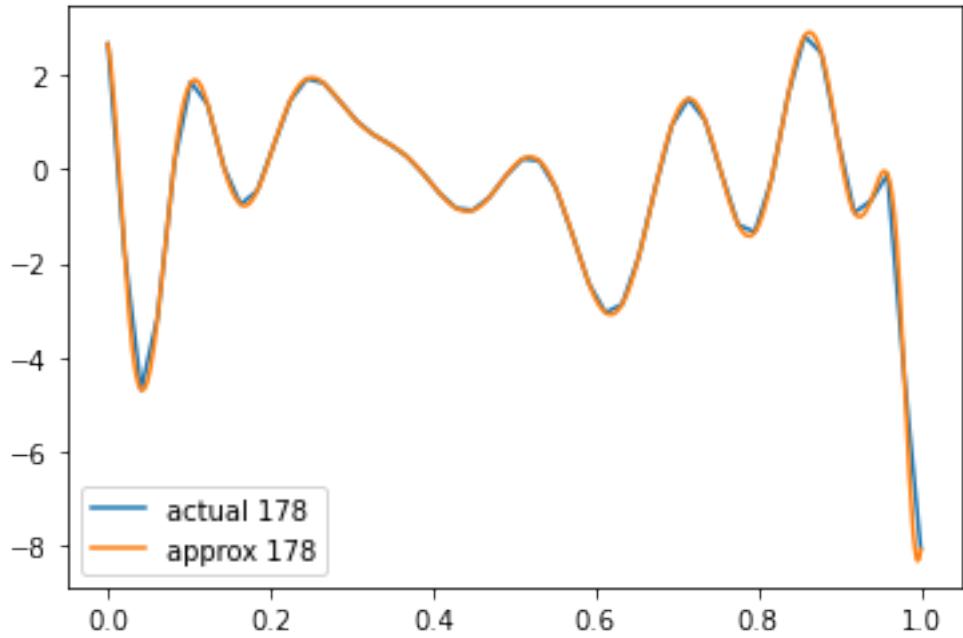


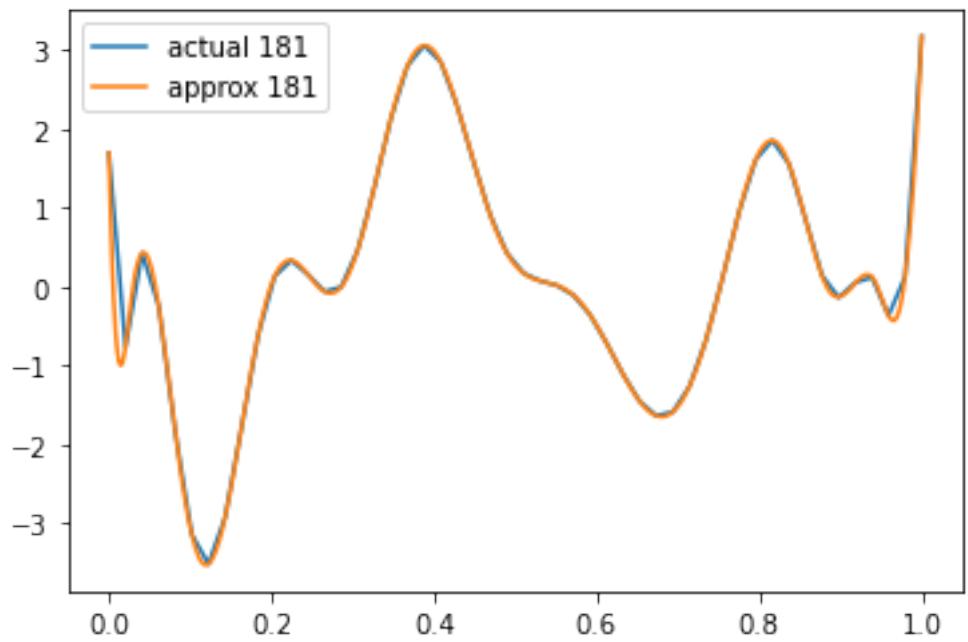
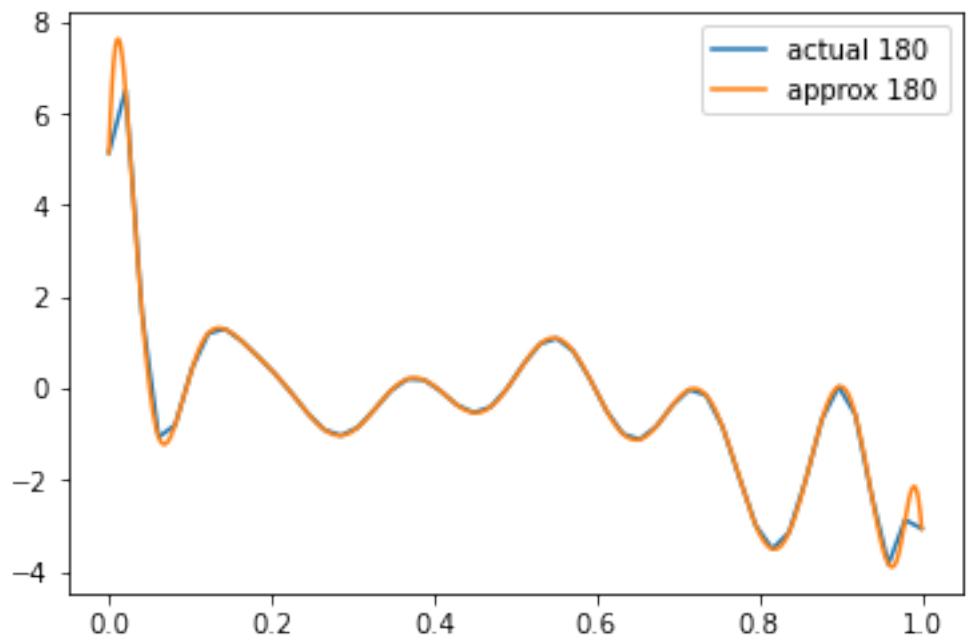
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c:\Users\Diego\anaconda3\lib\site-packages\scipy\optimize\optimize.py:282:  
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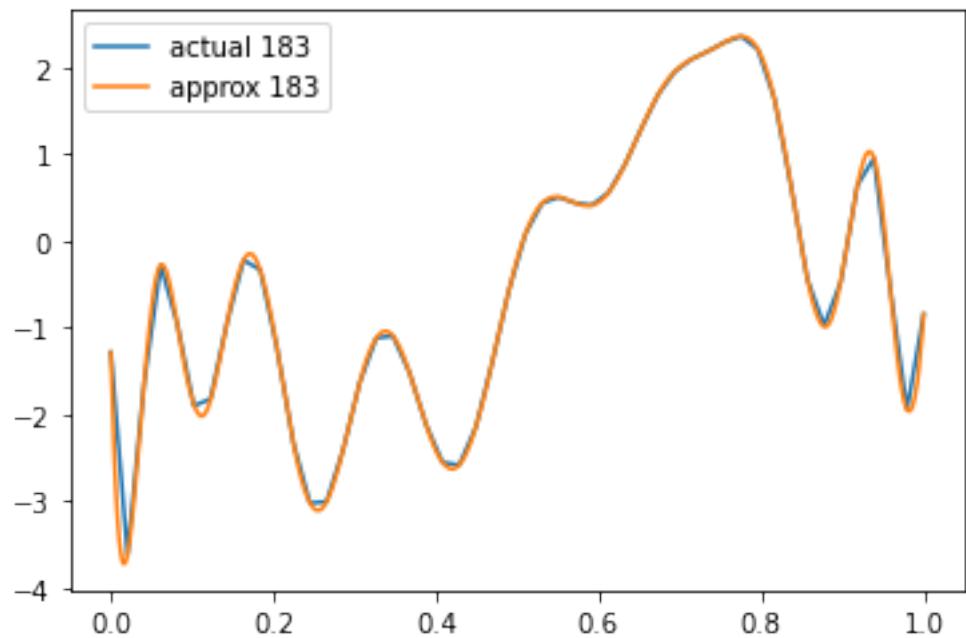
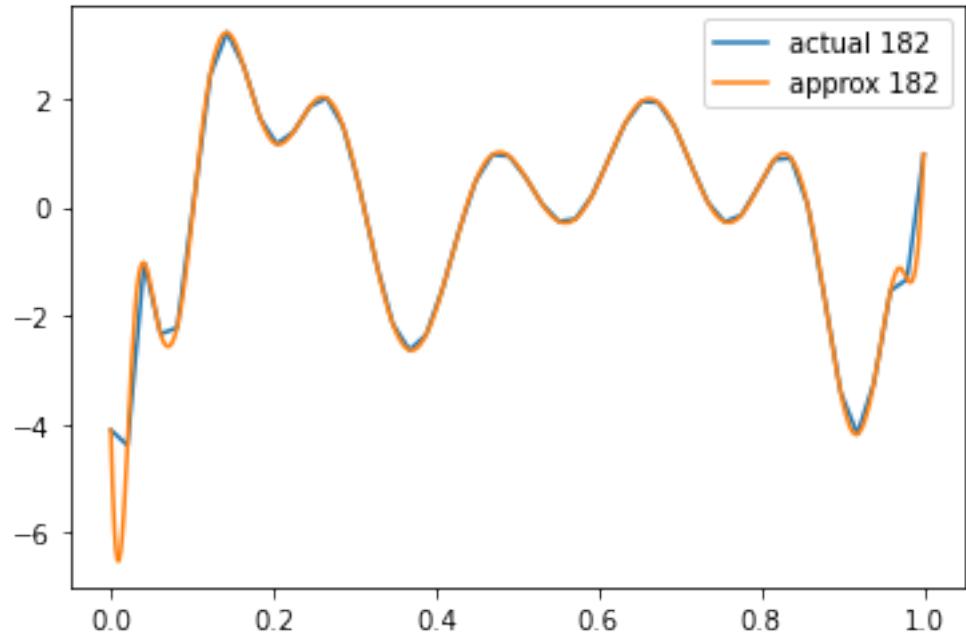


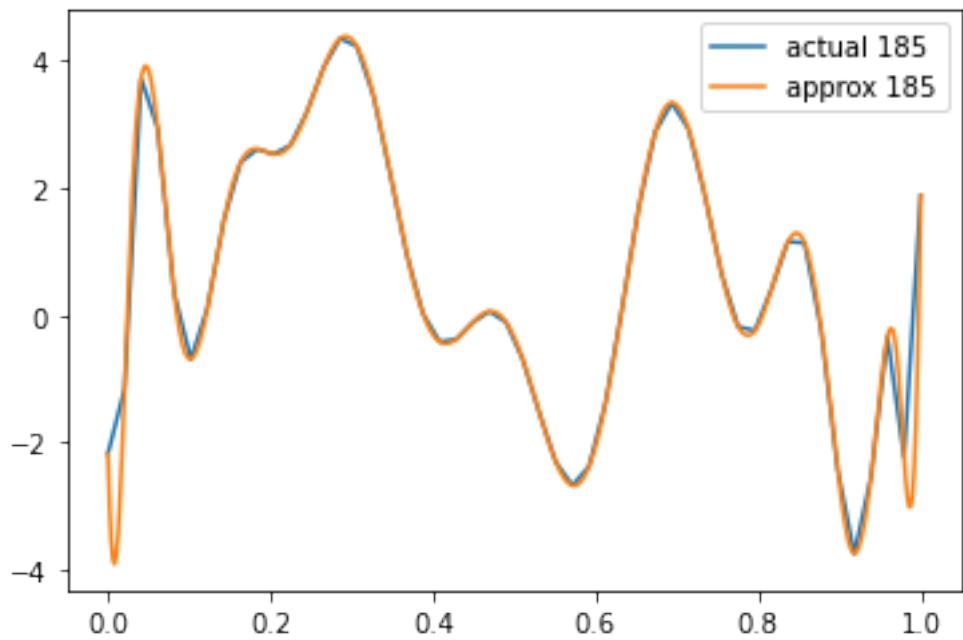
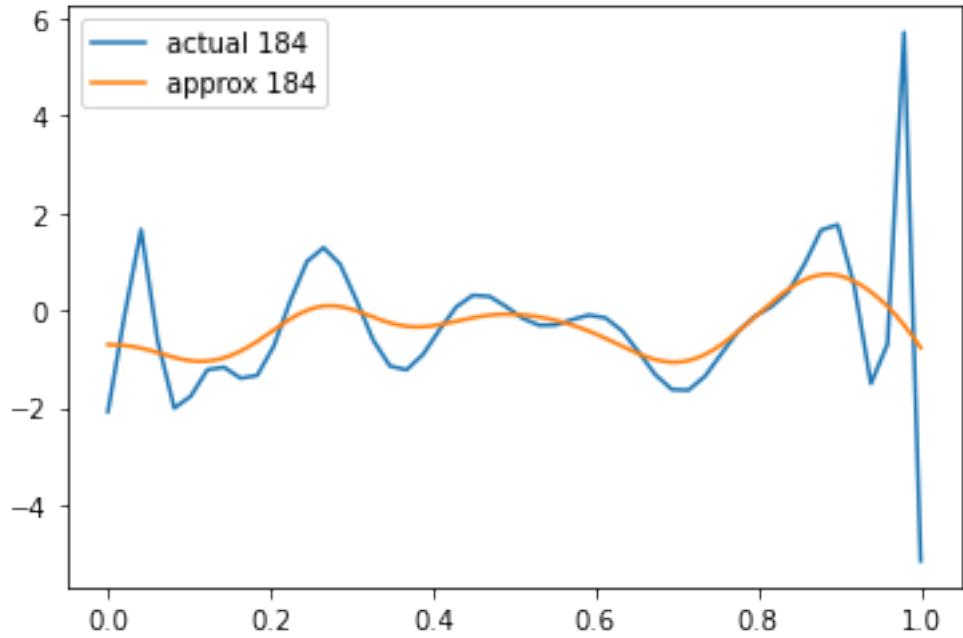


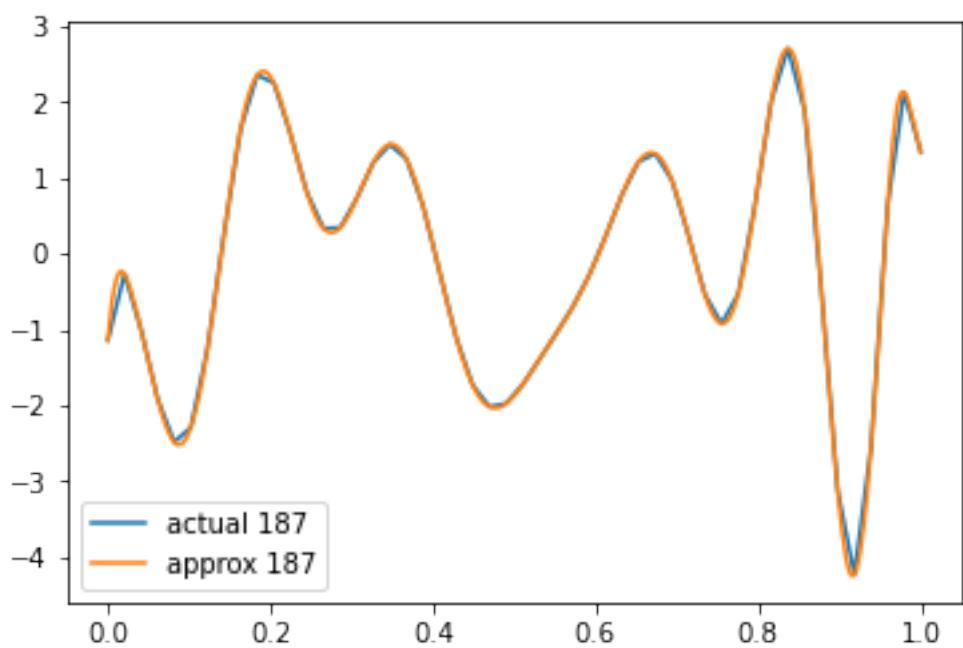
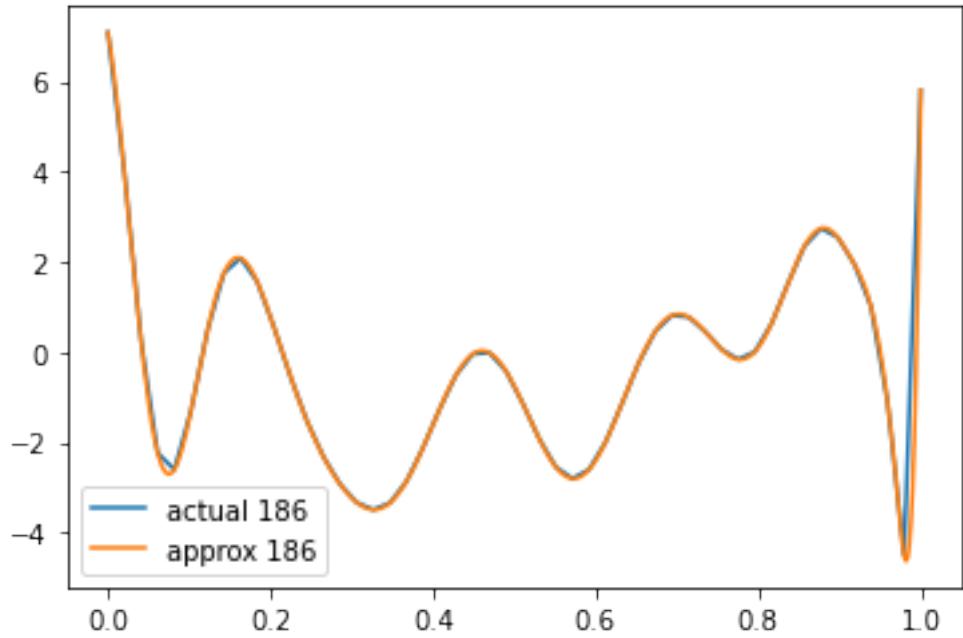


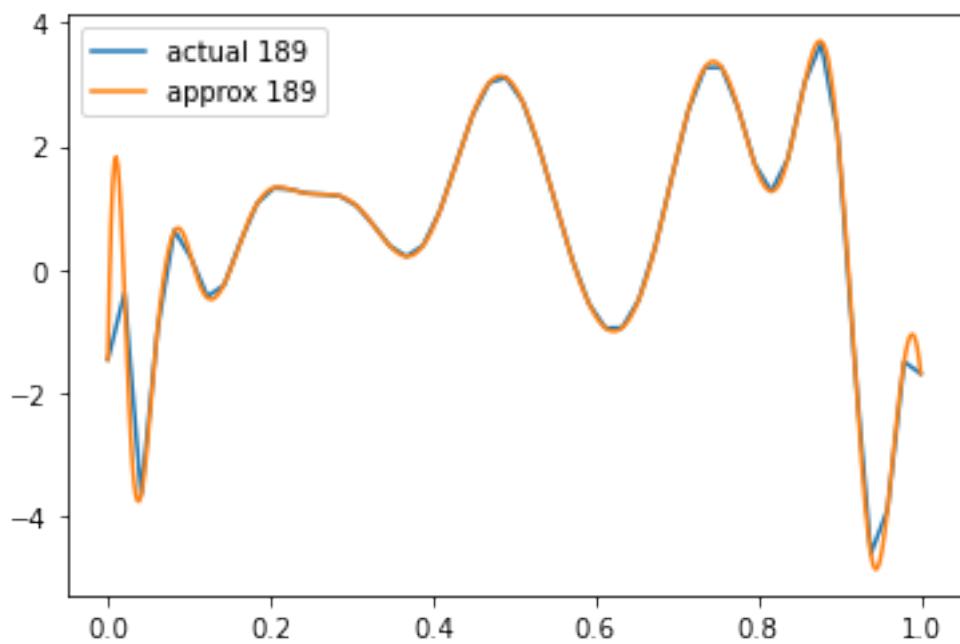
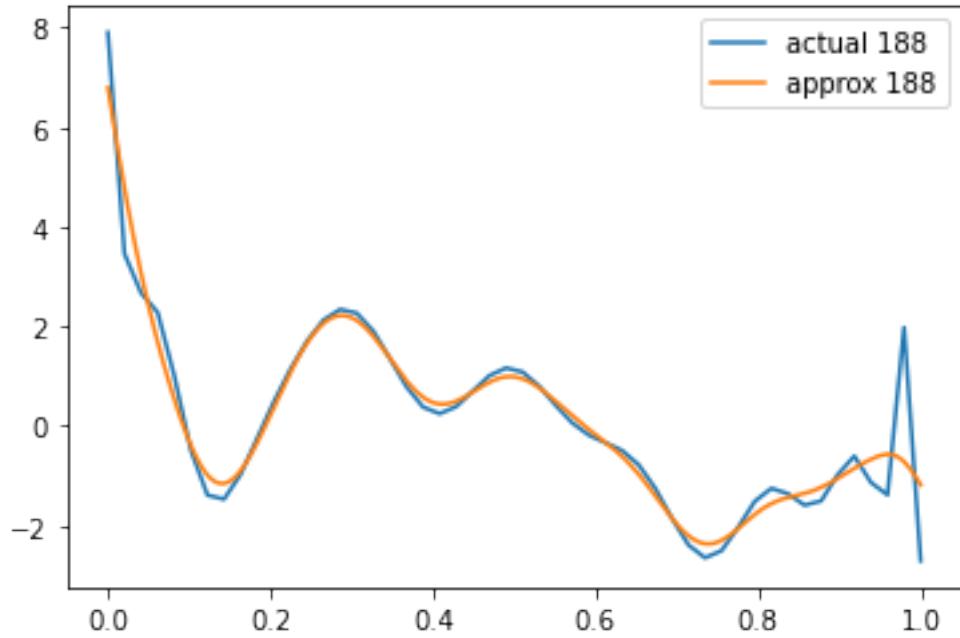


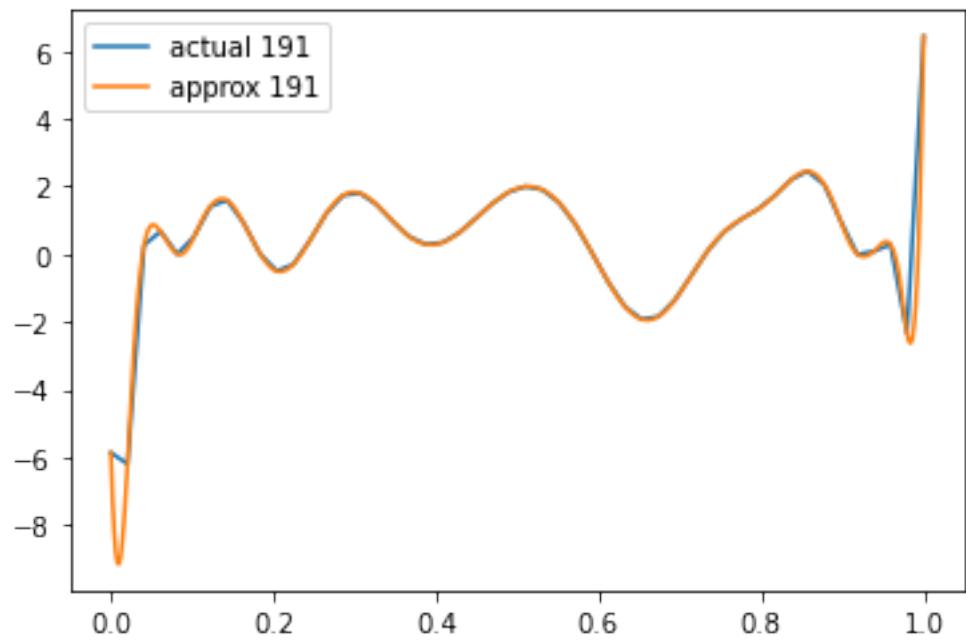
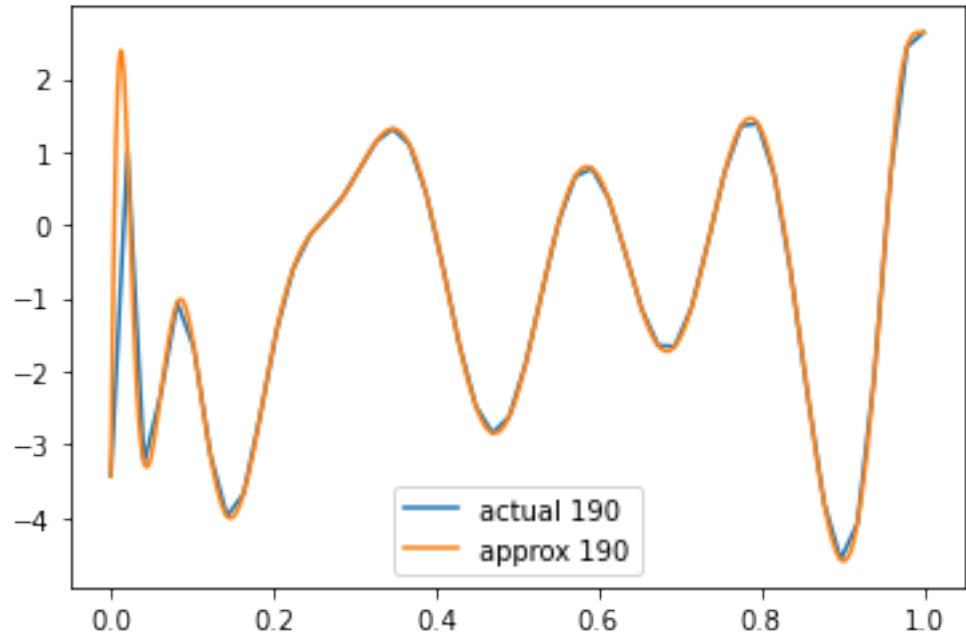


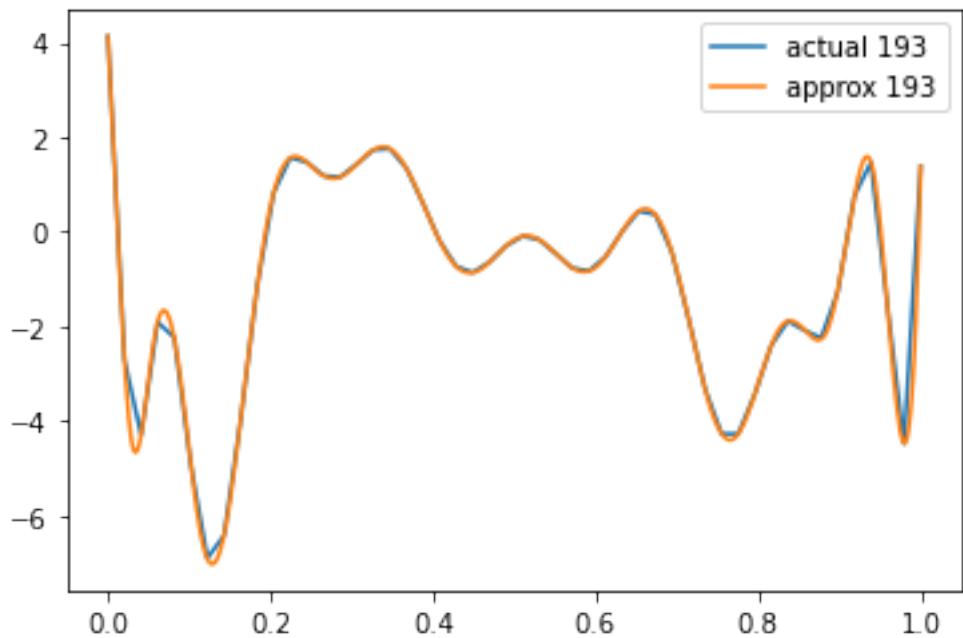
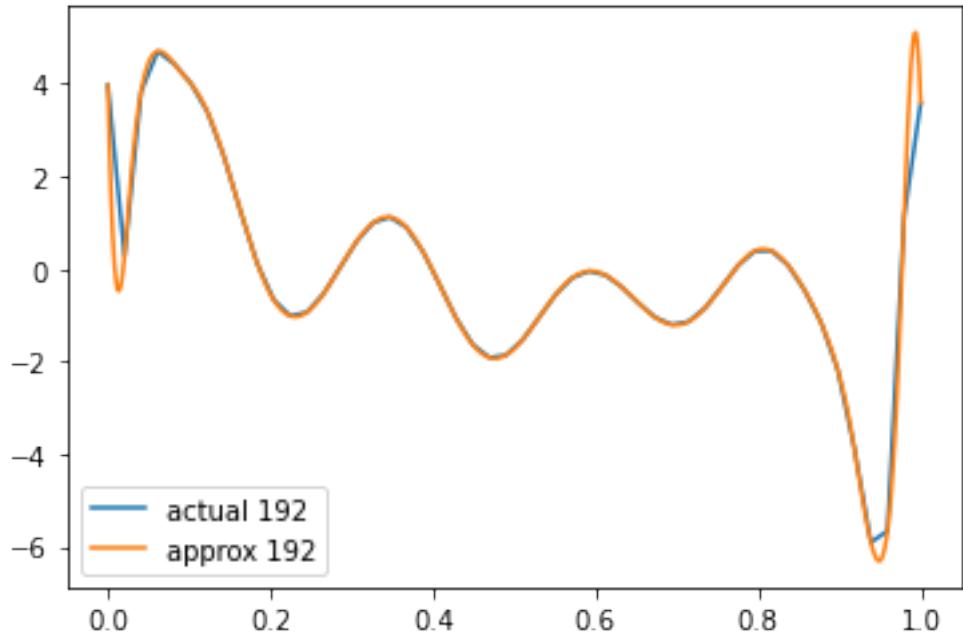


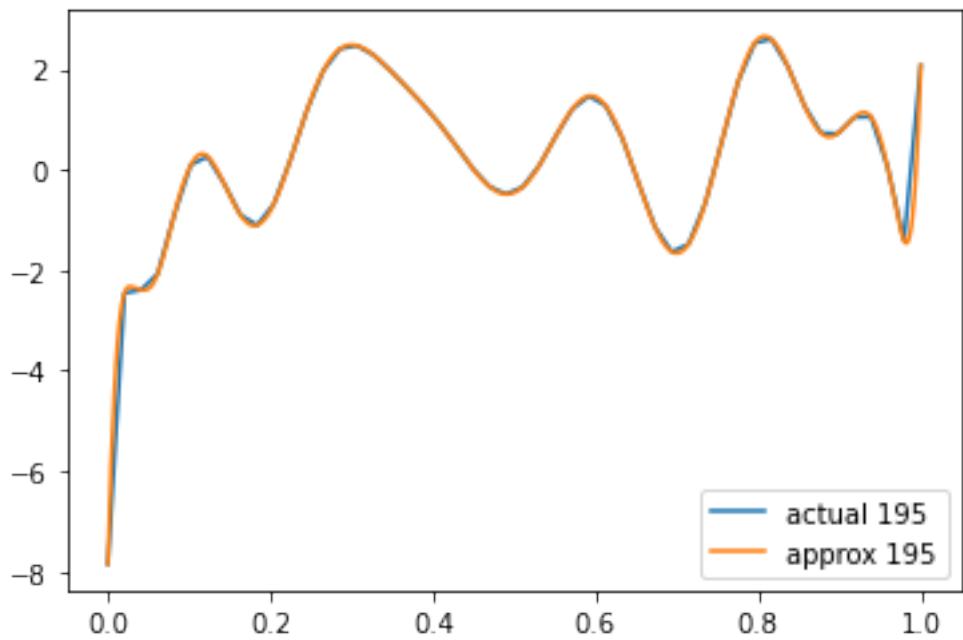
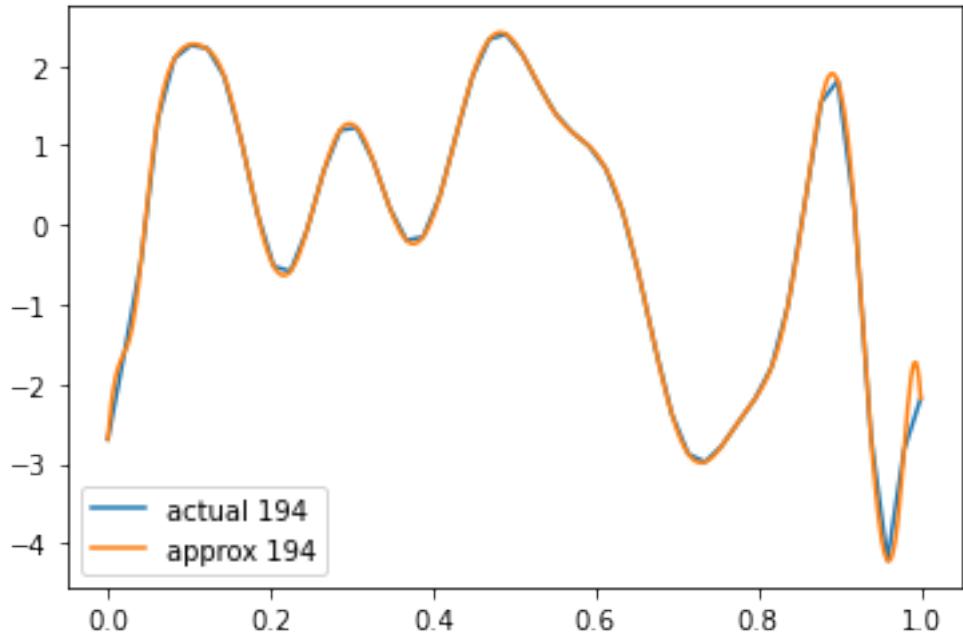


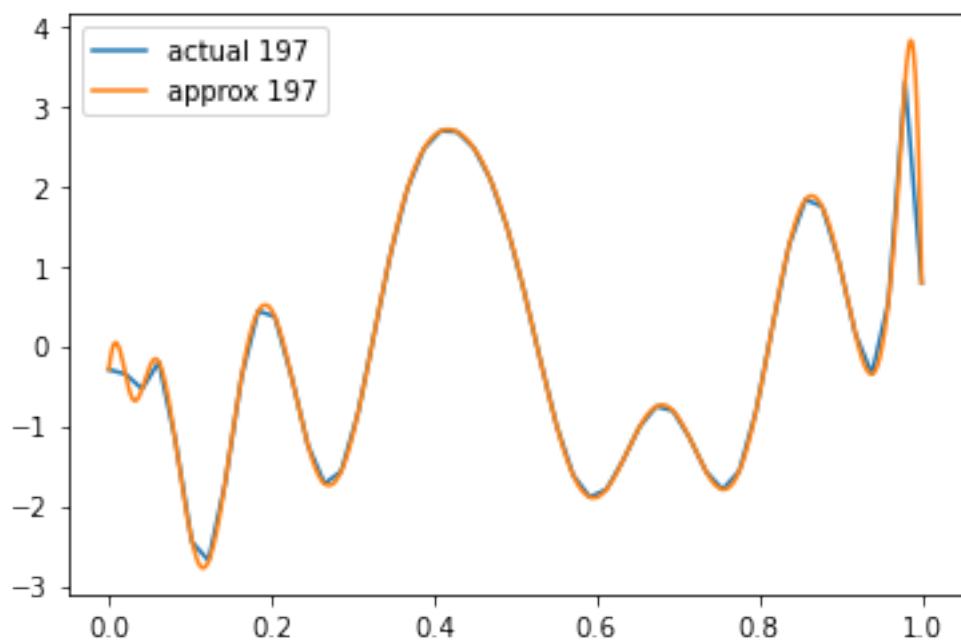
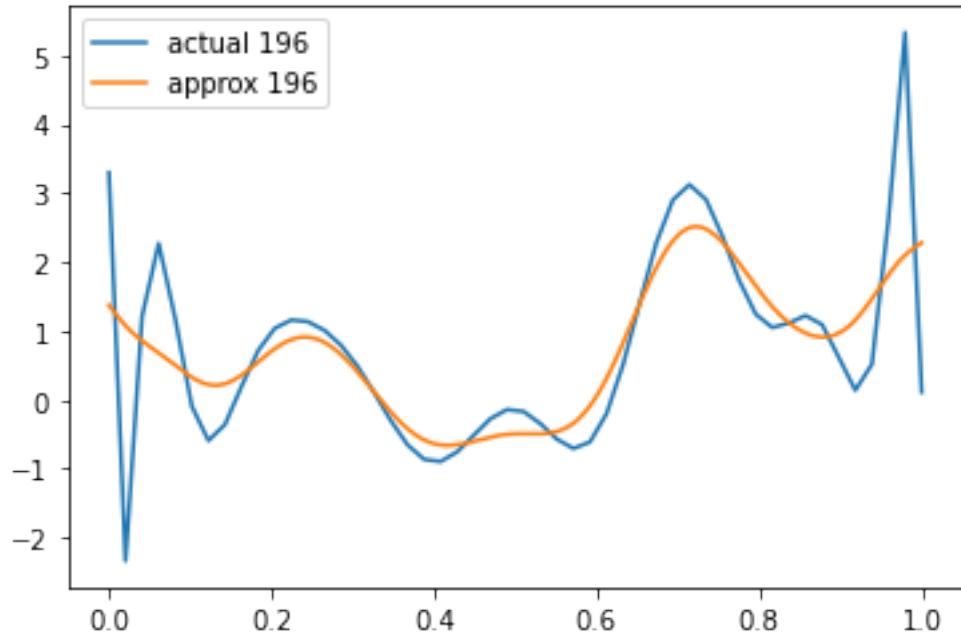


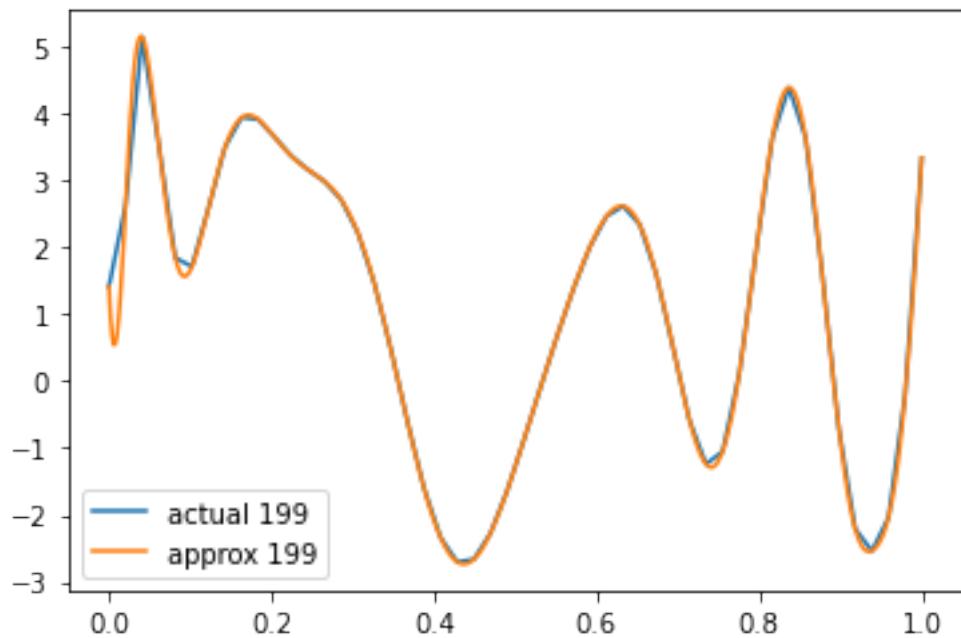
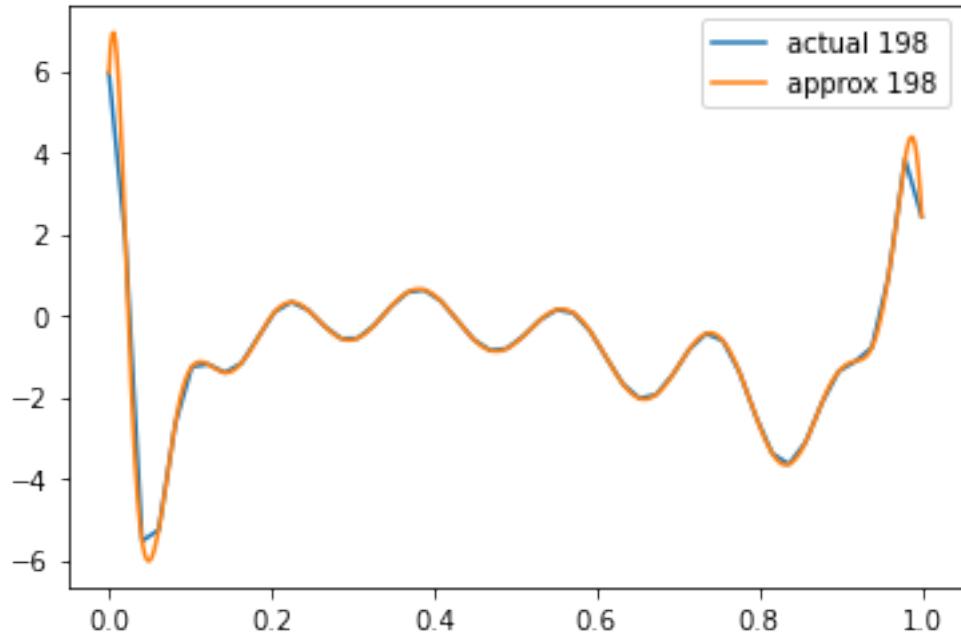


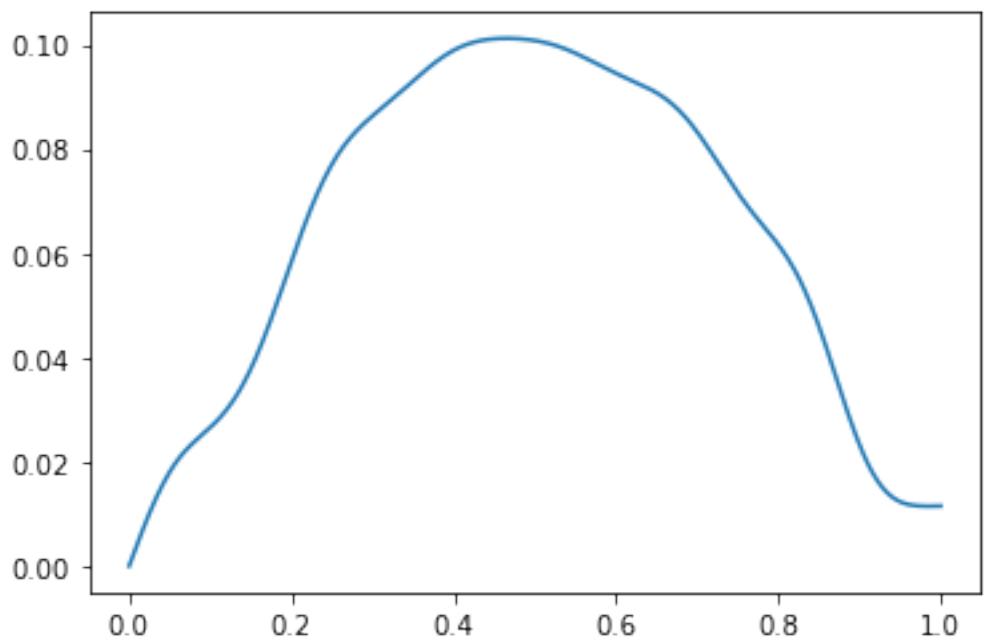
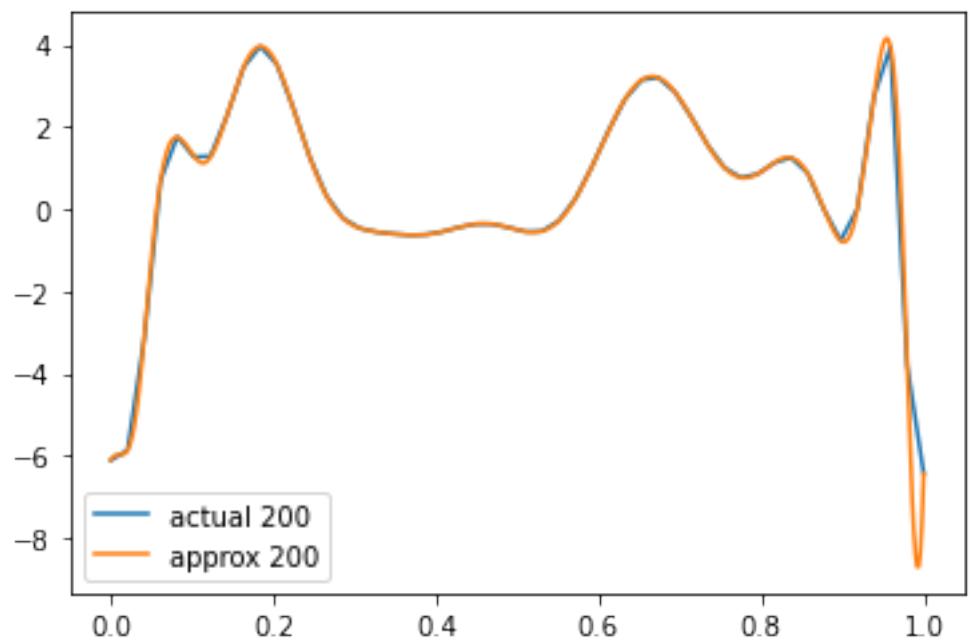


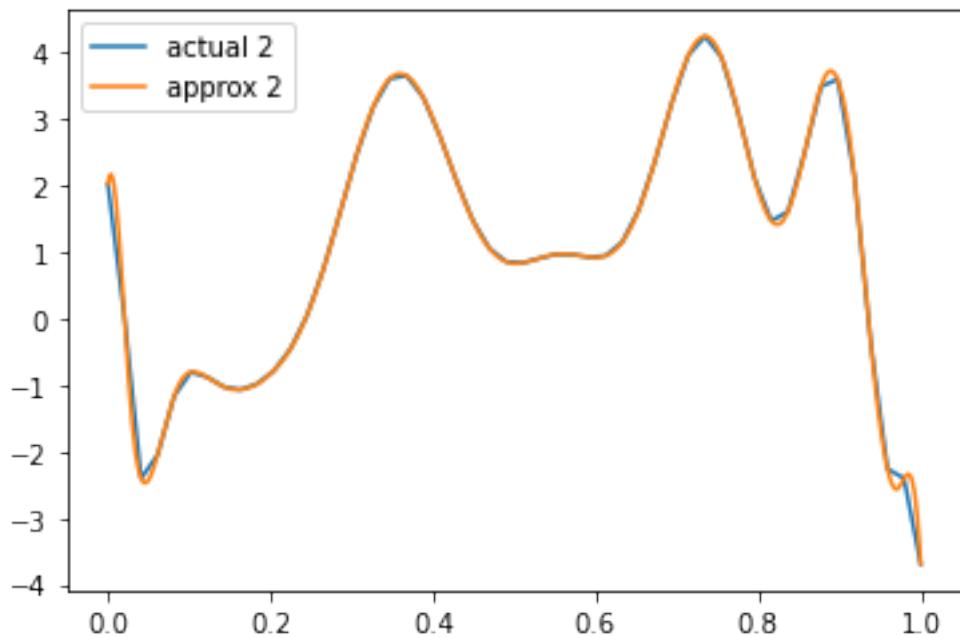
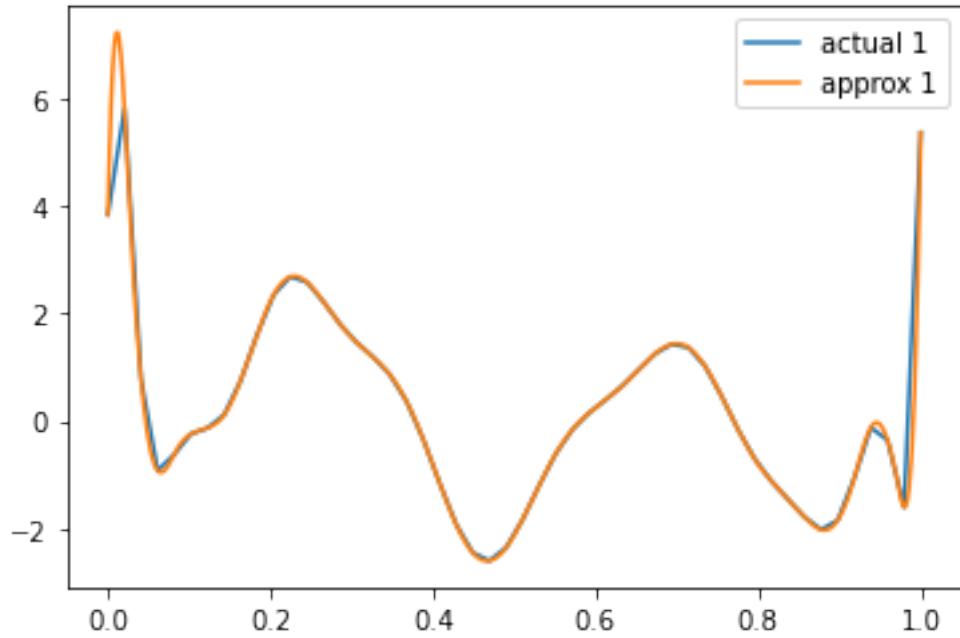


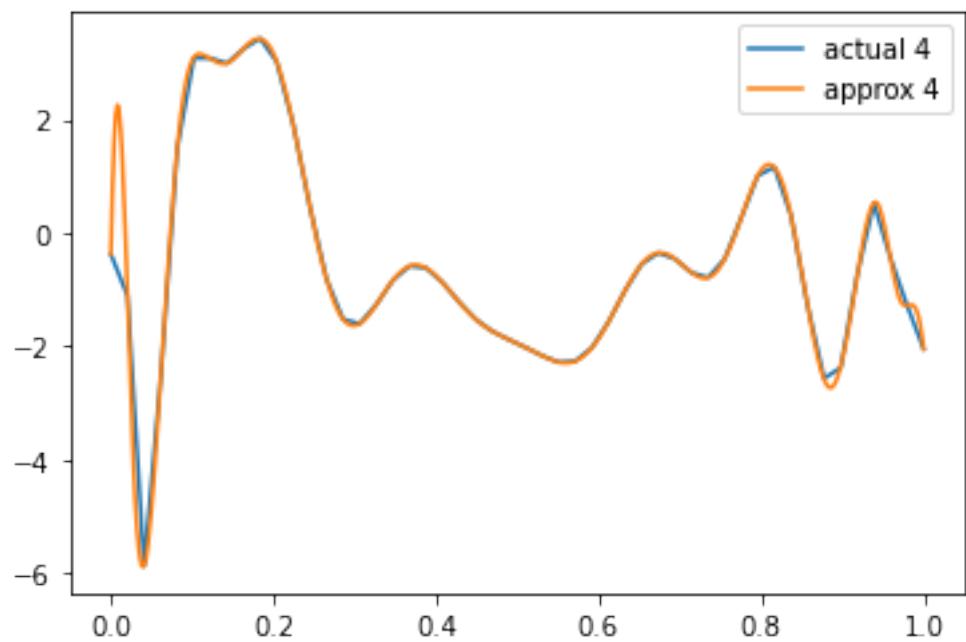
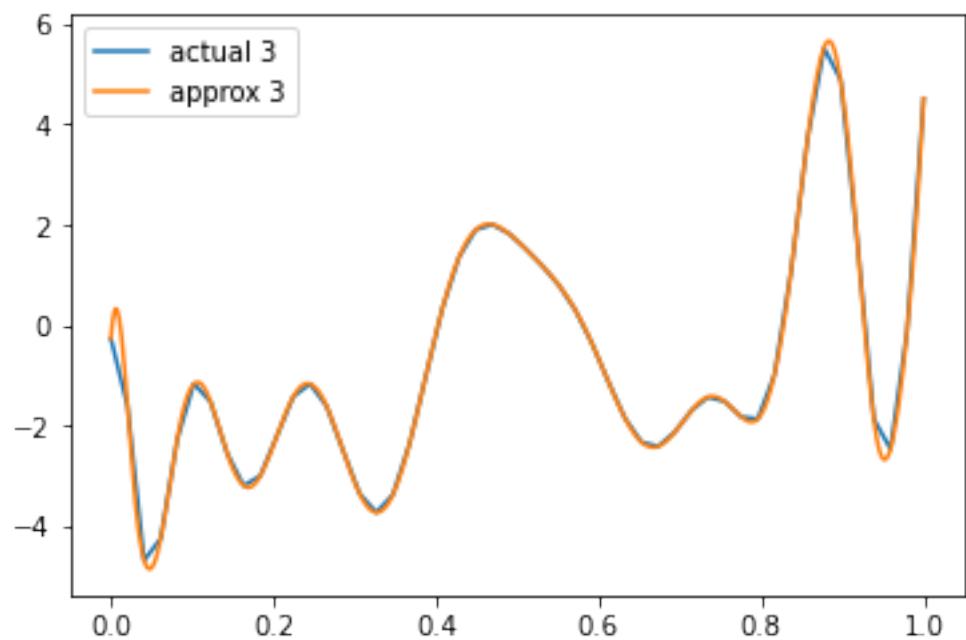


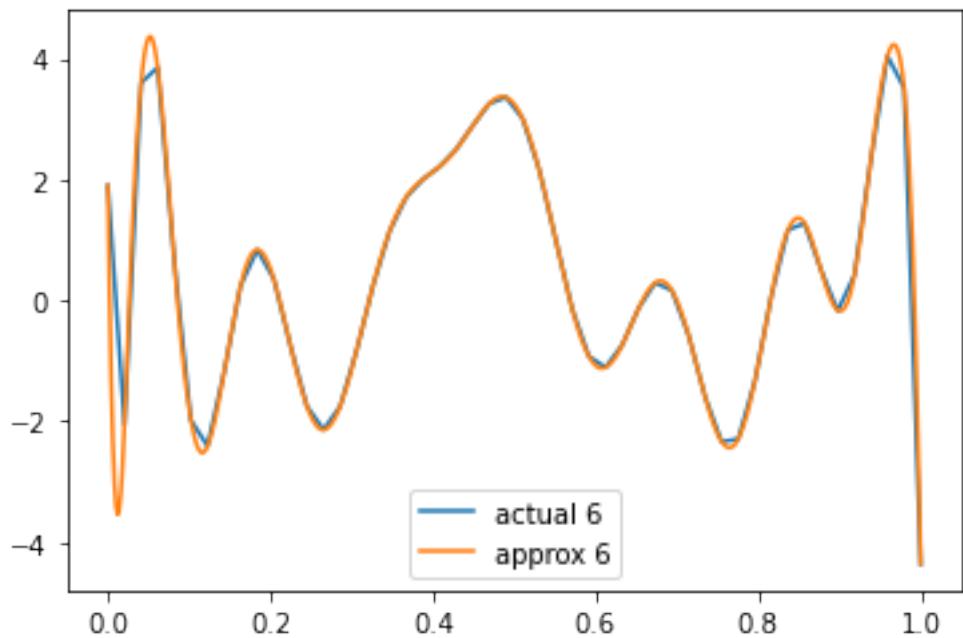
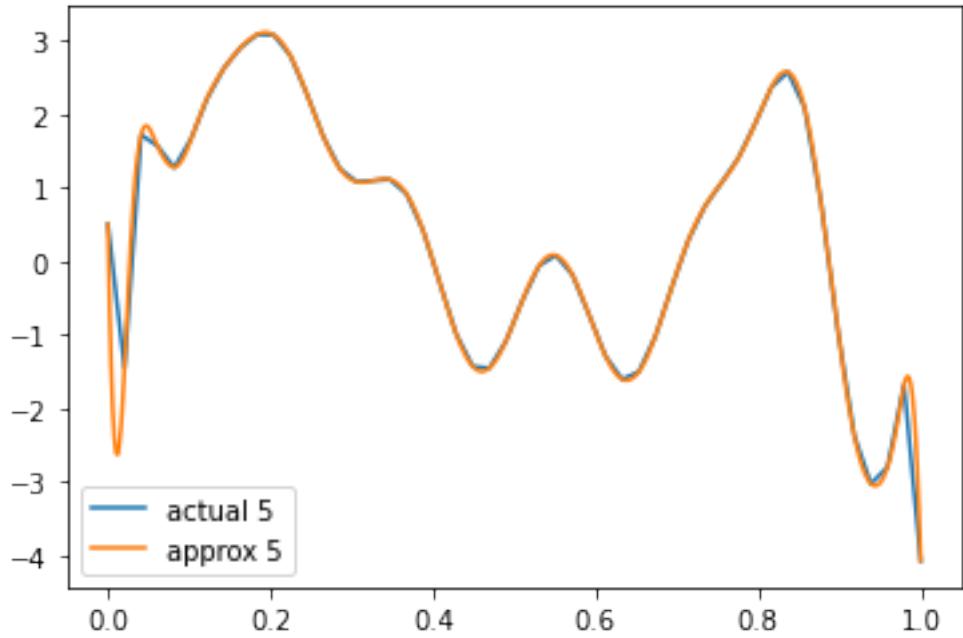


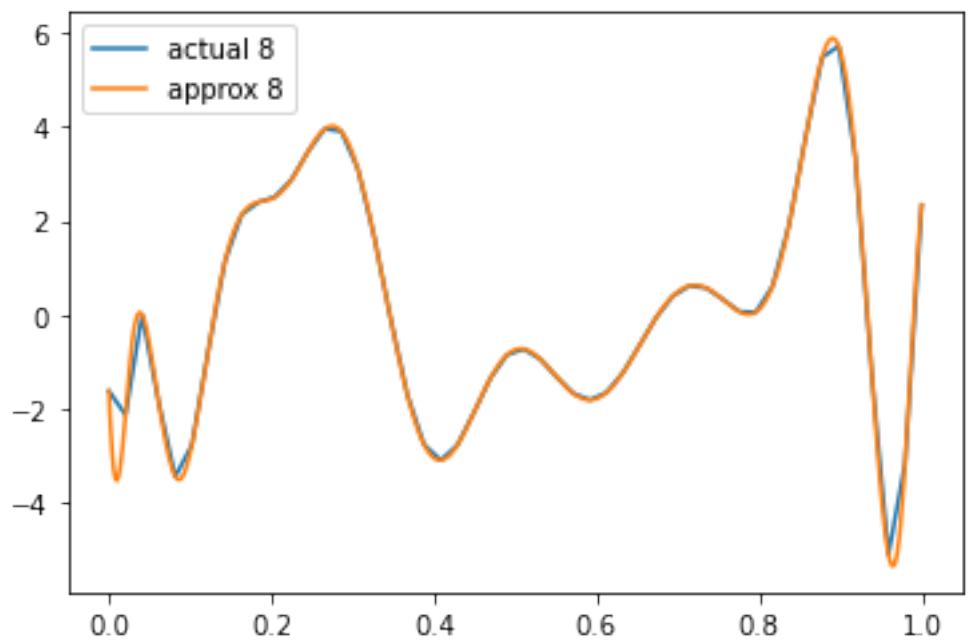
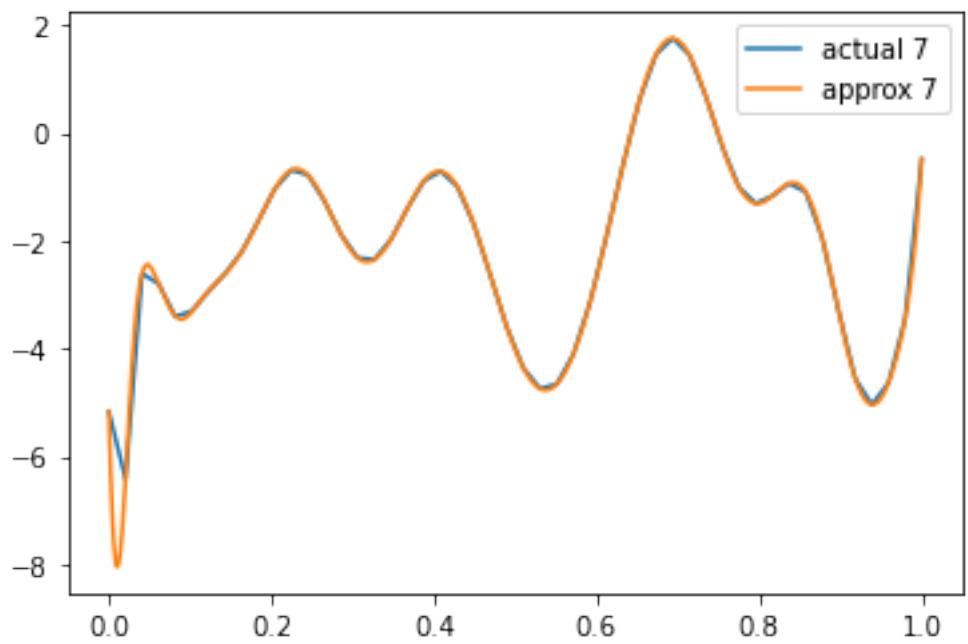


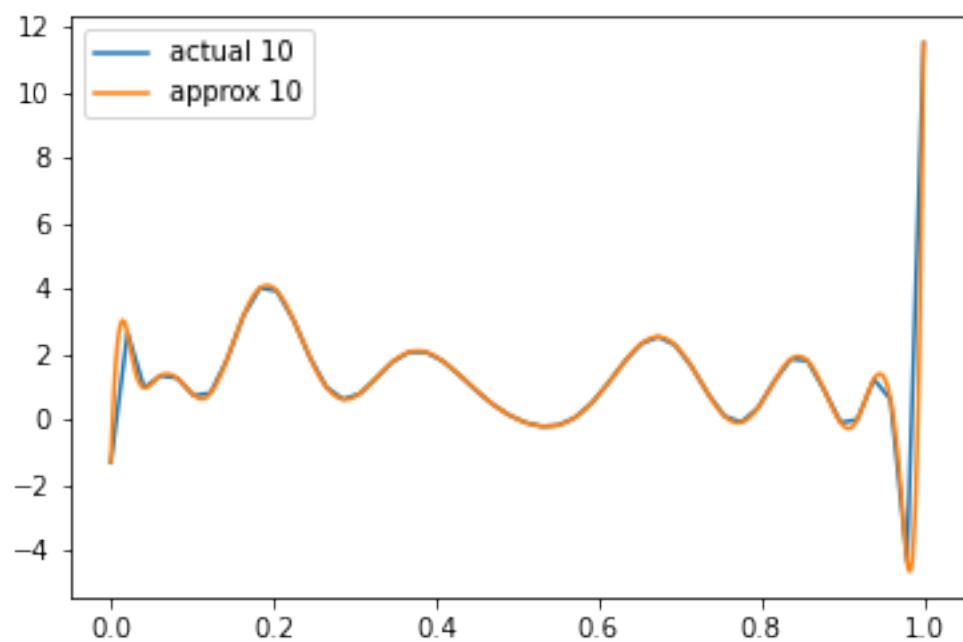
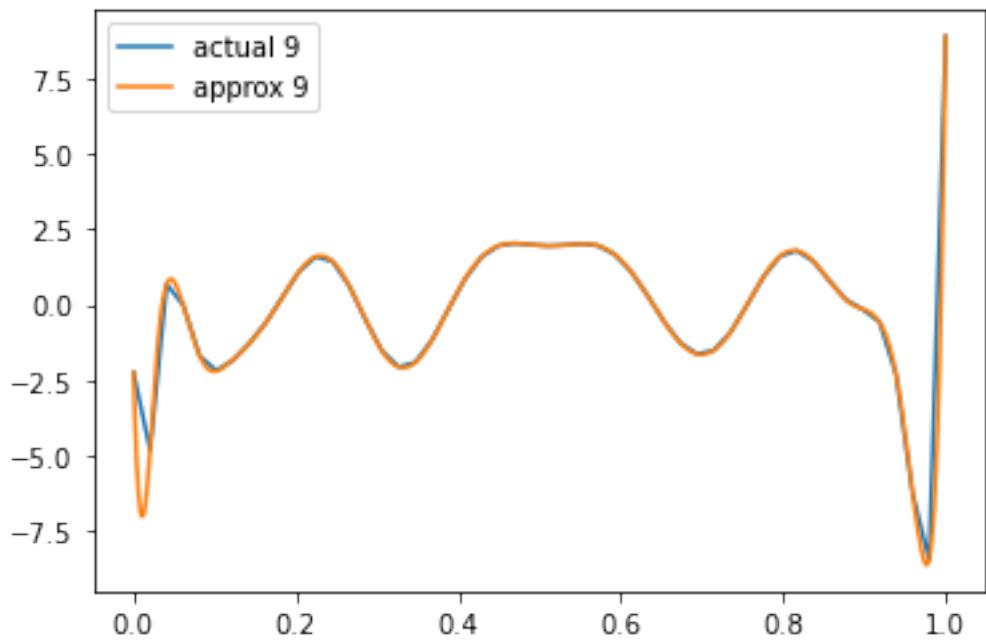


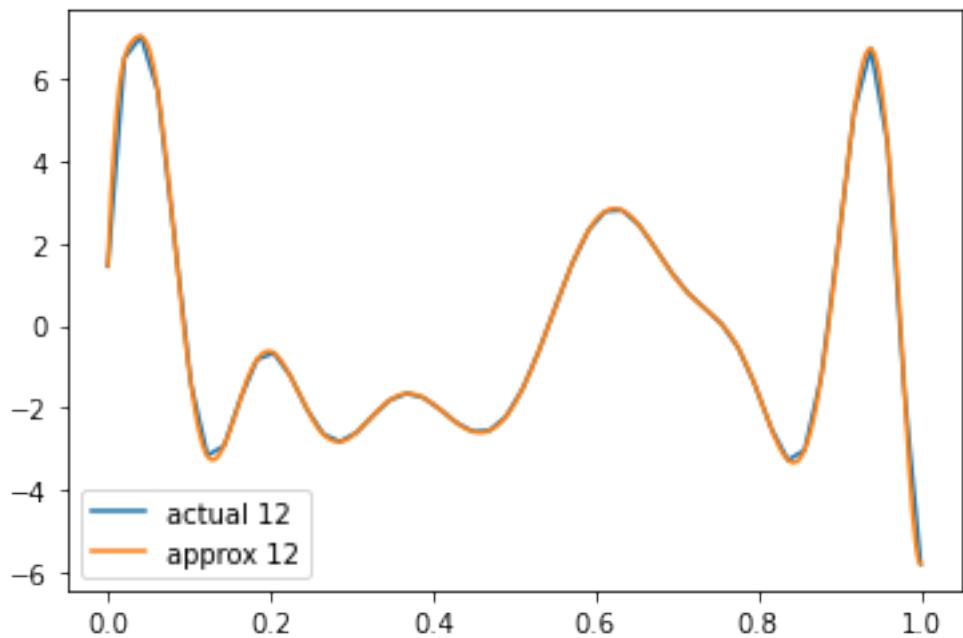
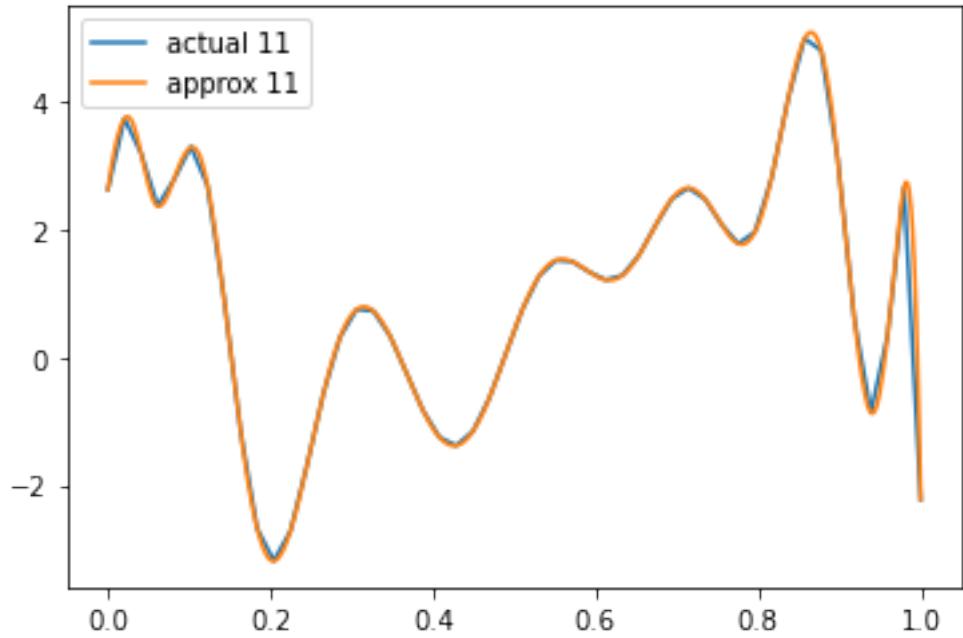


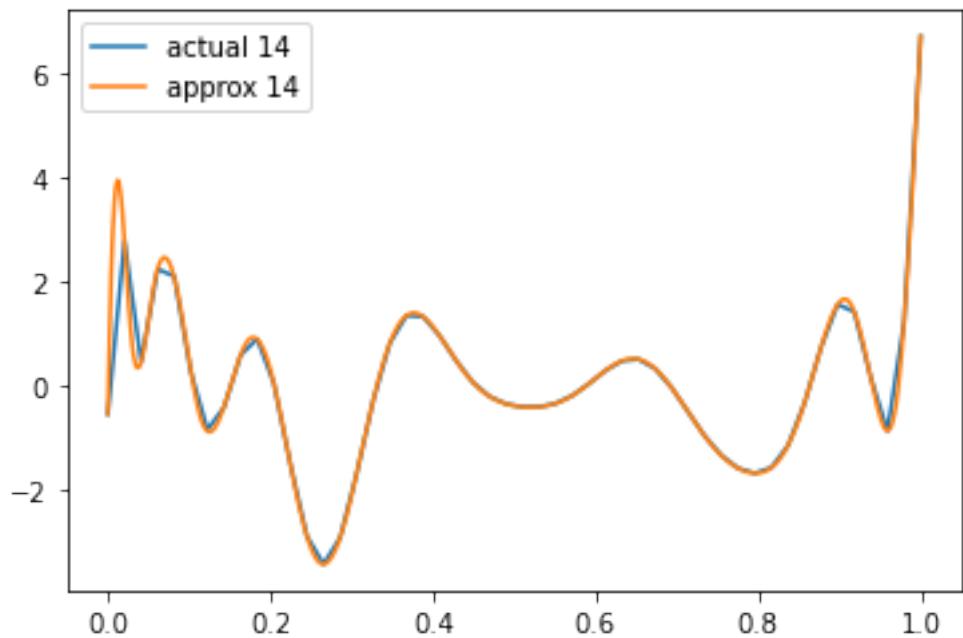
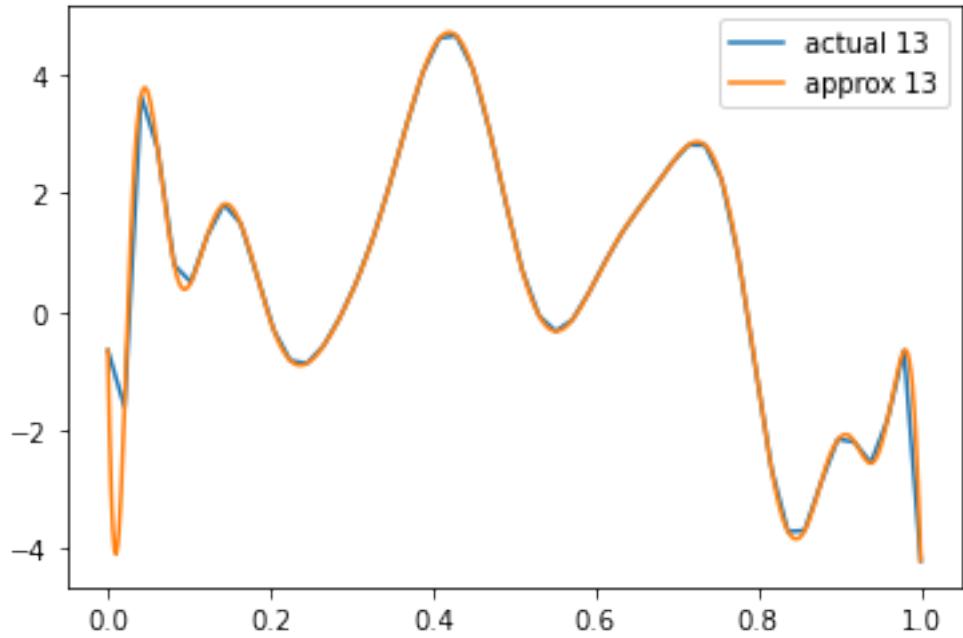


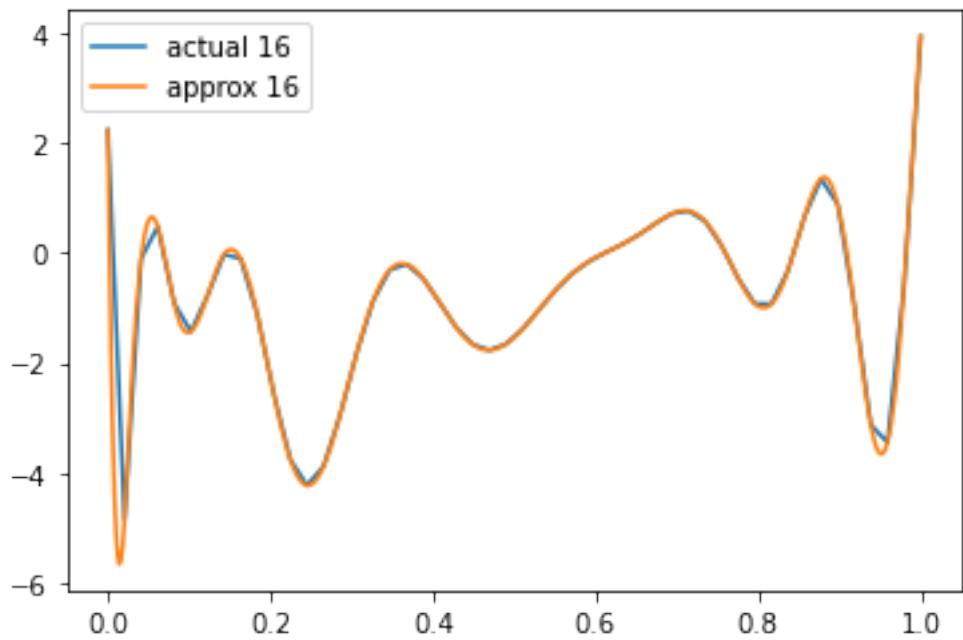
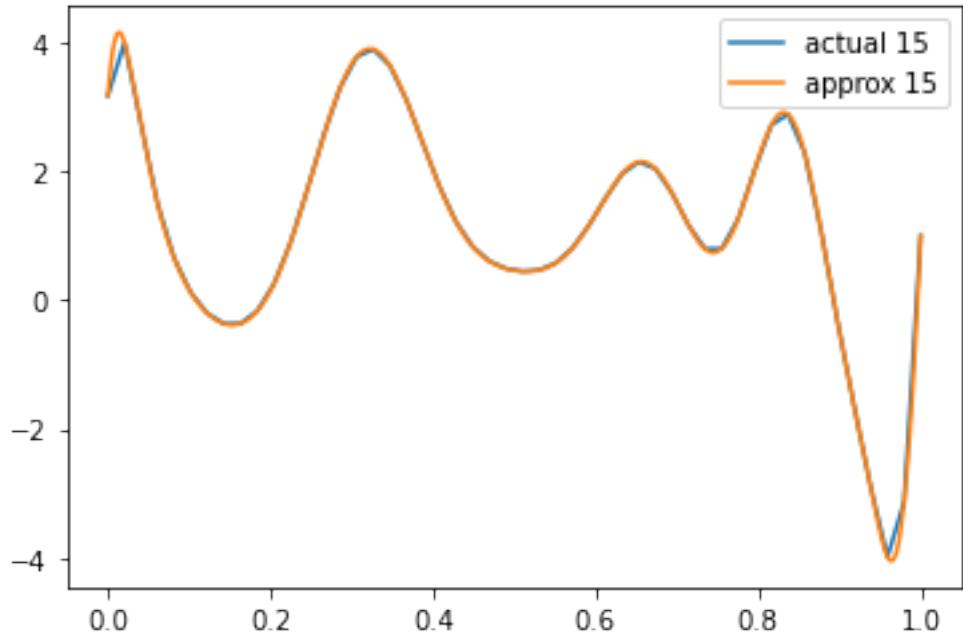


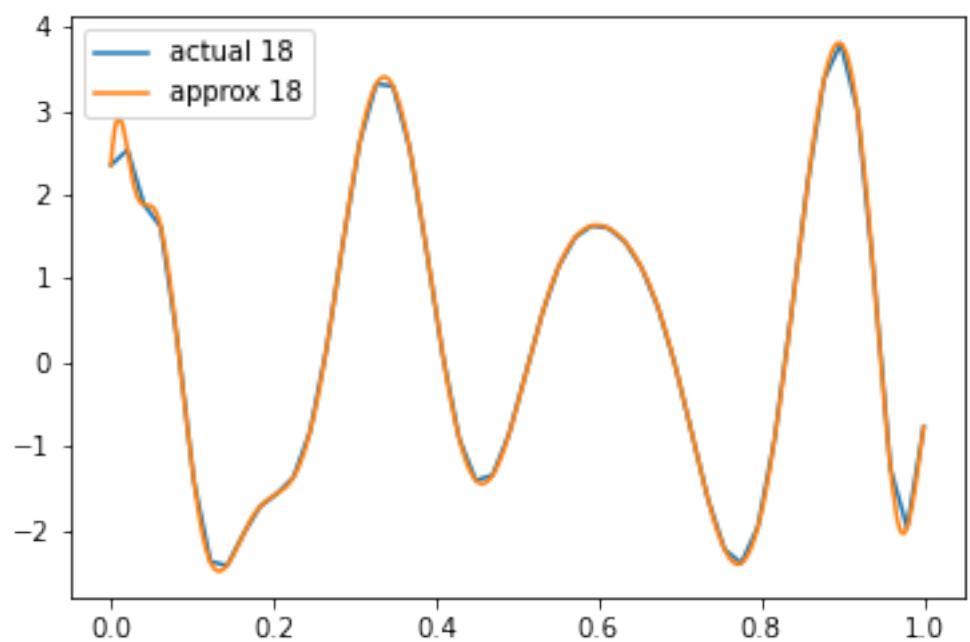
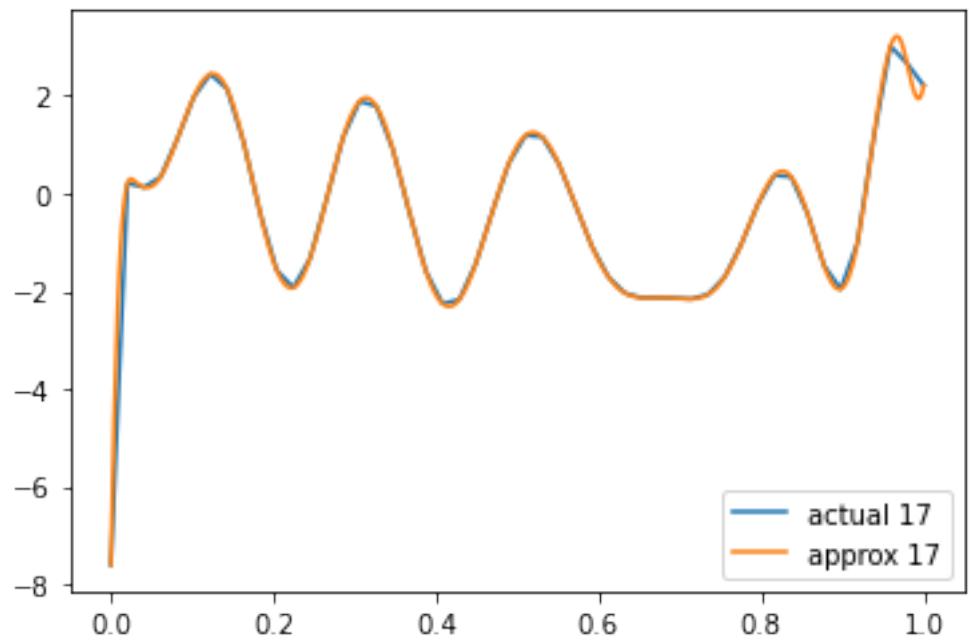


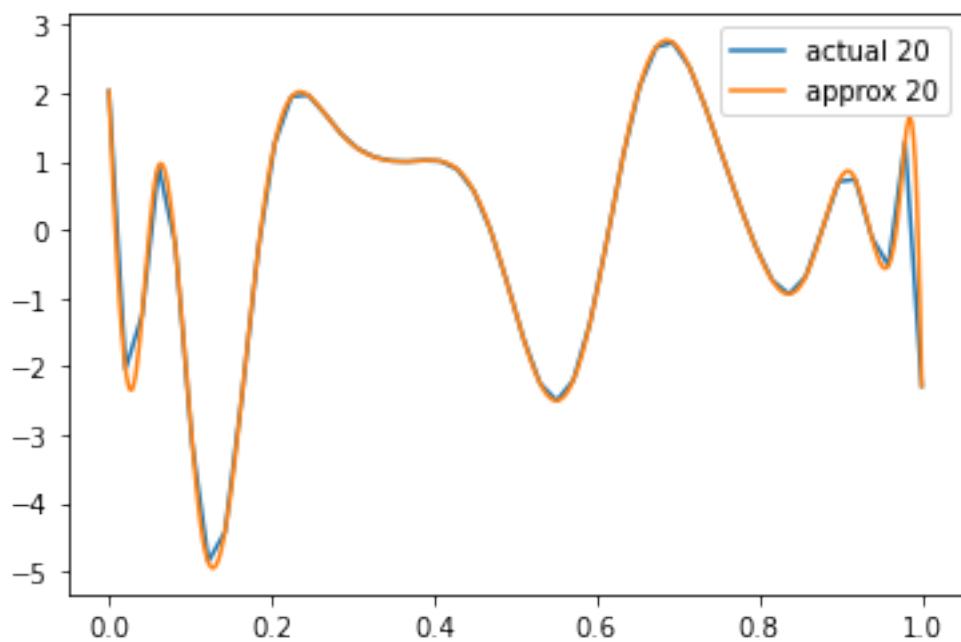
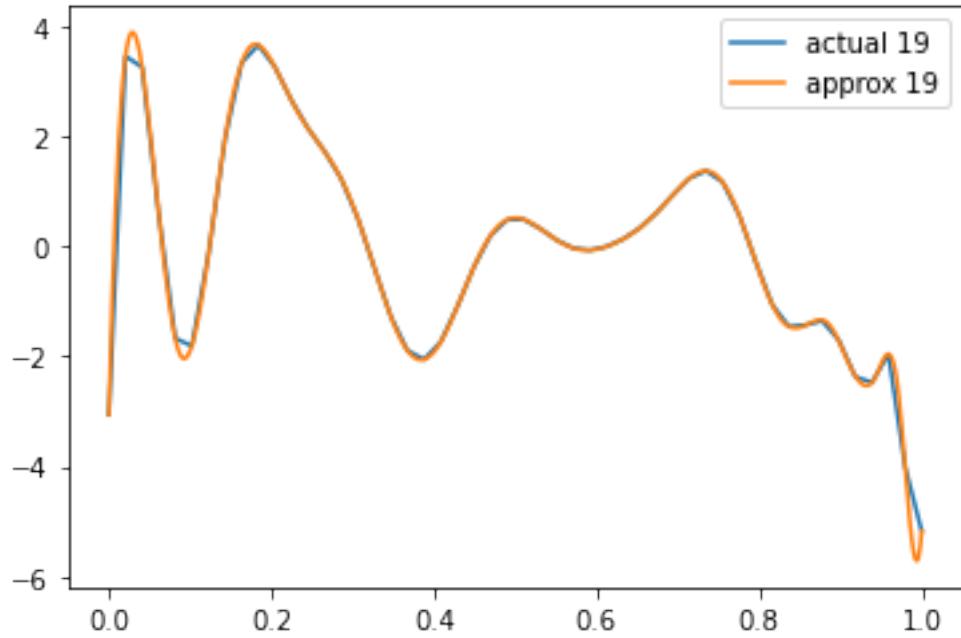


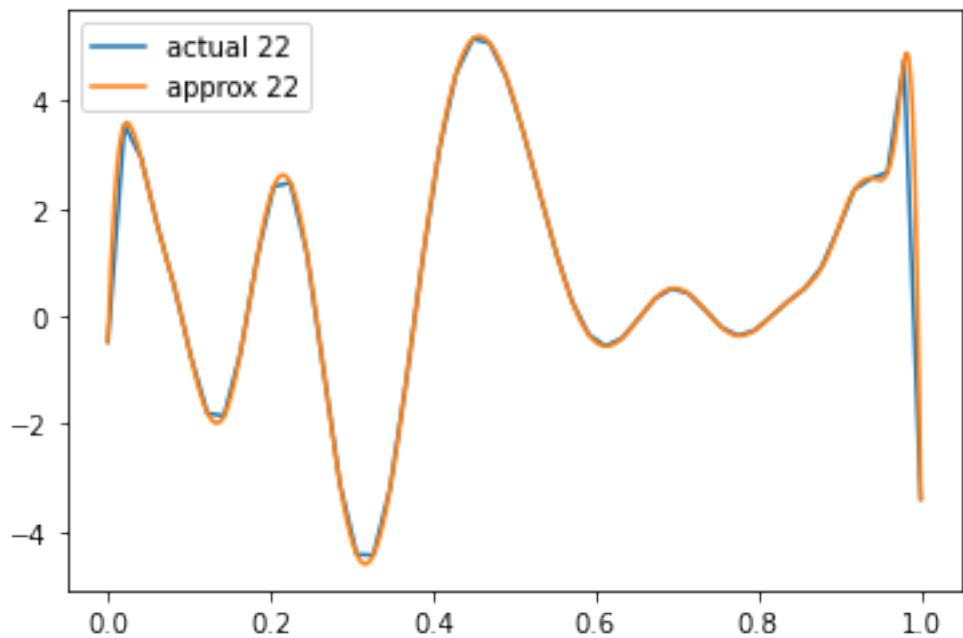
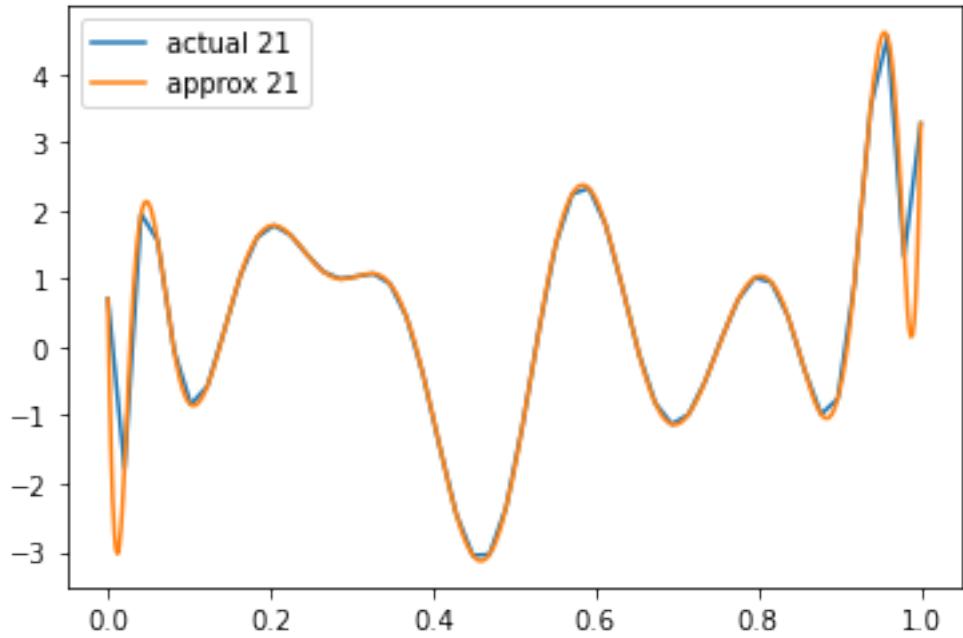


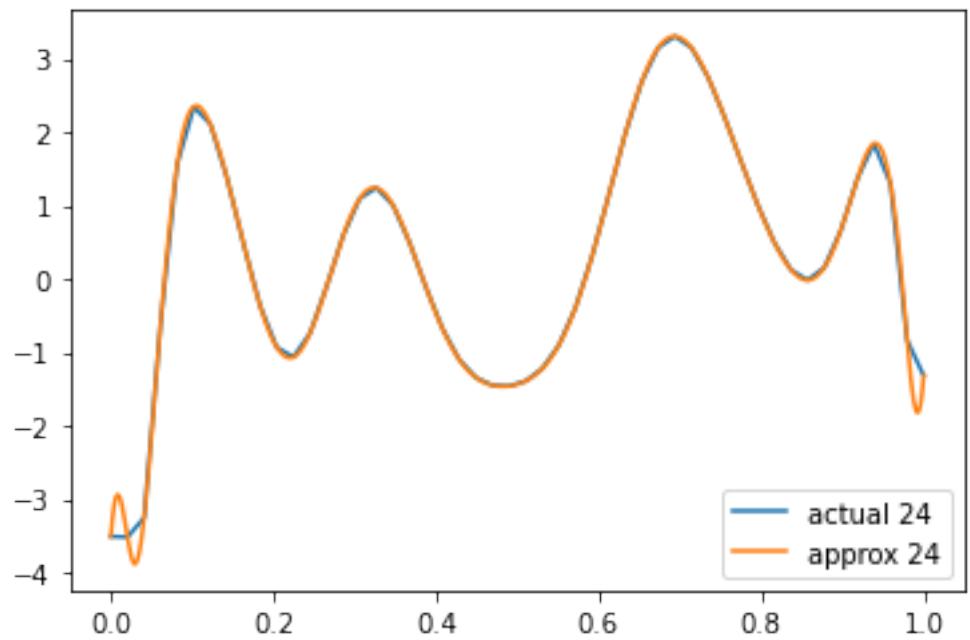
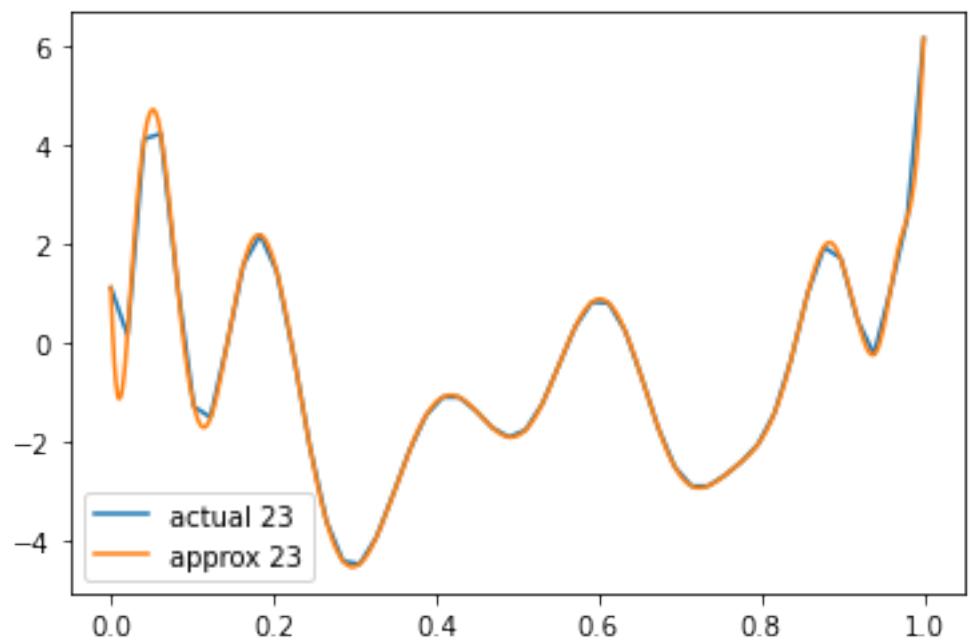


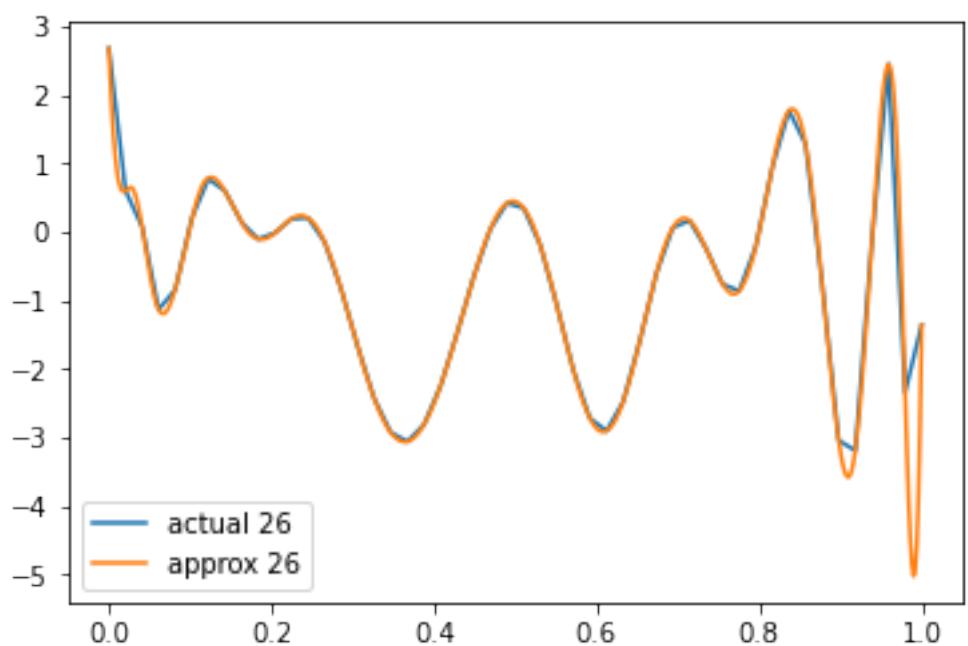
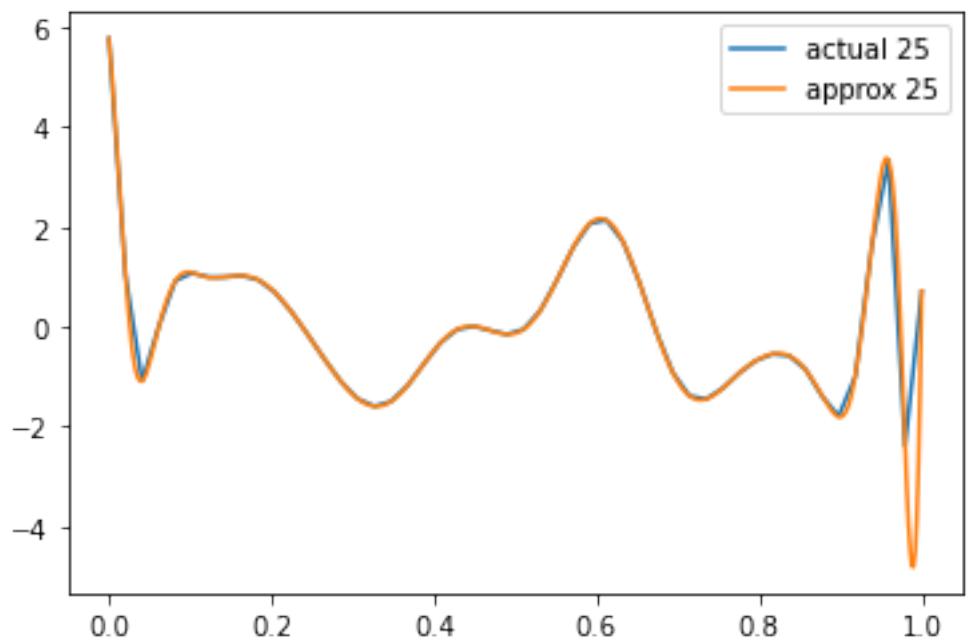


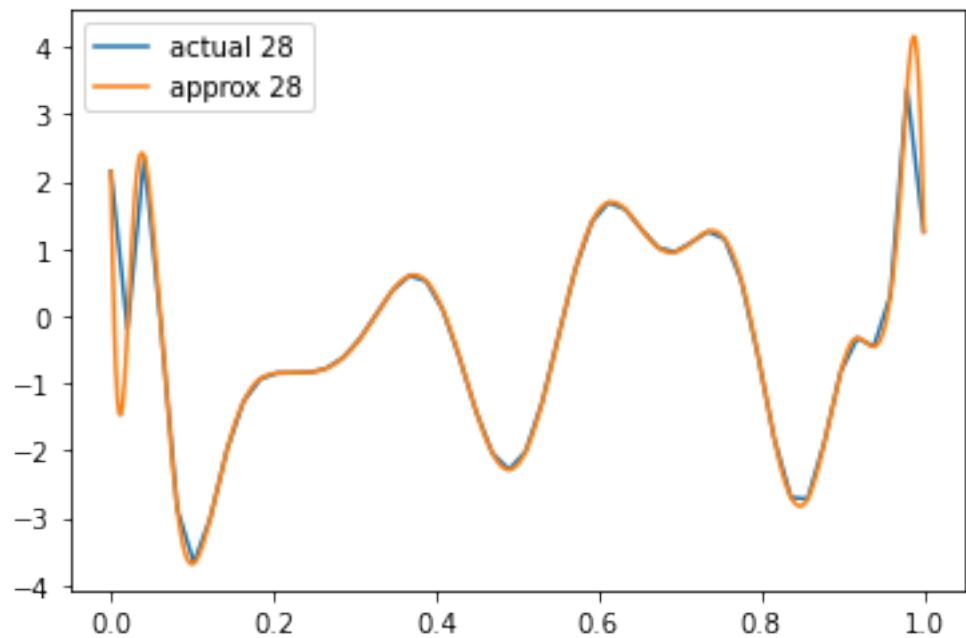
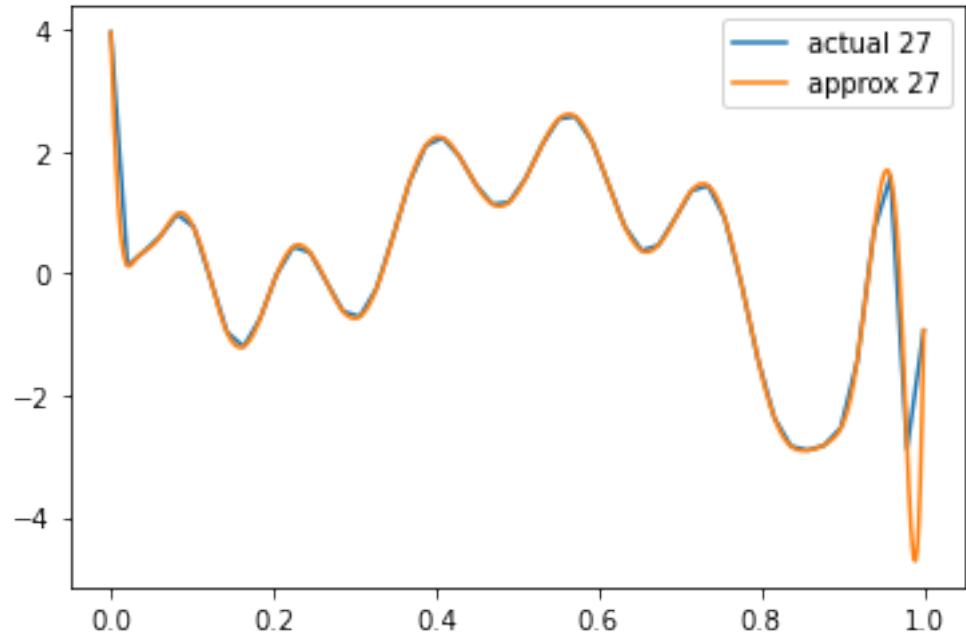


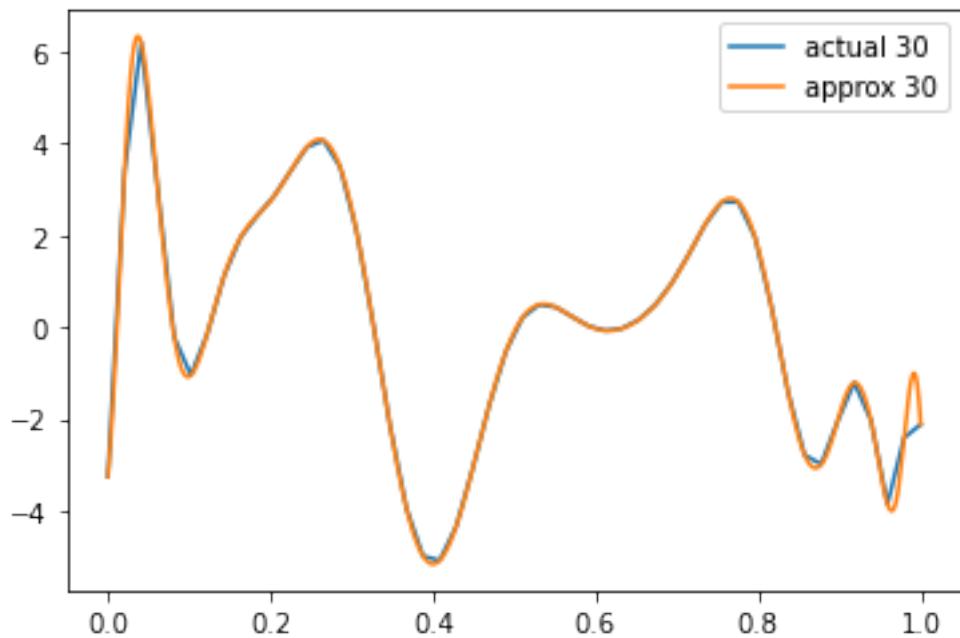
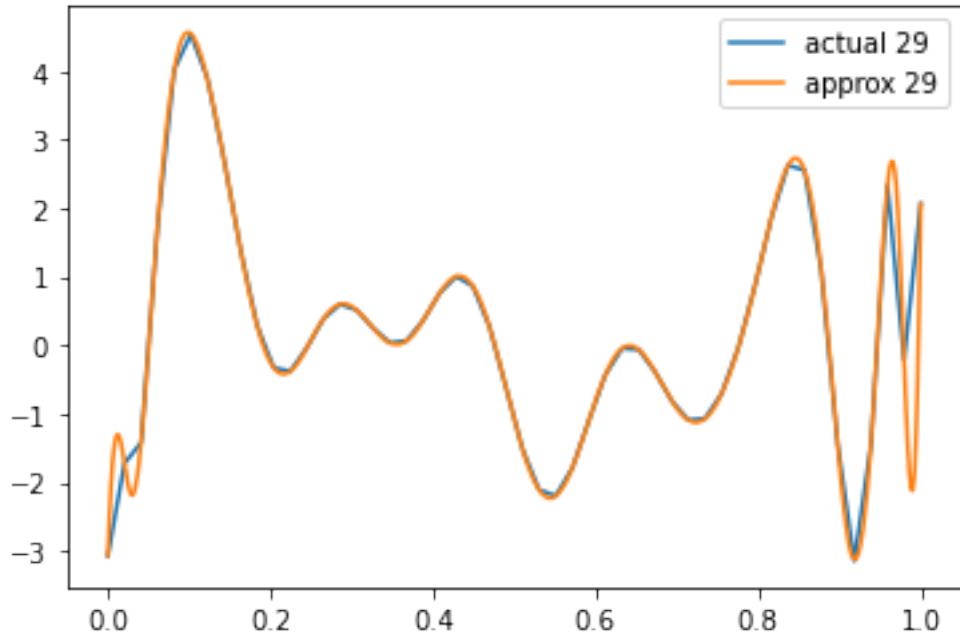


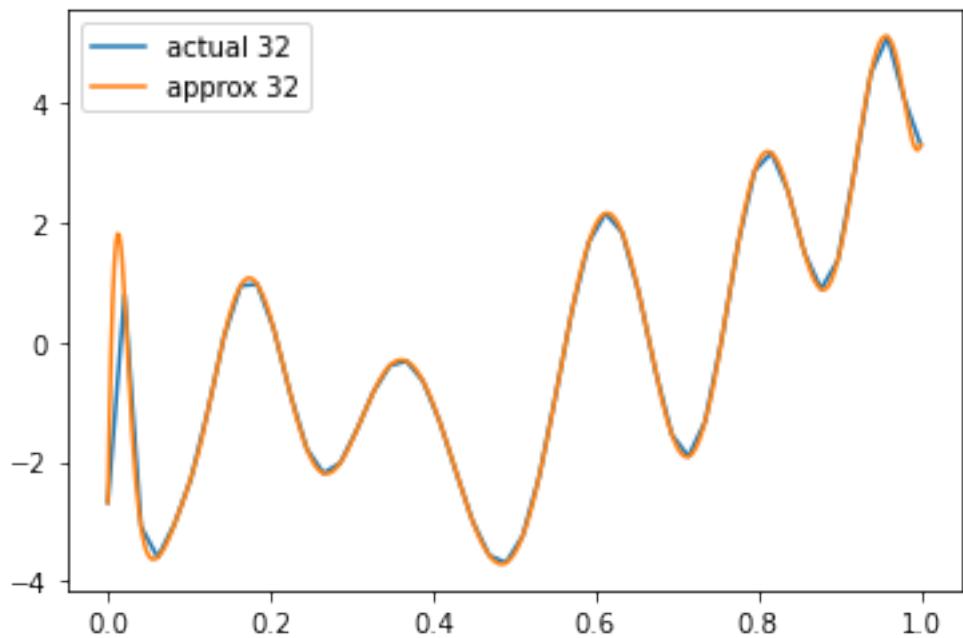
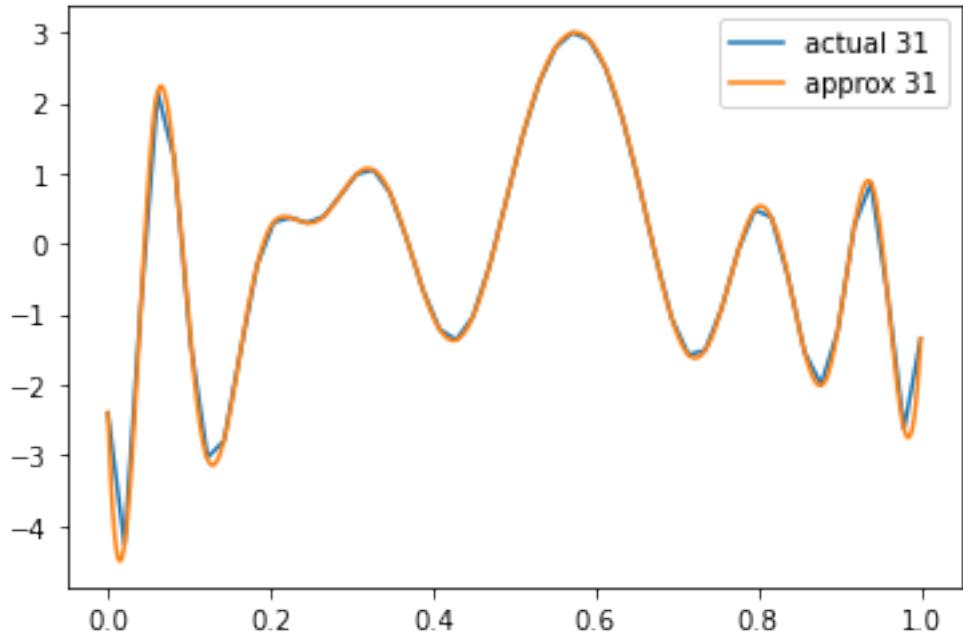


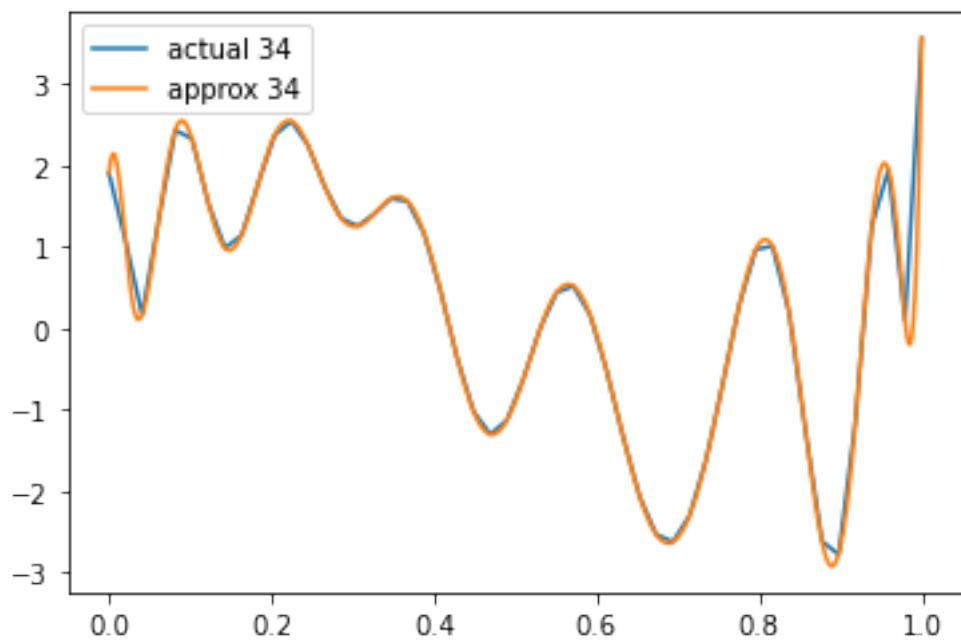
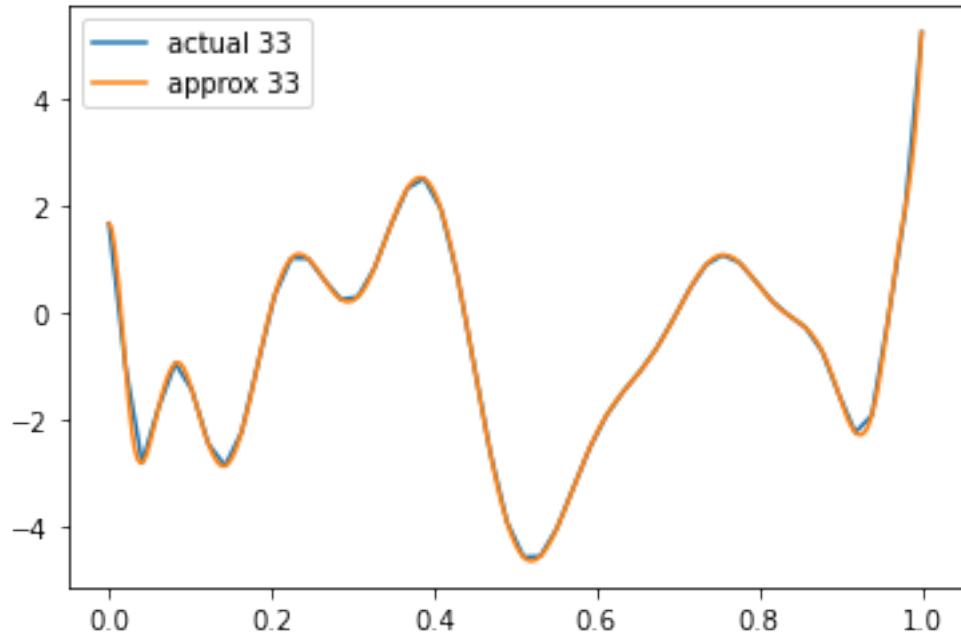


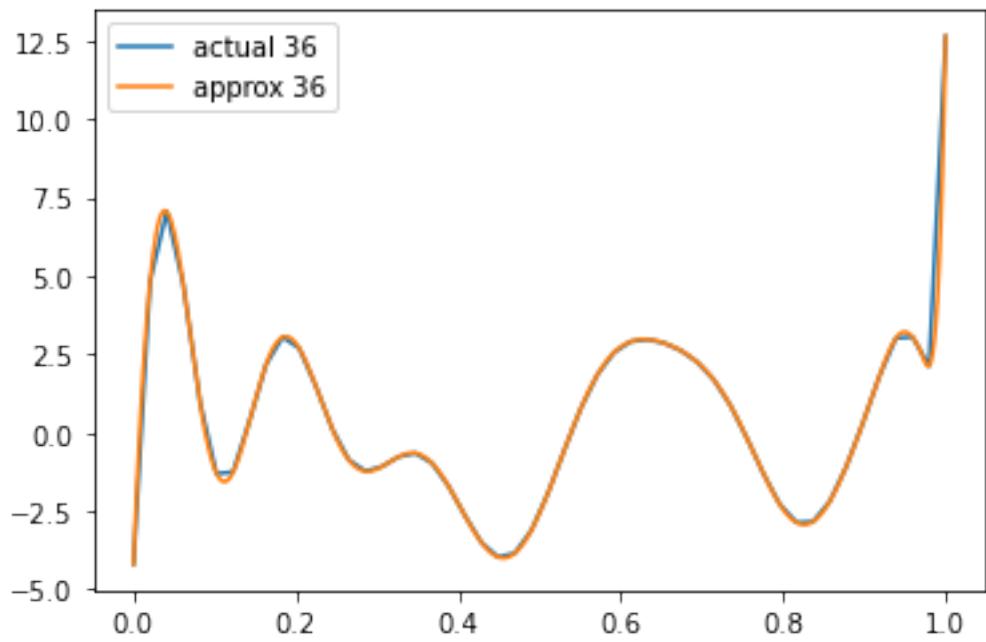
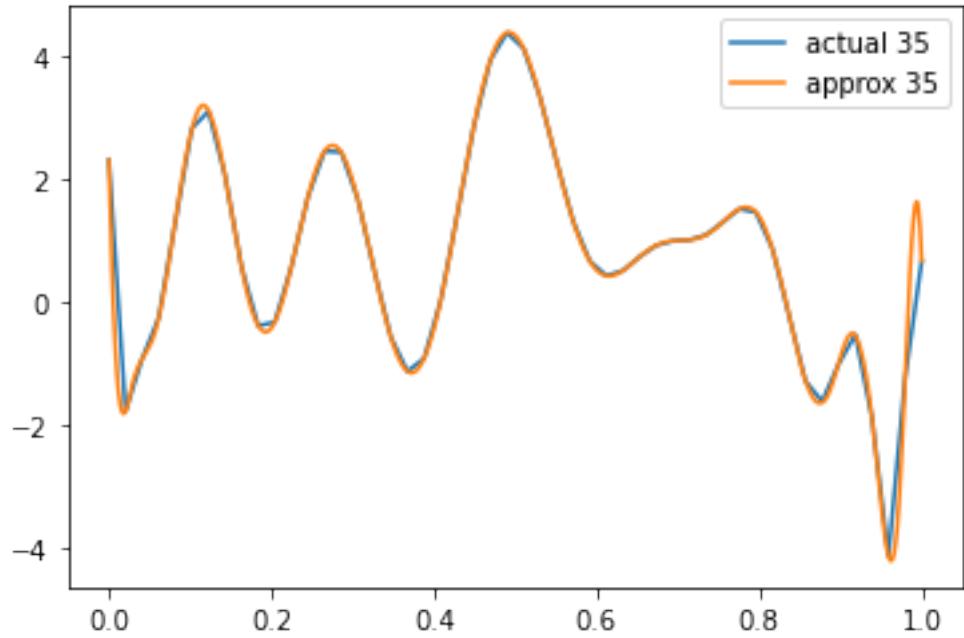


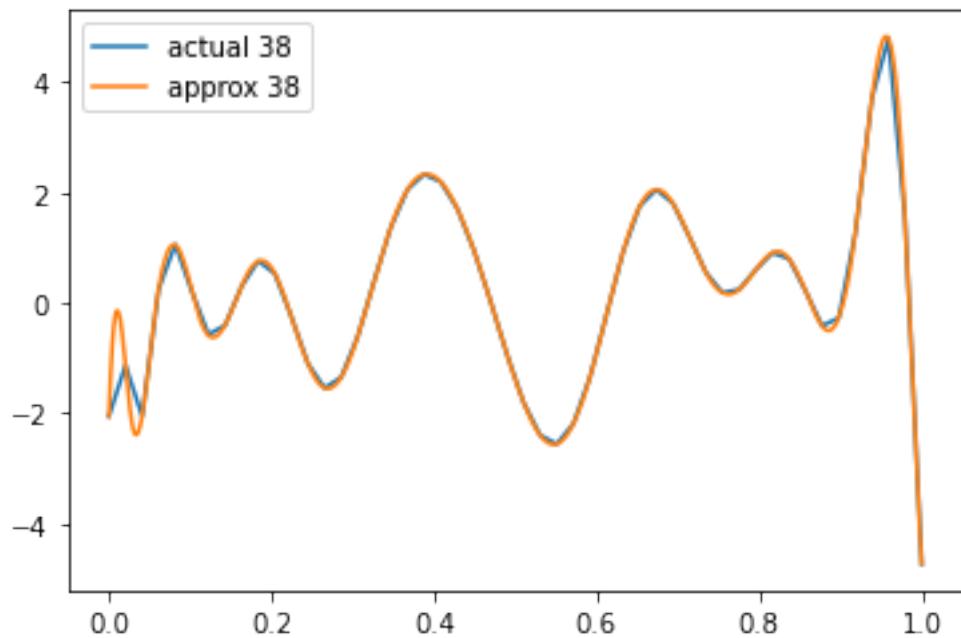
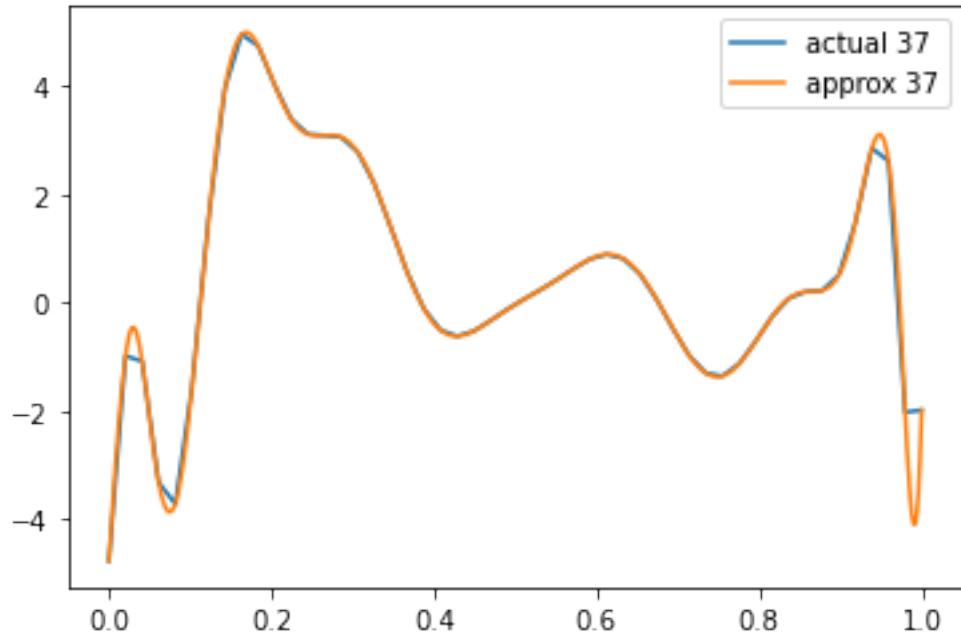


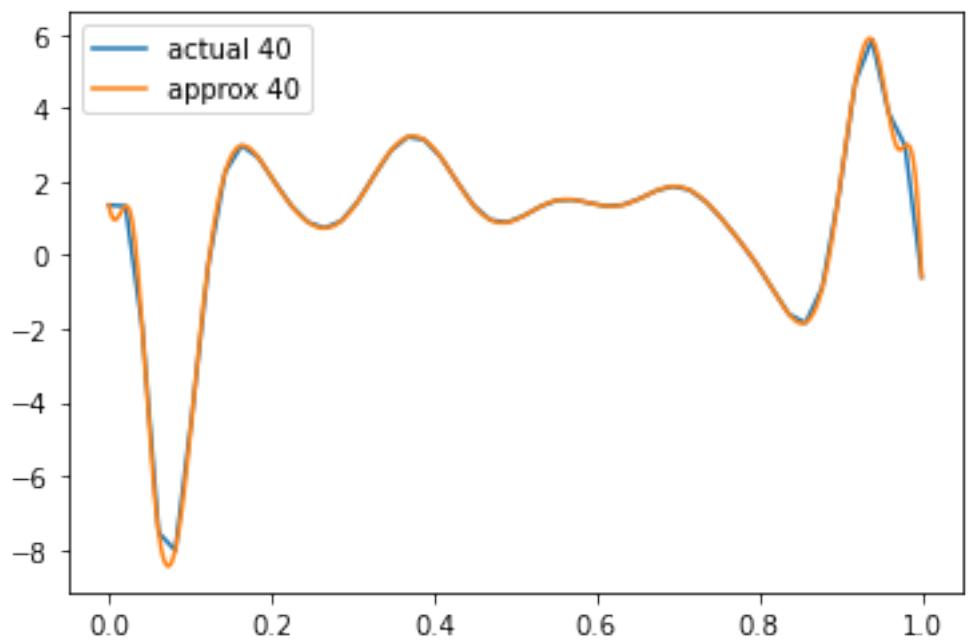
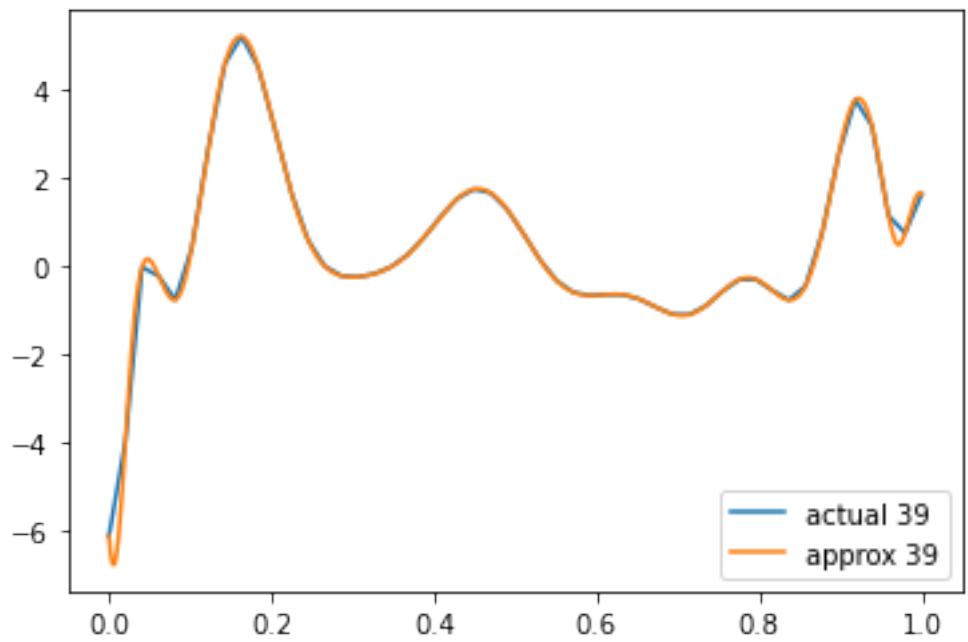


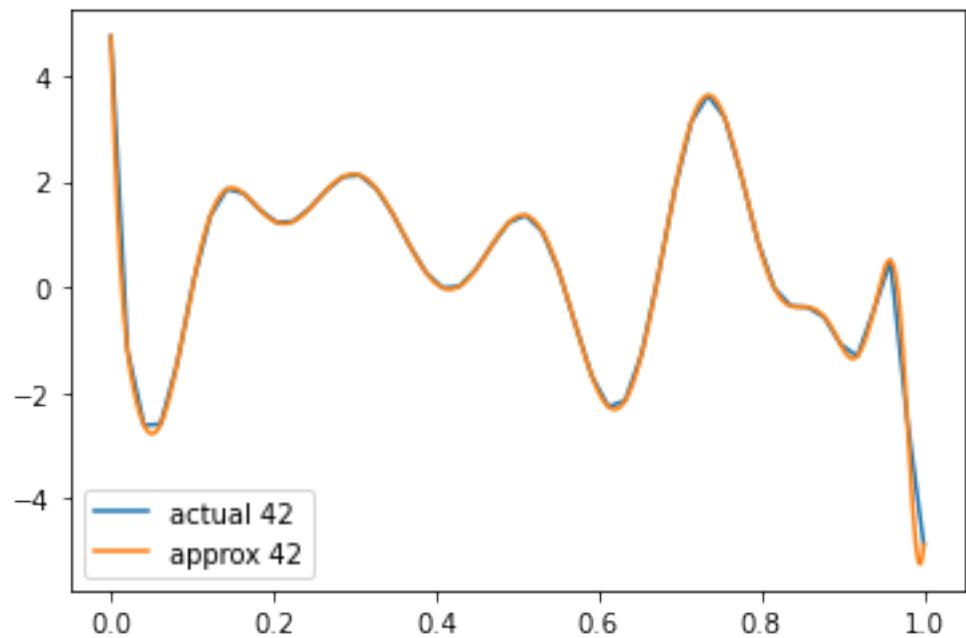
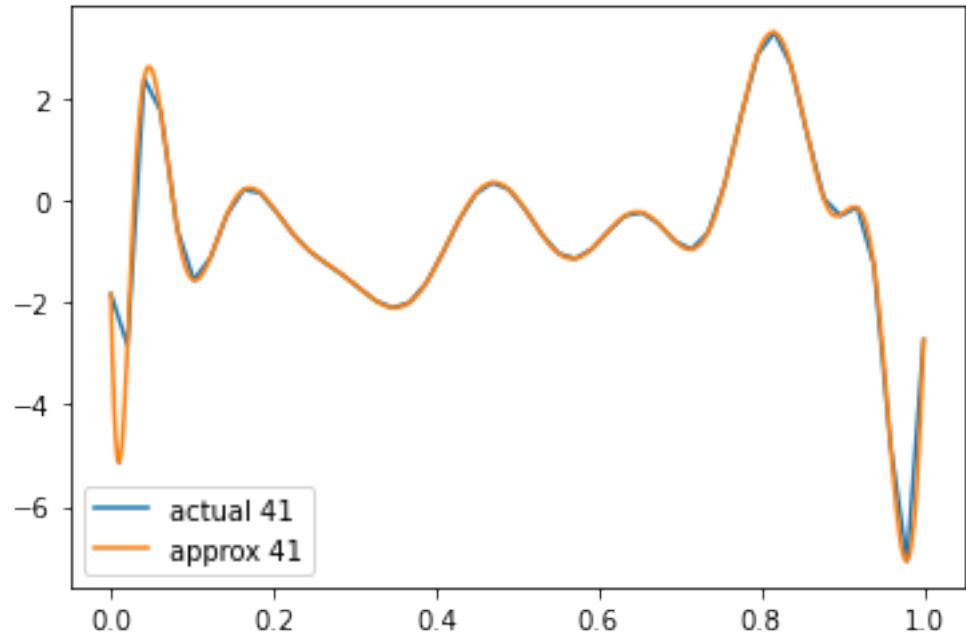


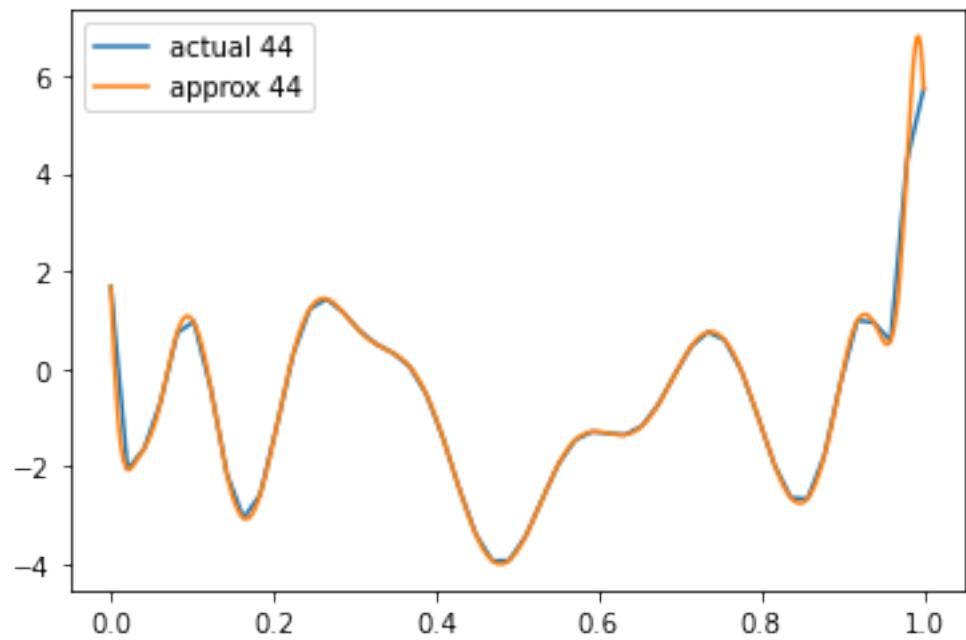
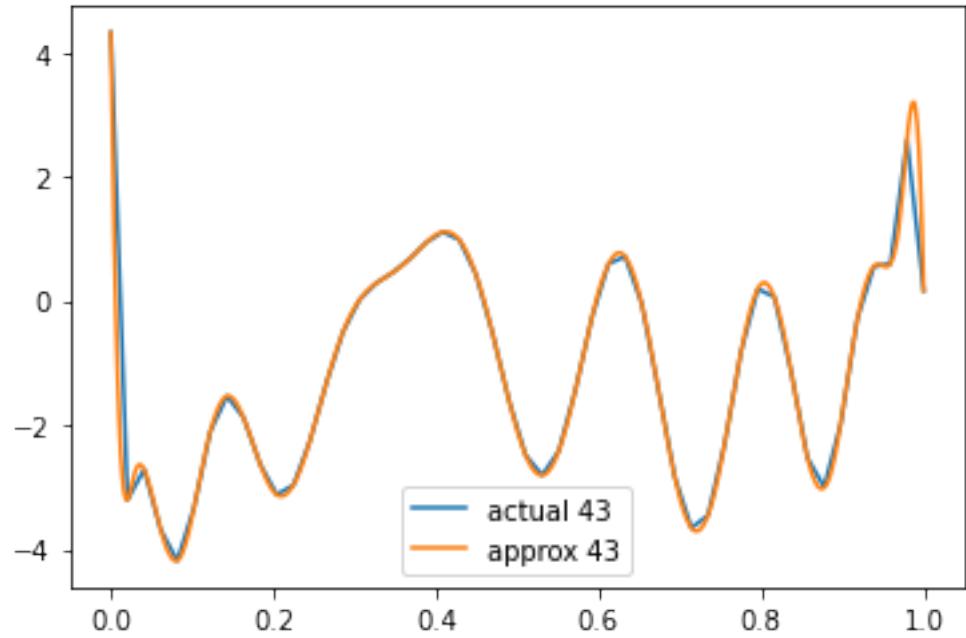


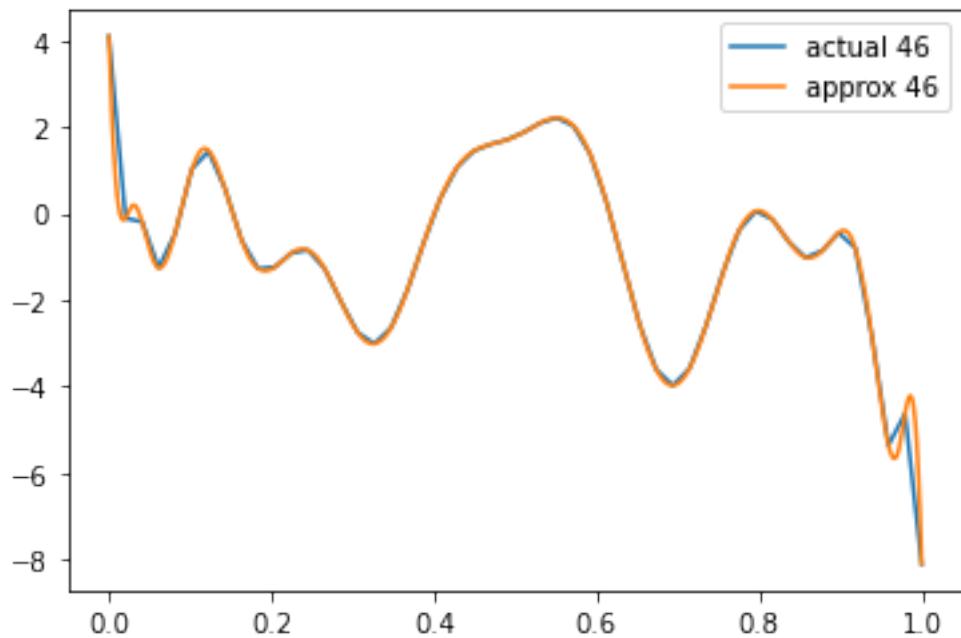
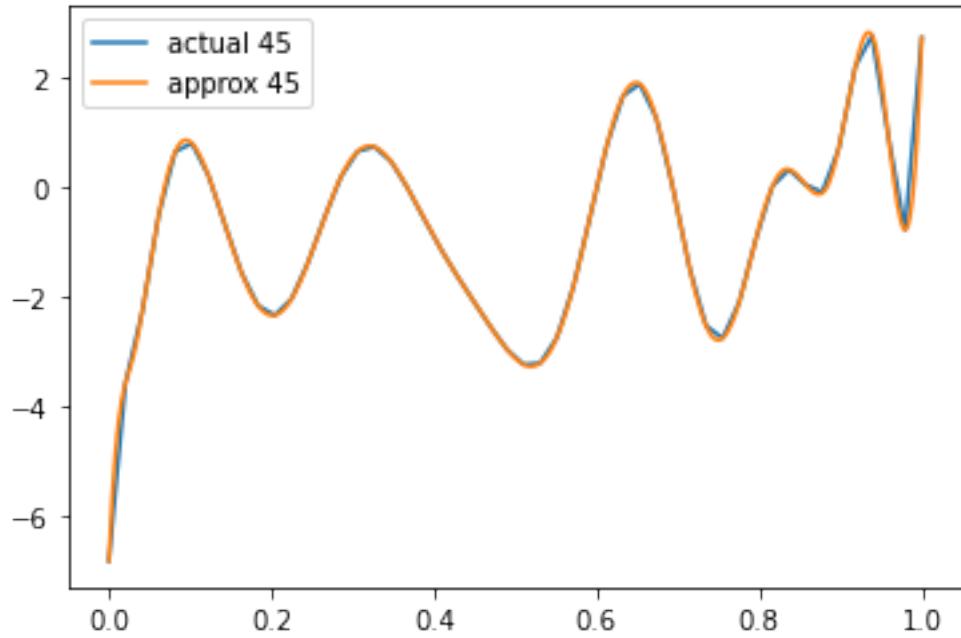


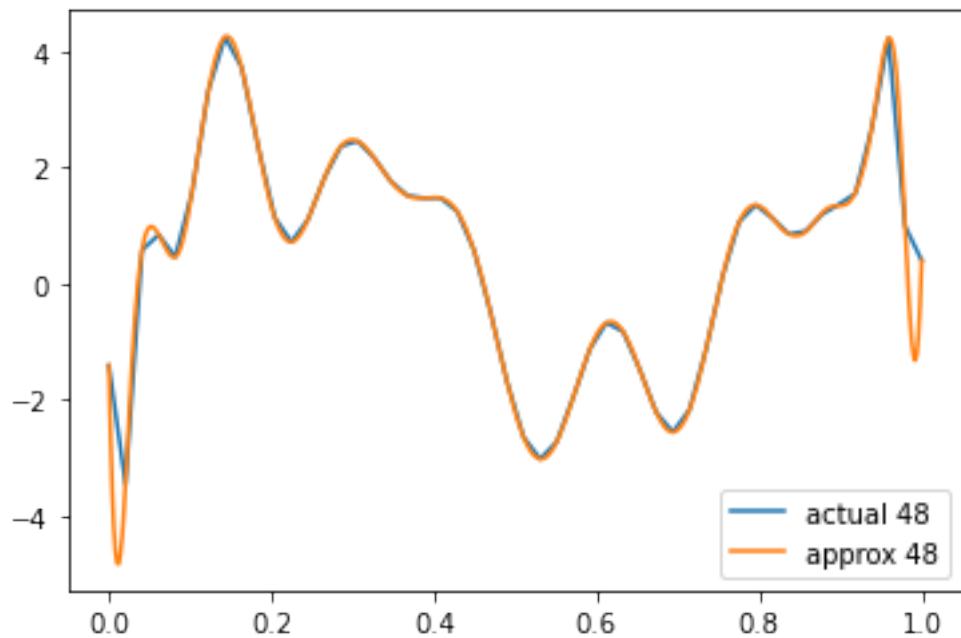
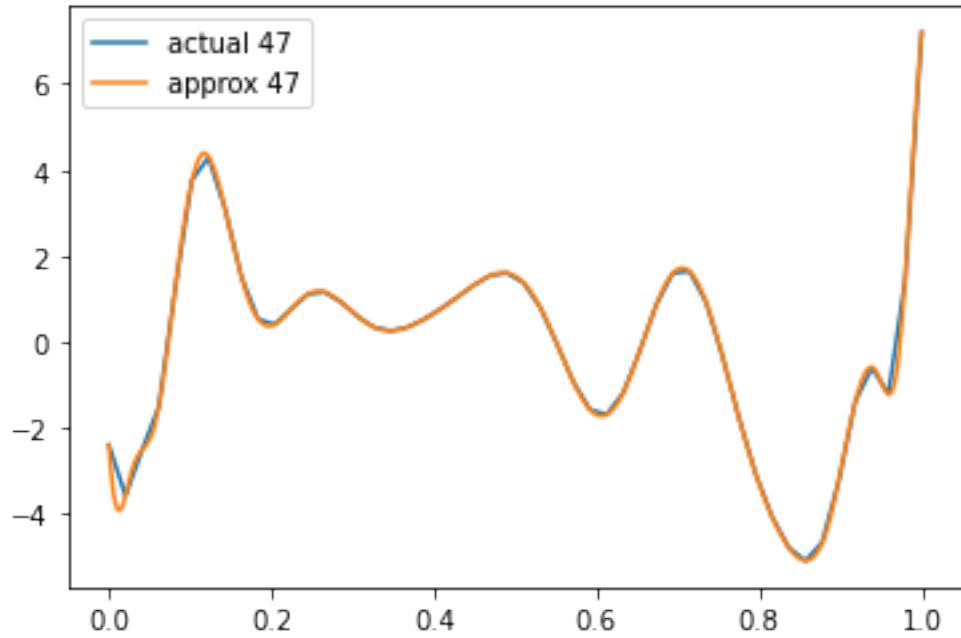


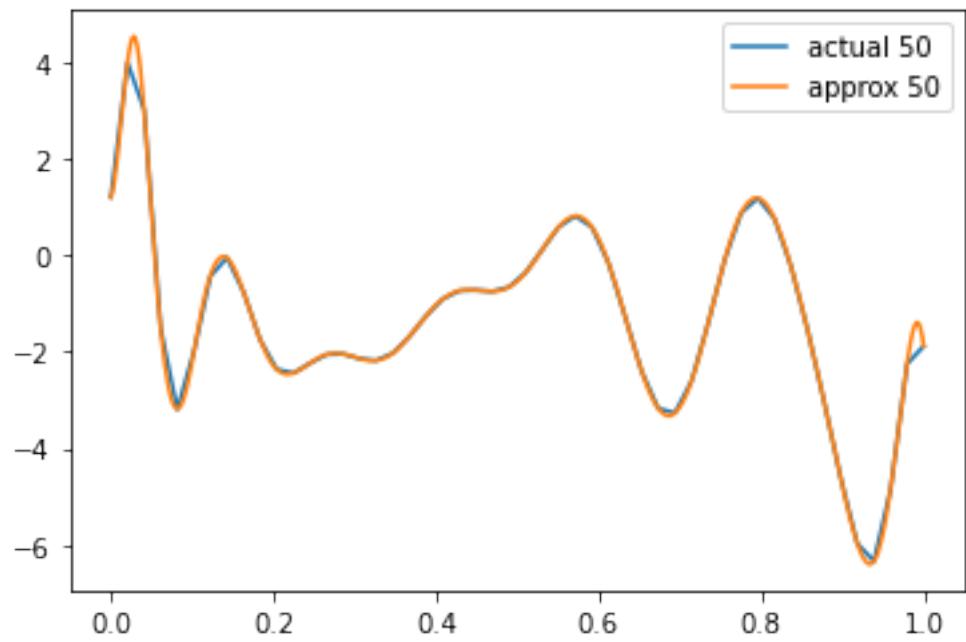
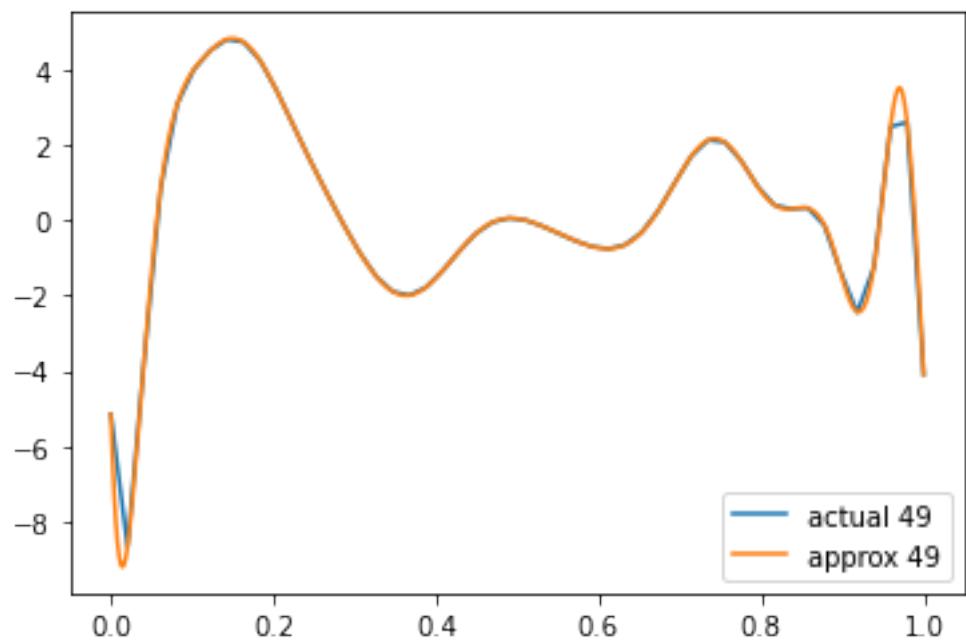


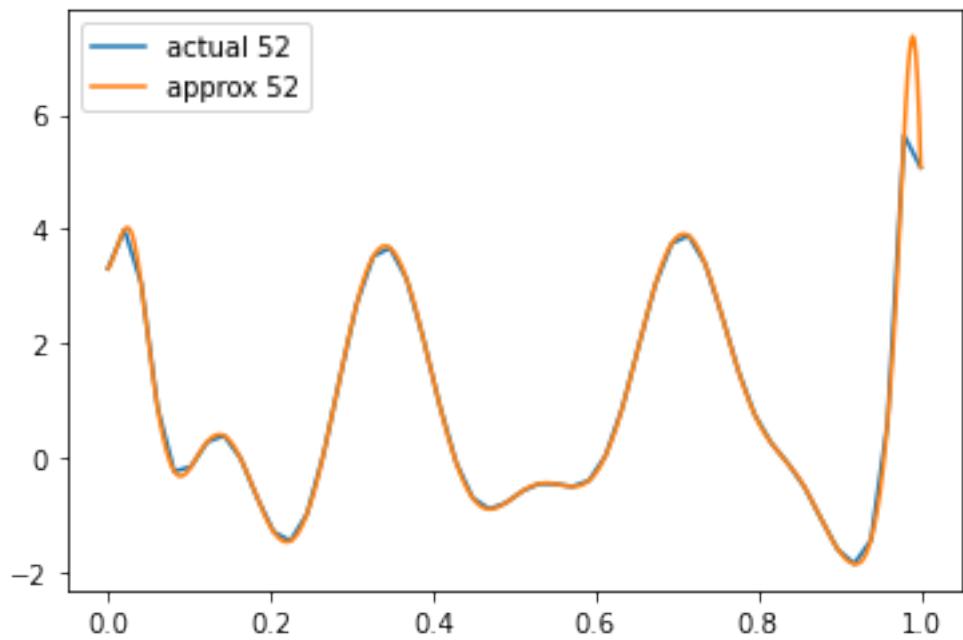
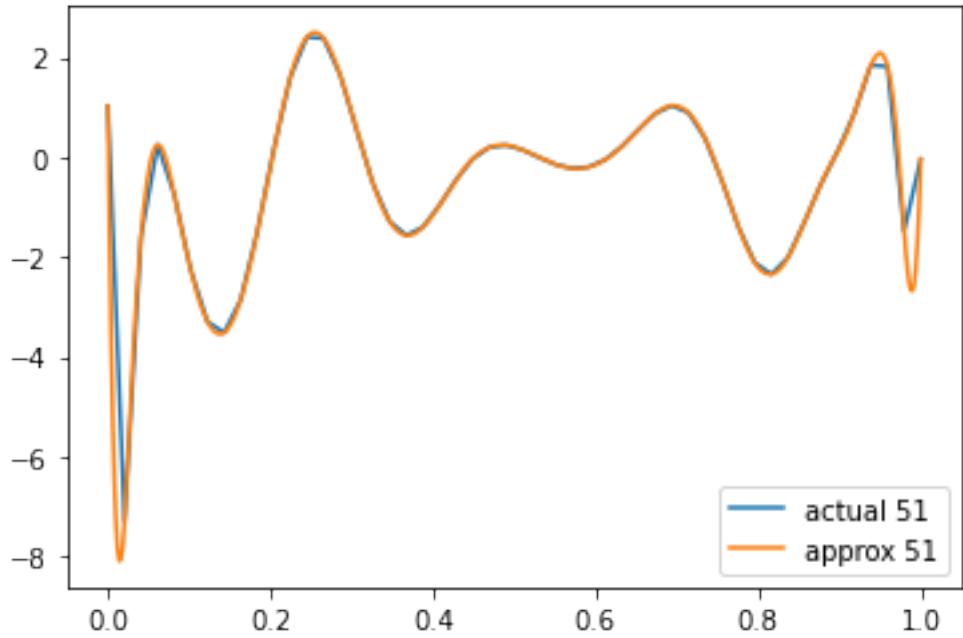


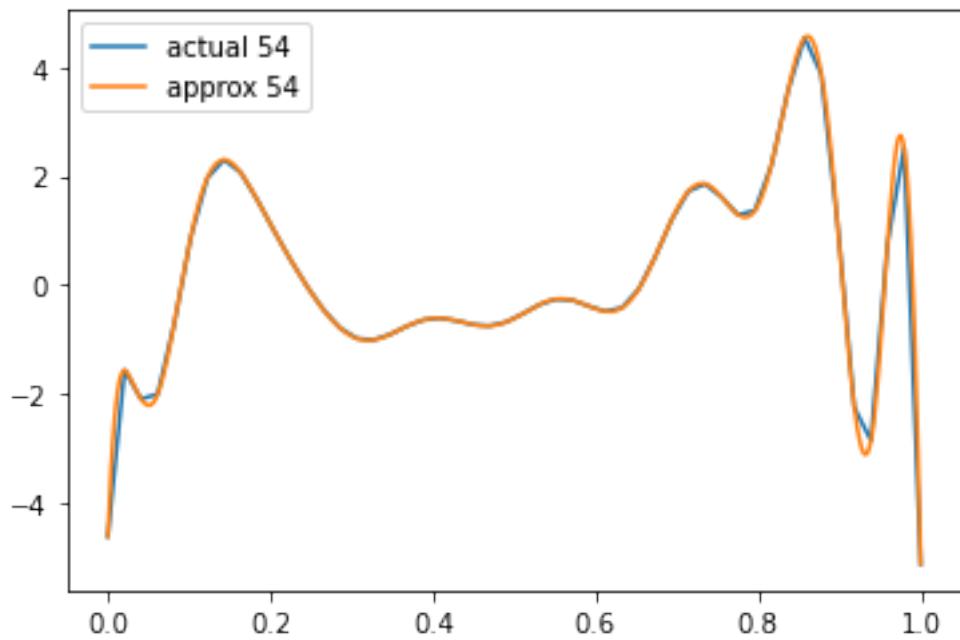
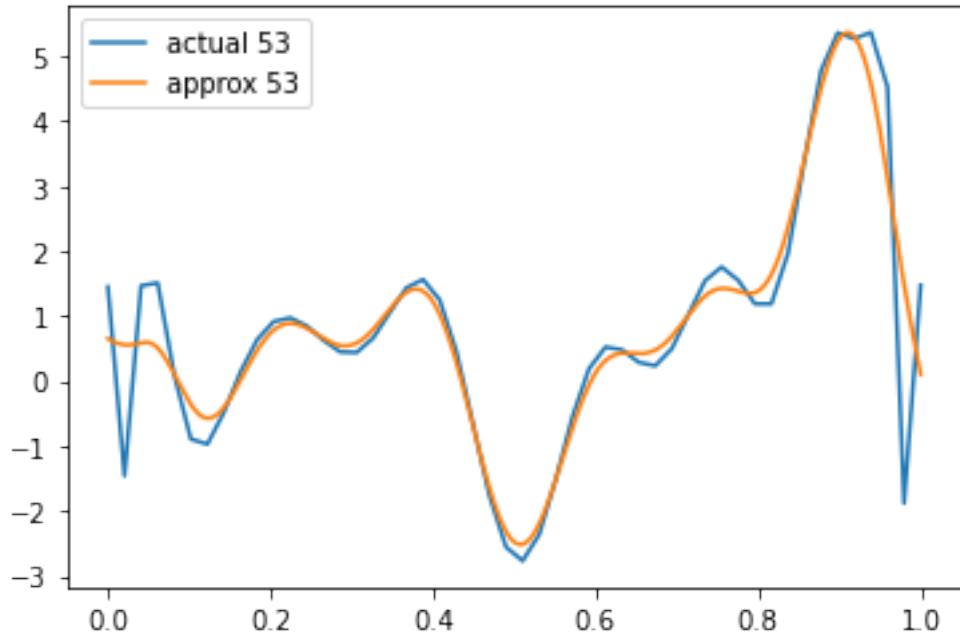


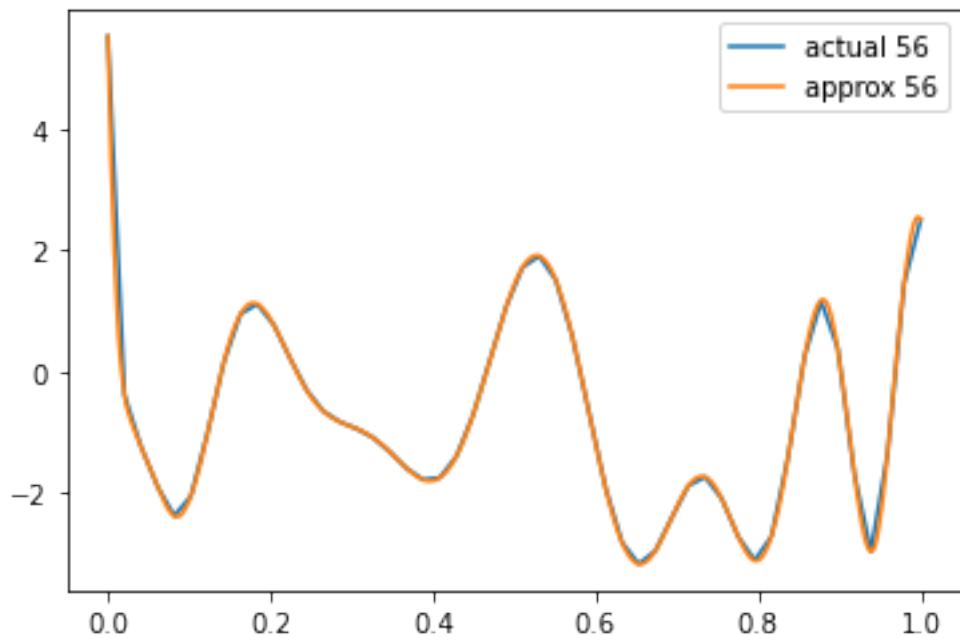
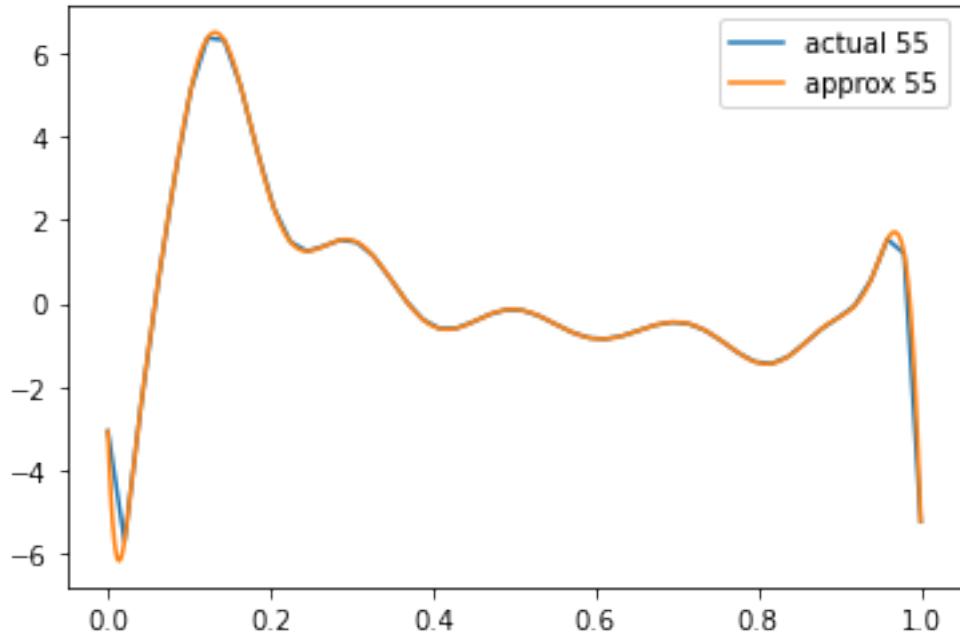


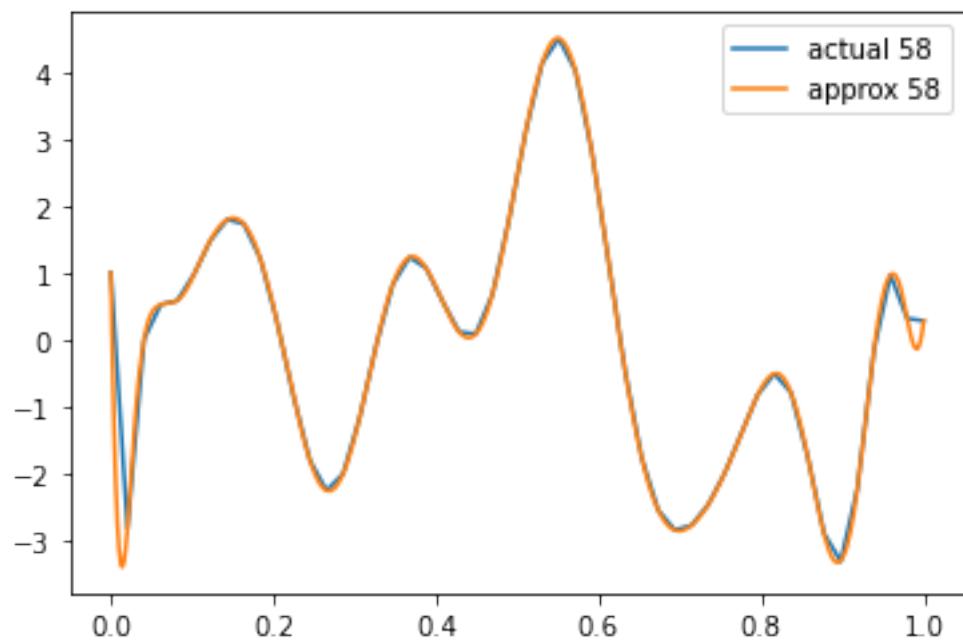
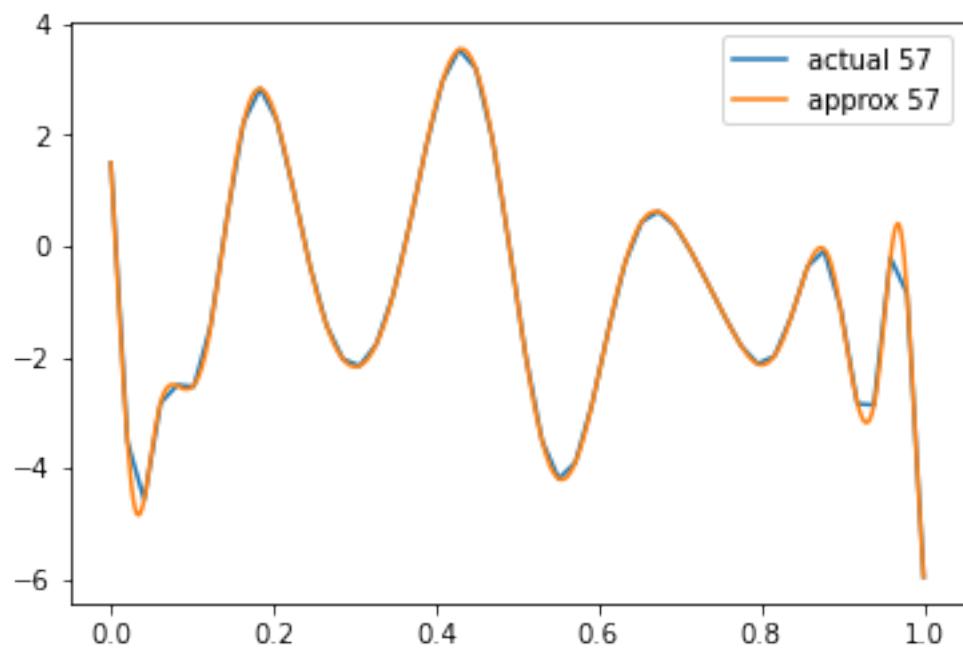


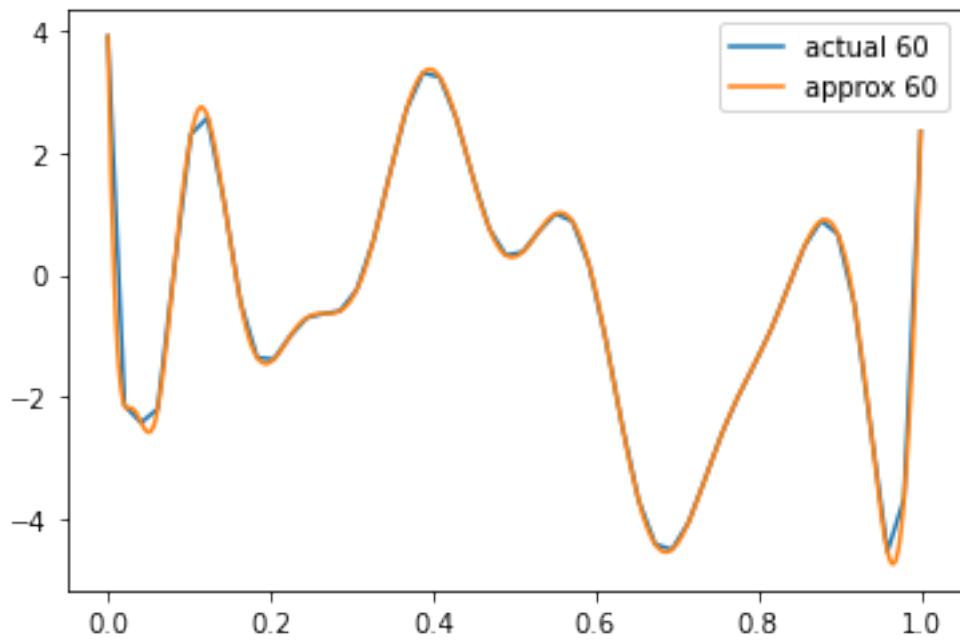
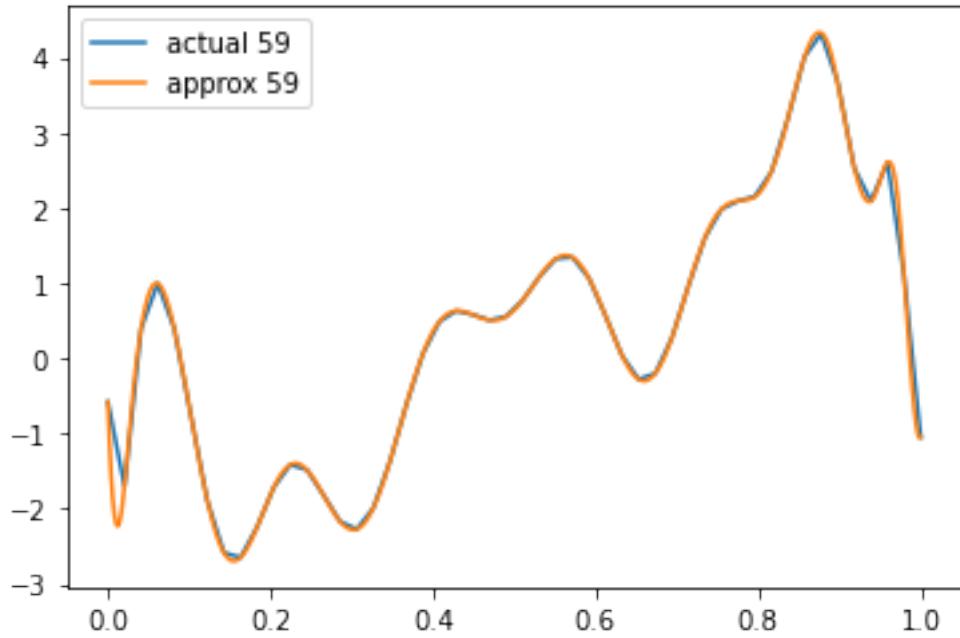


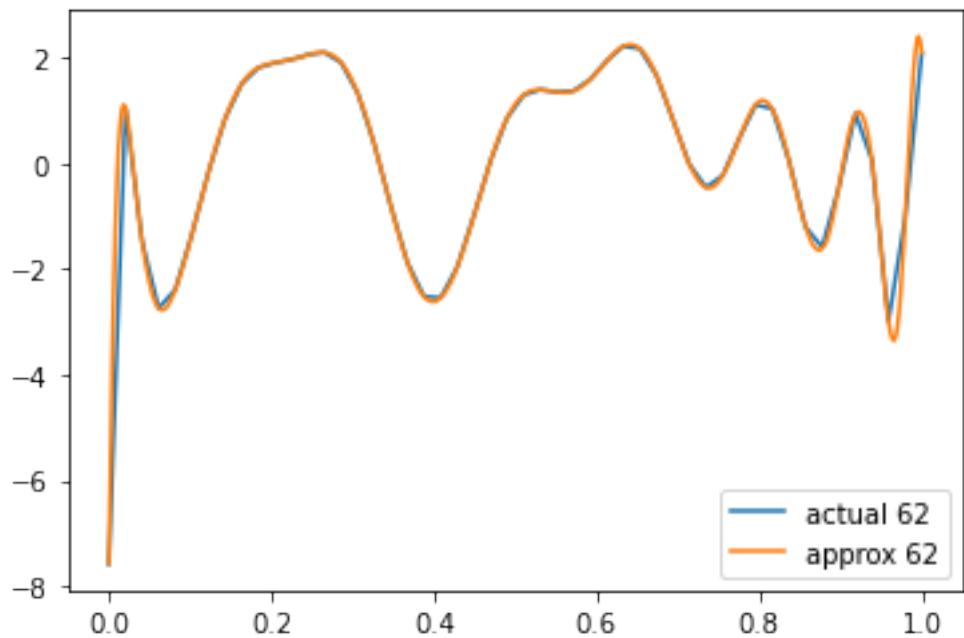
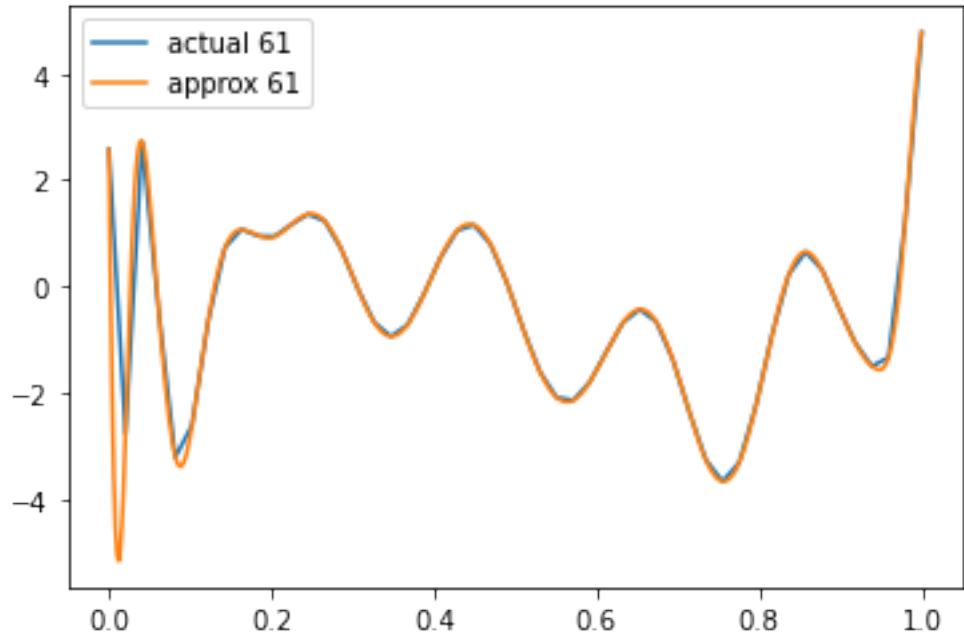


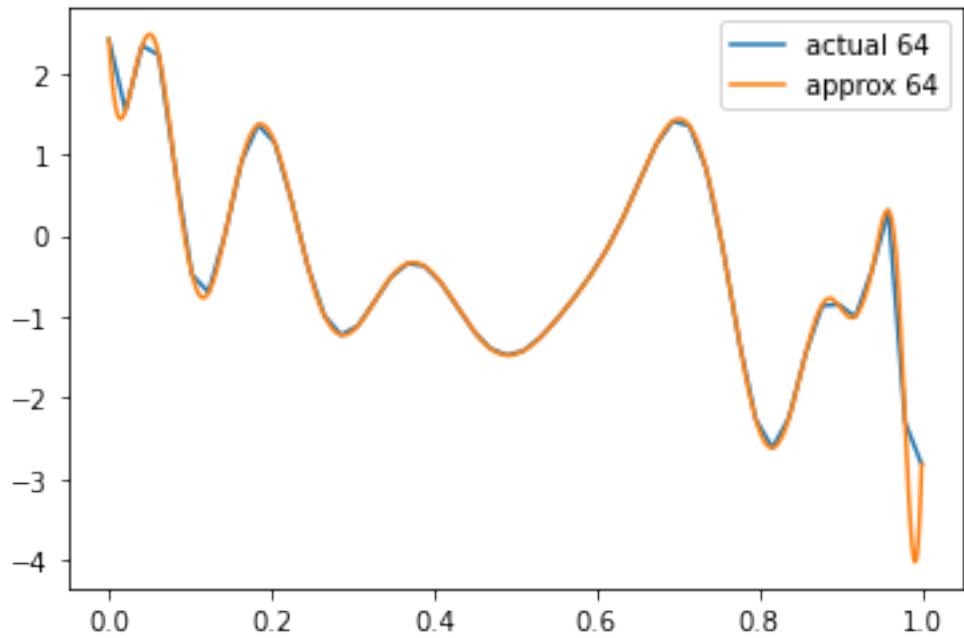
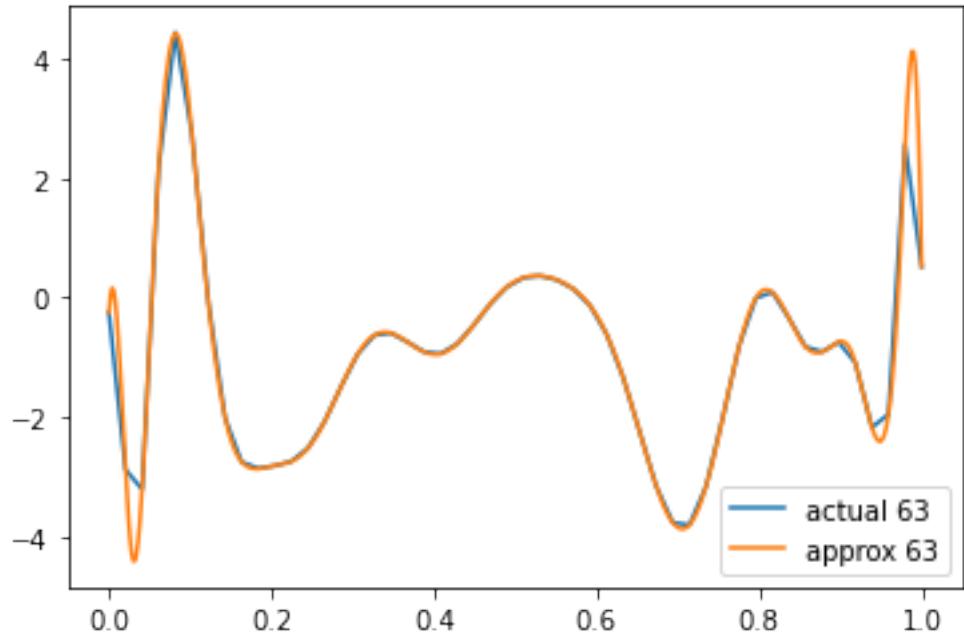


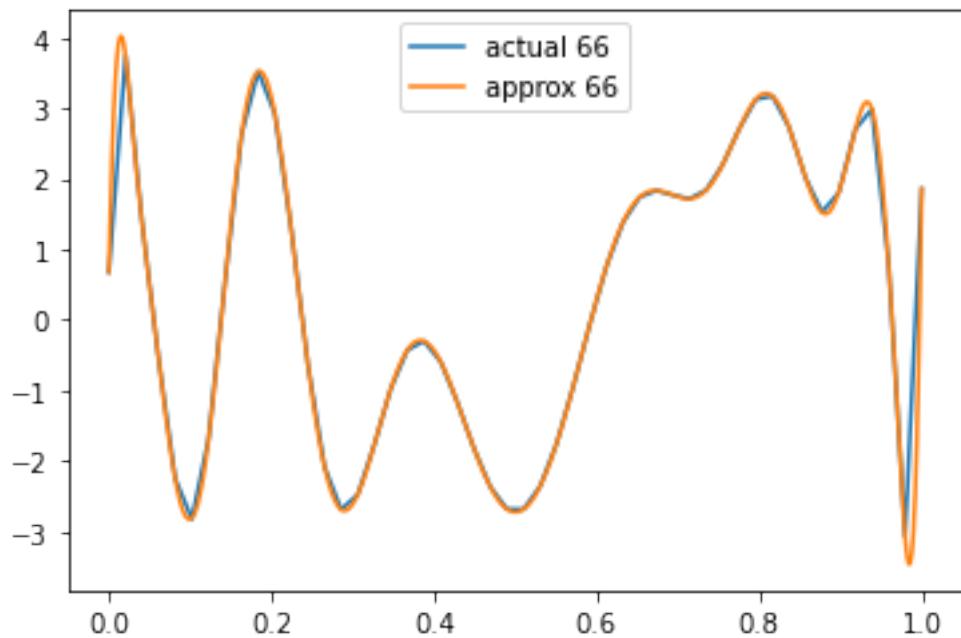
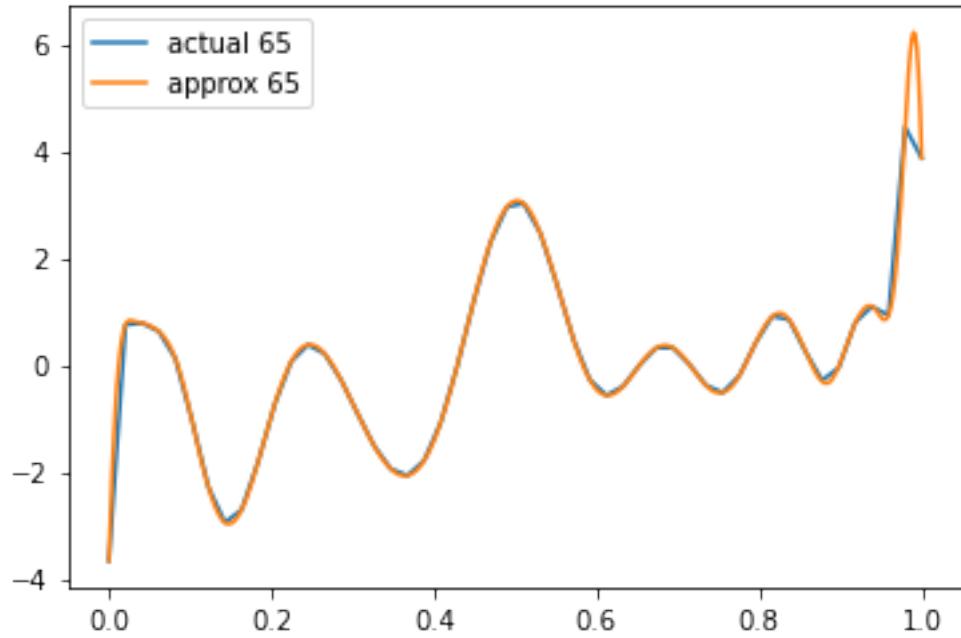




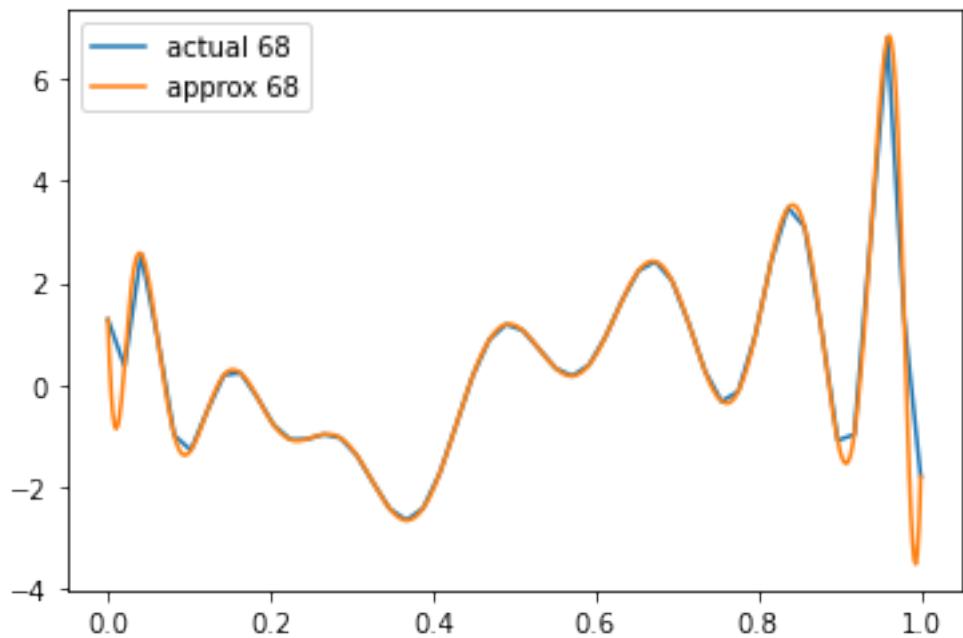
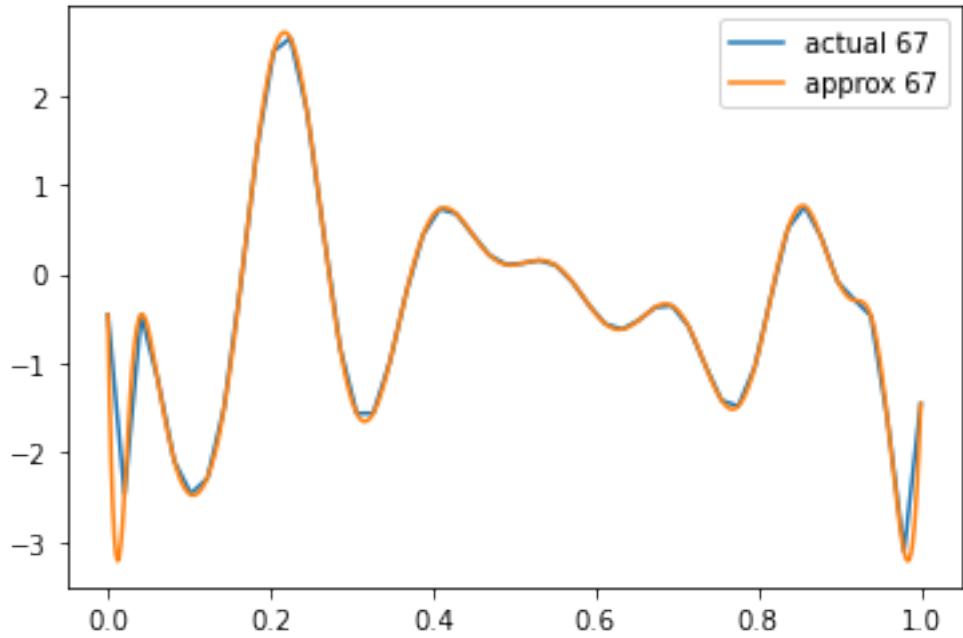


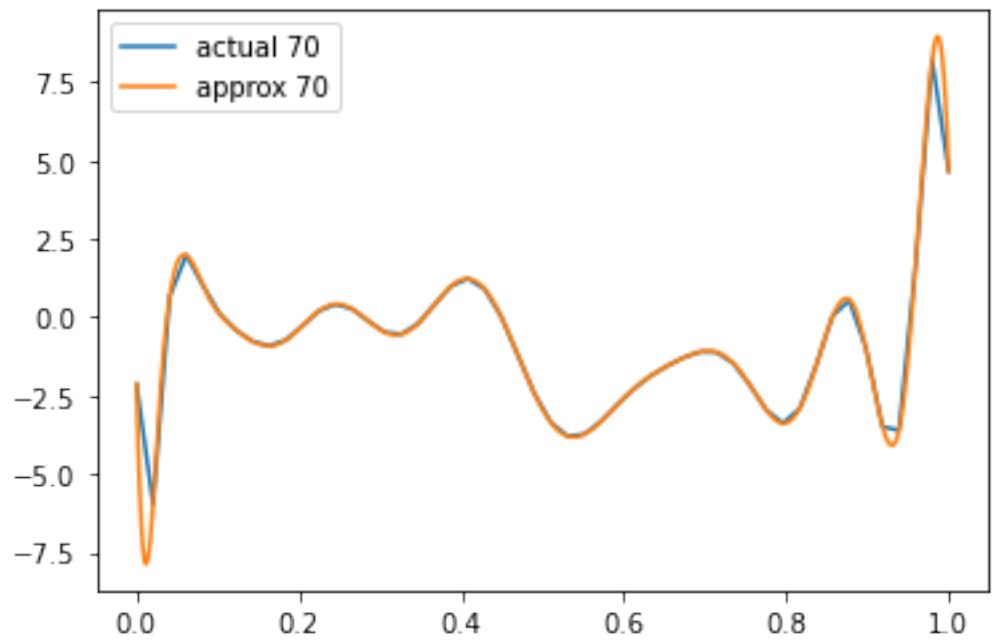
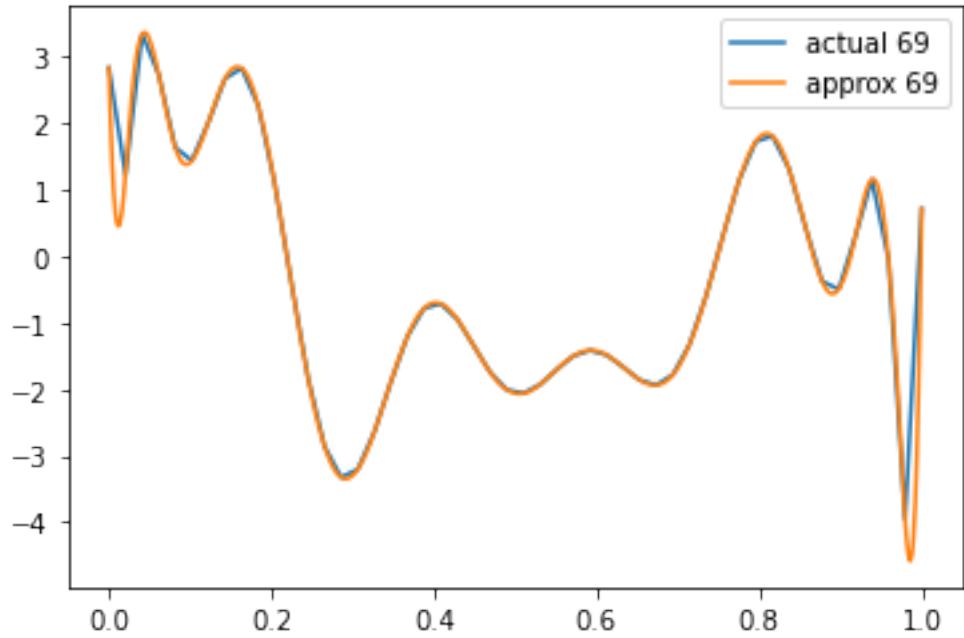


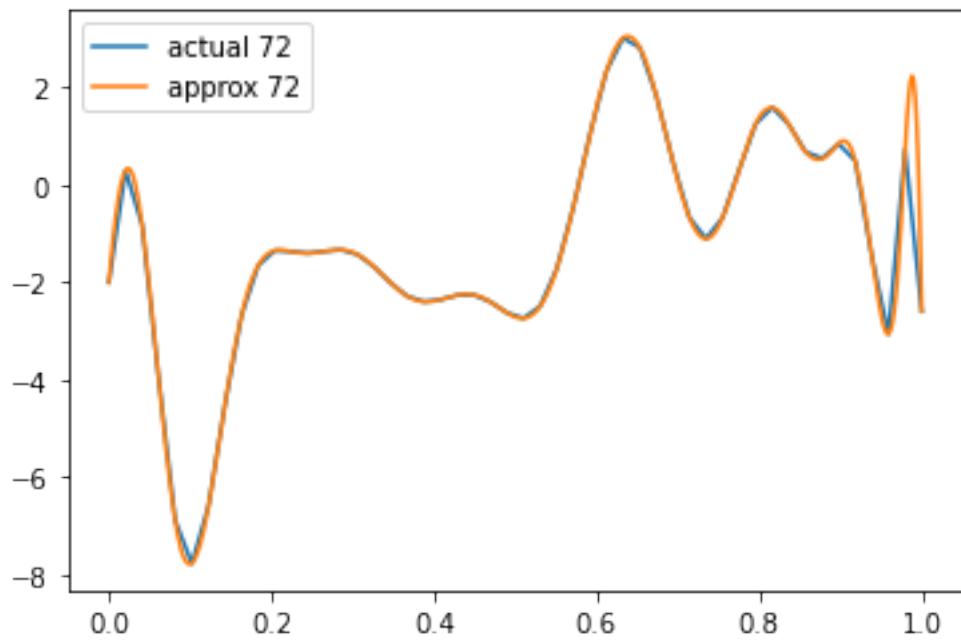
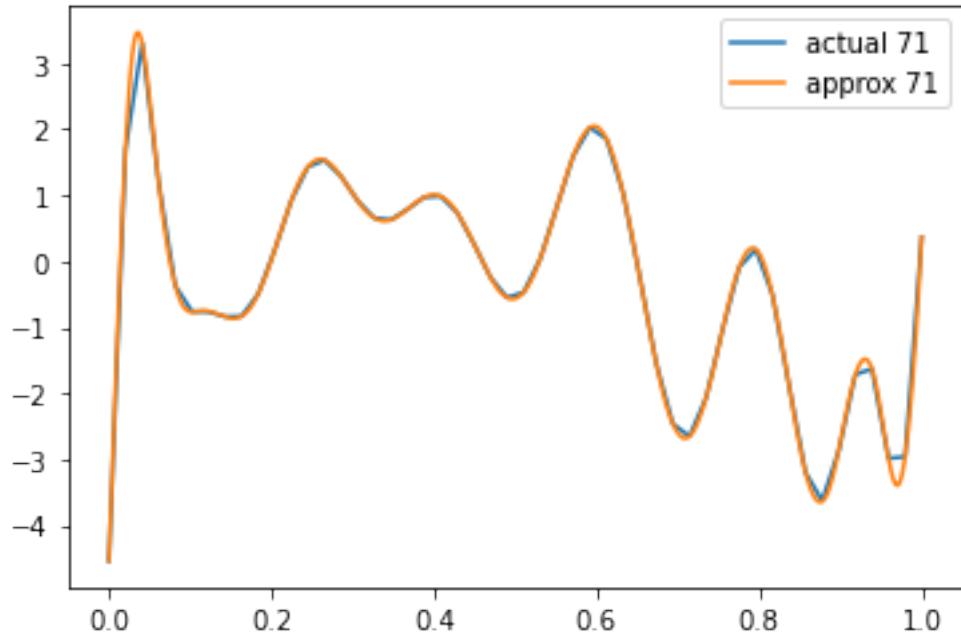


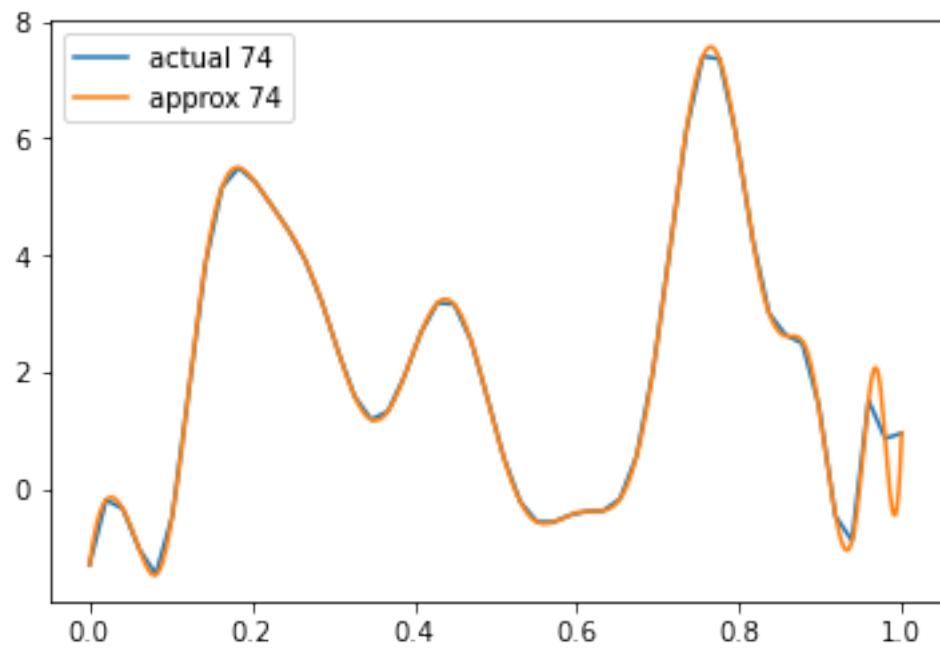
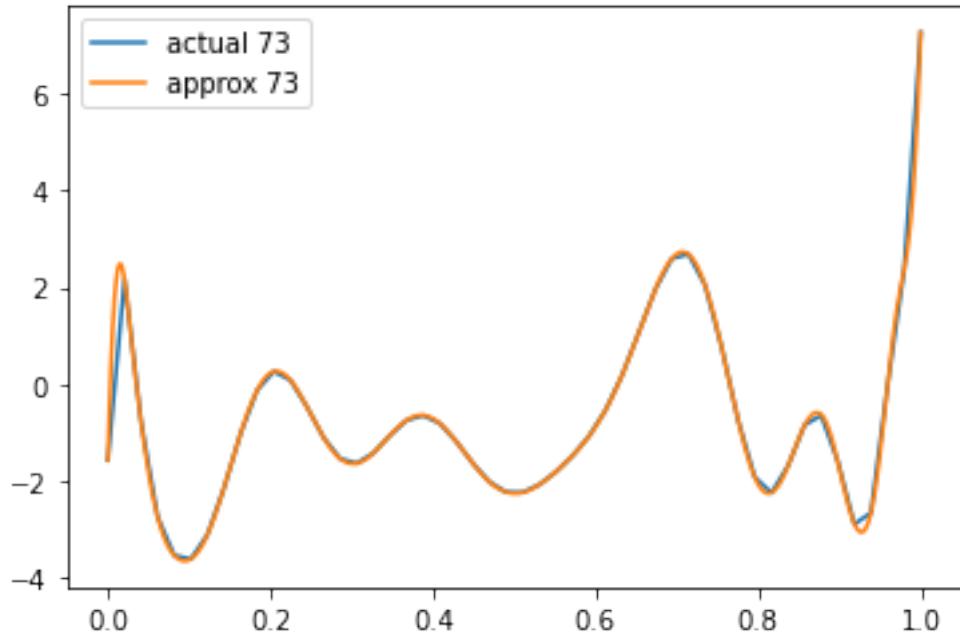


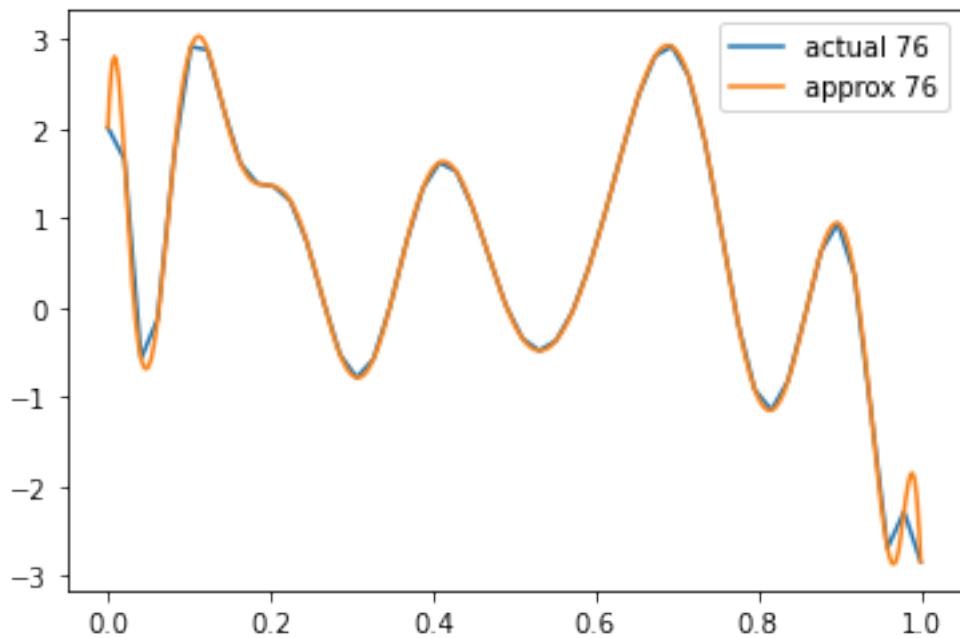
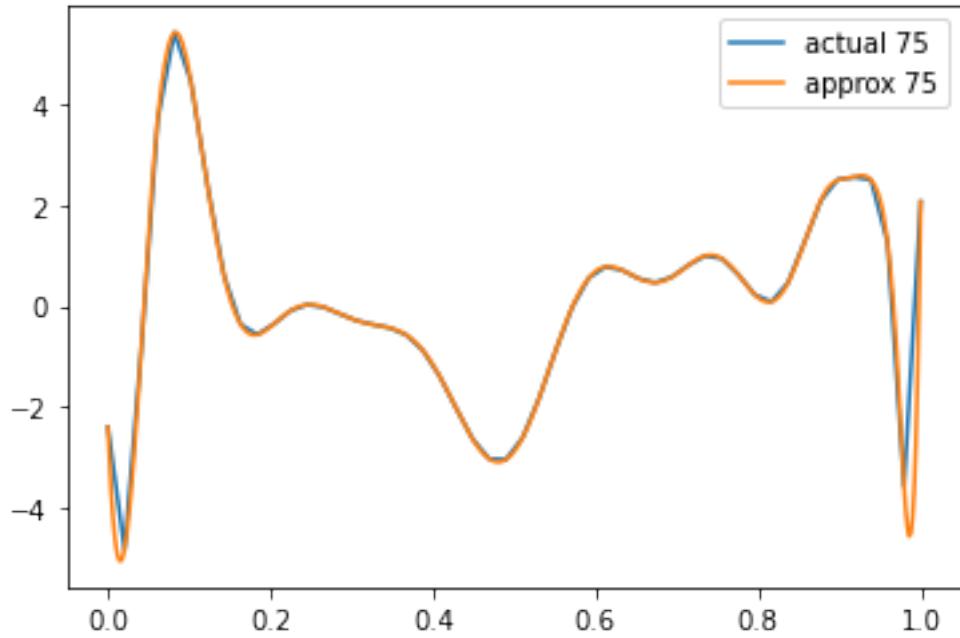
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to bounds  
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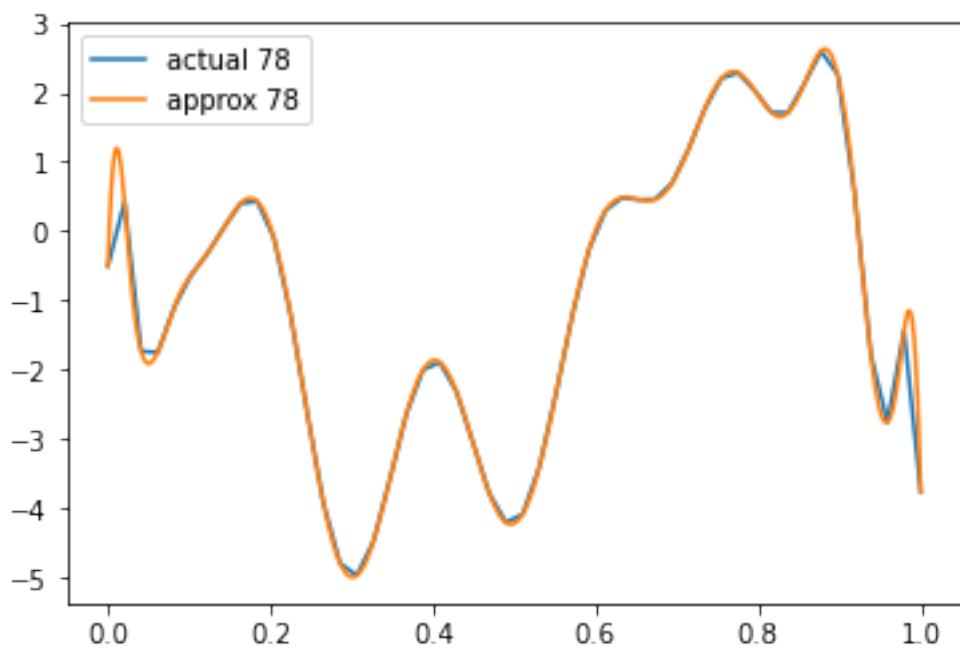
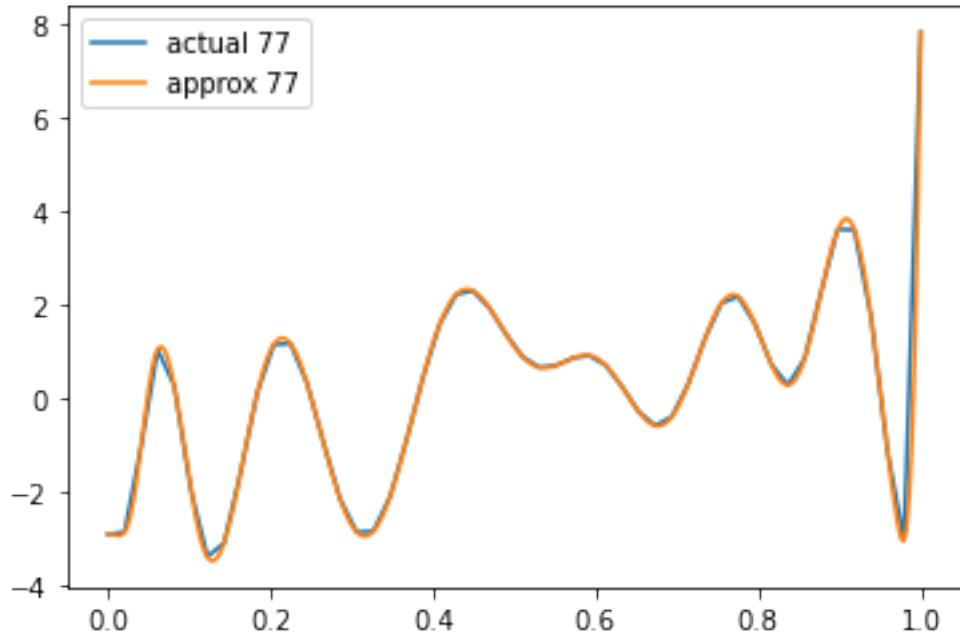


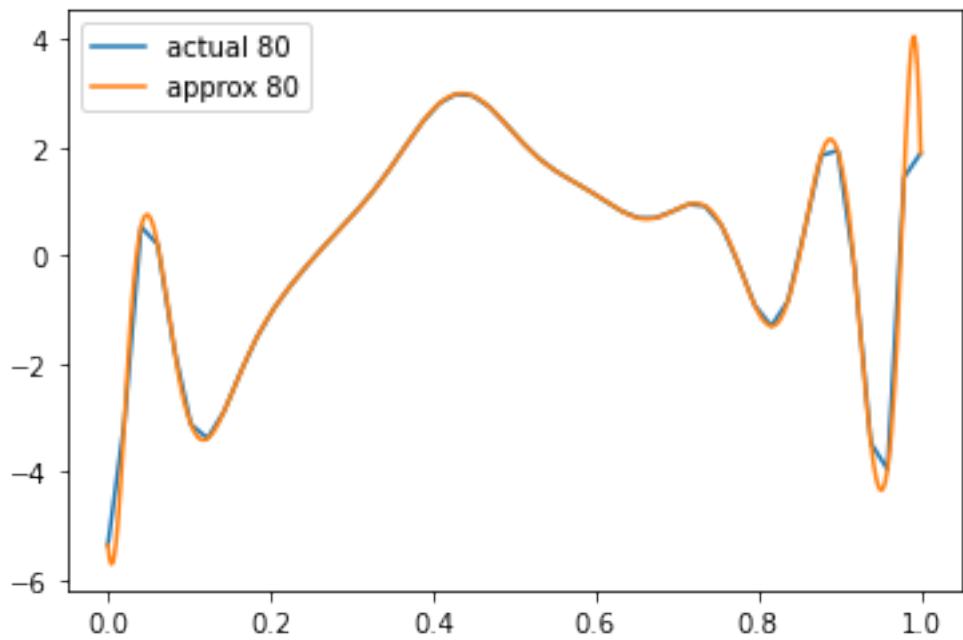
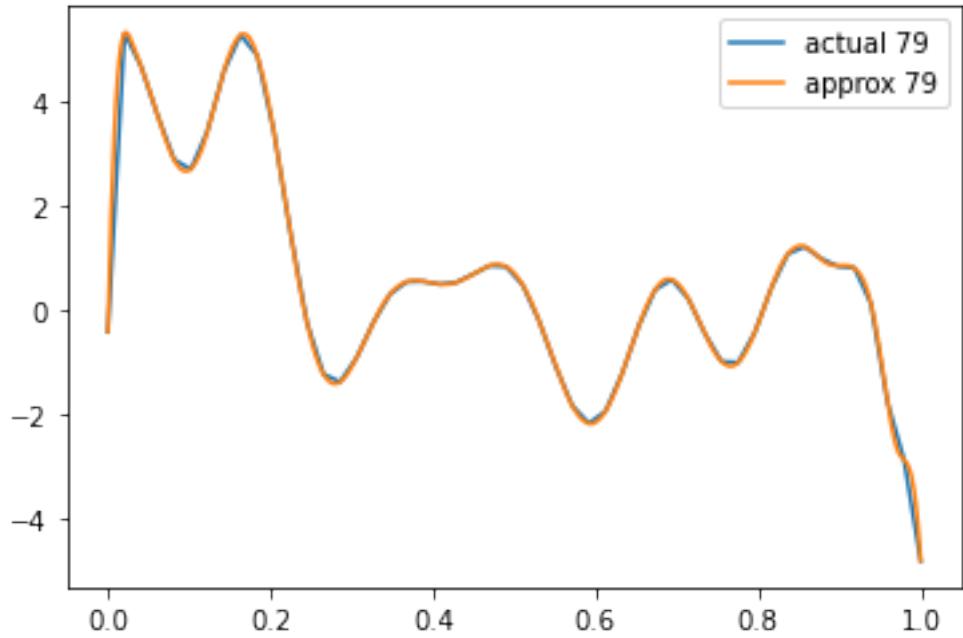


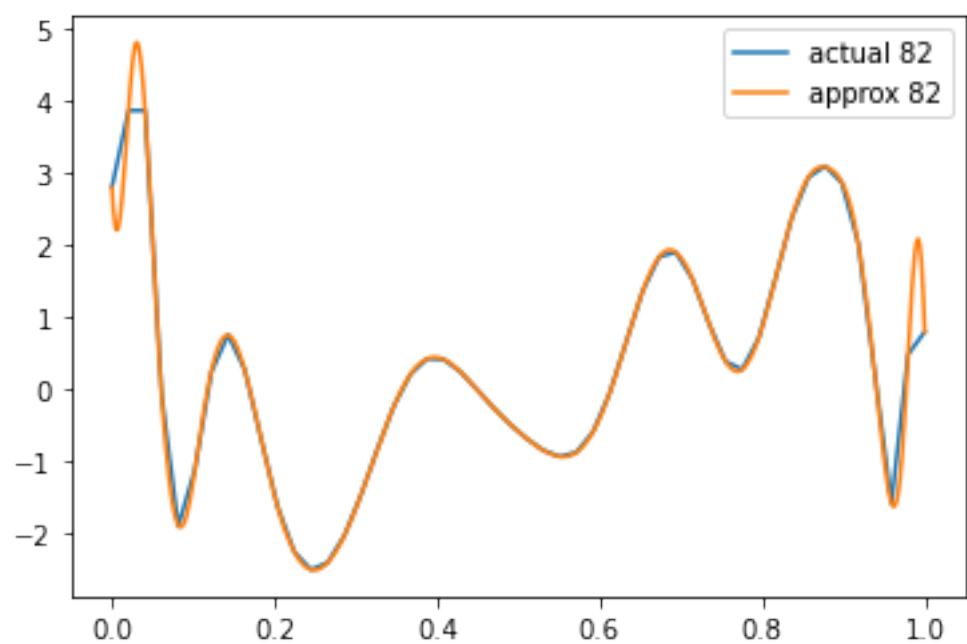
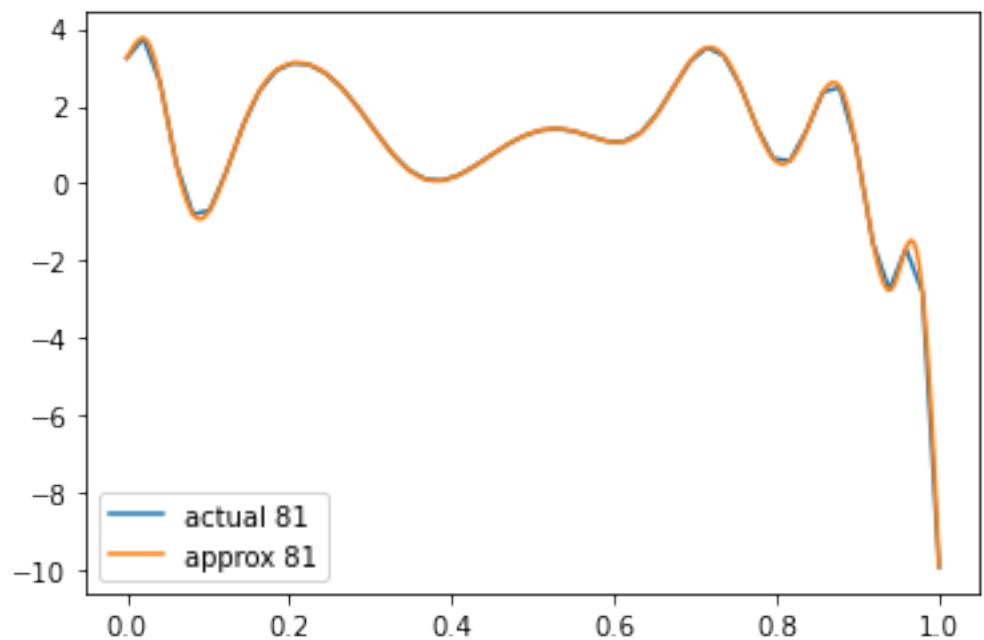


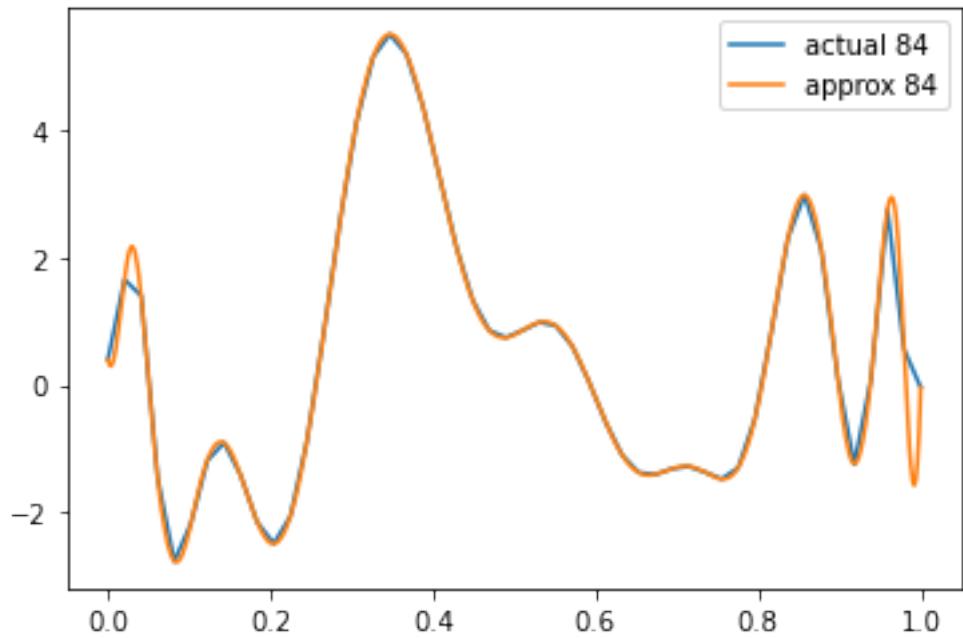
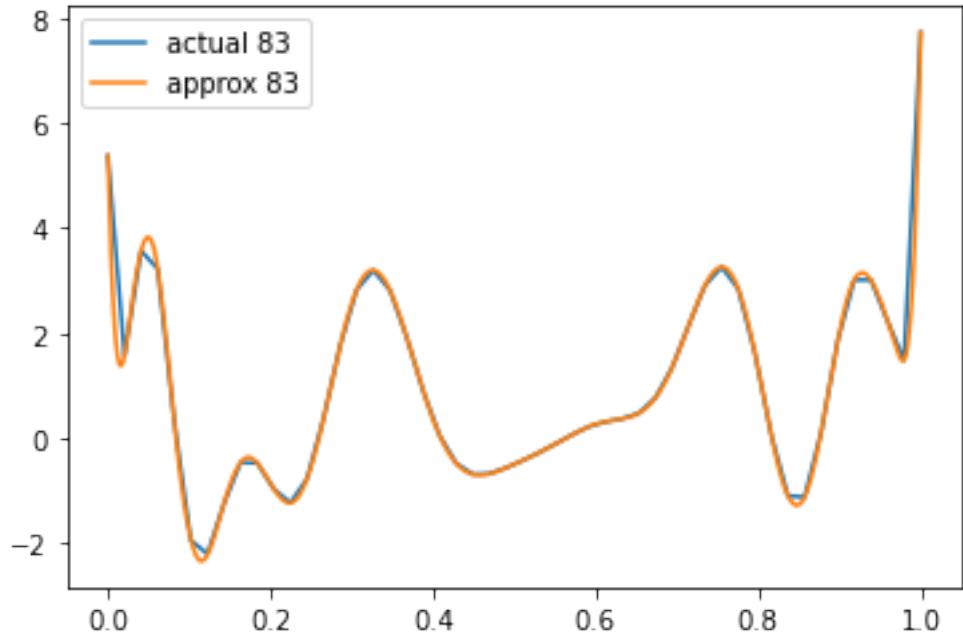


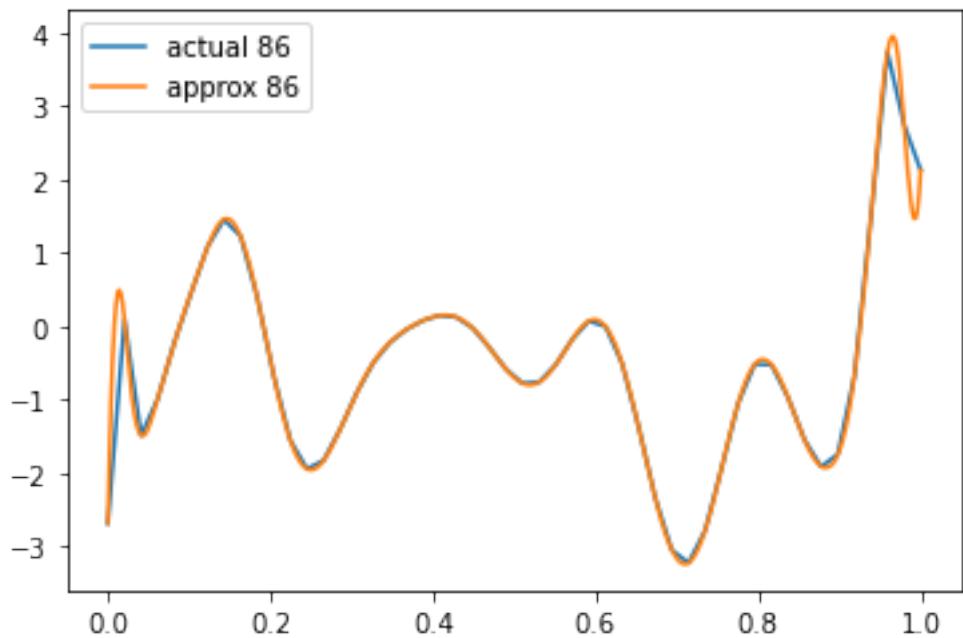
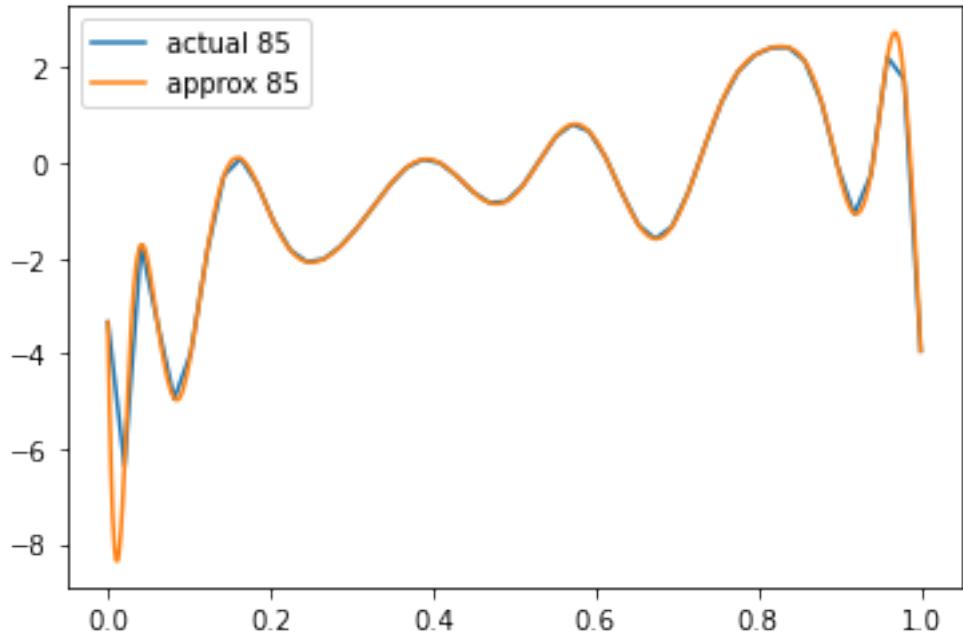


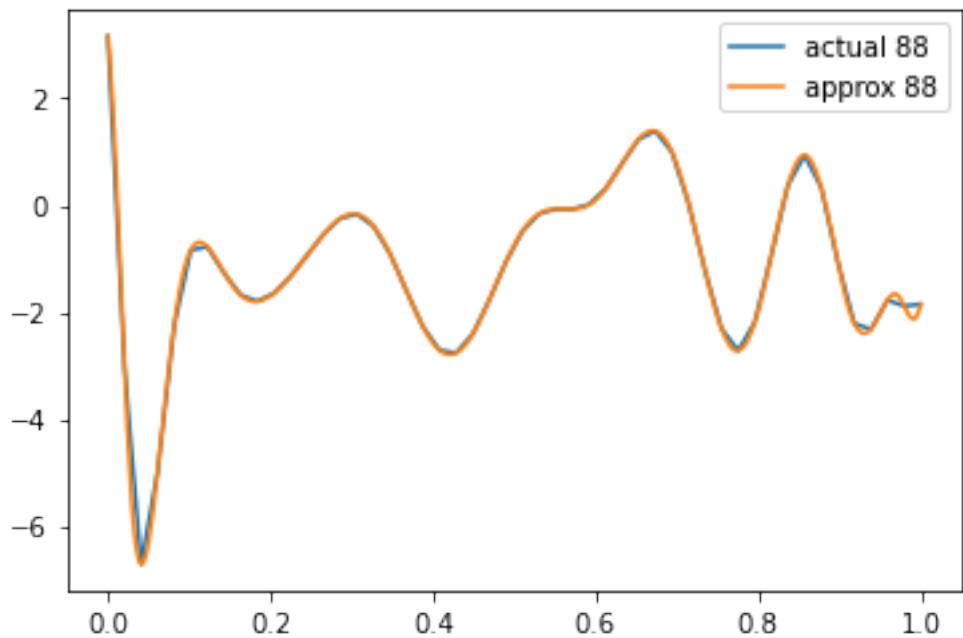
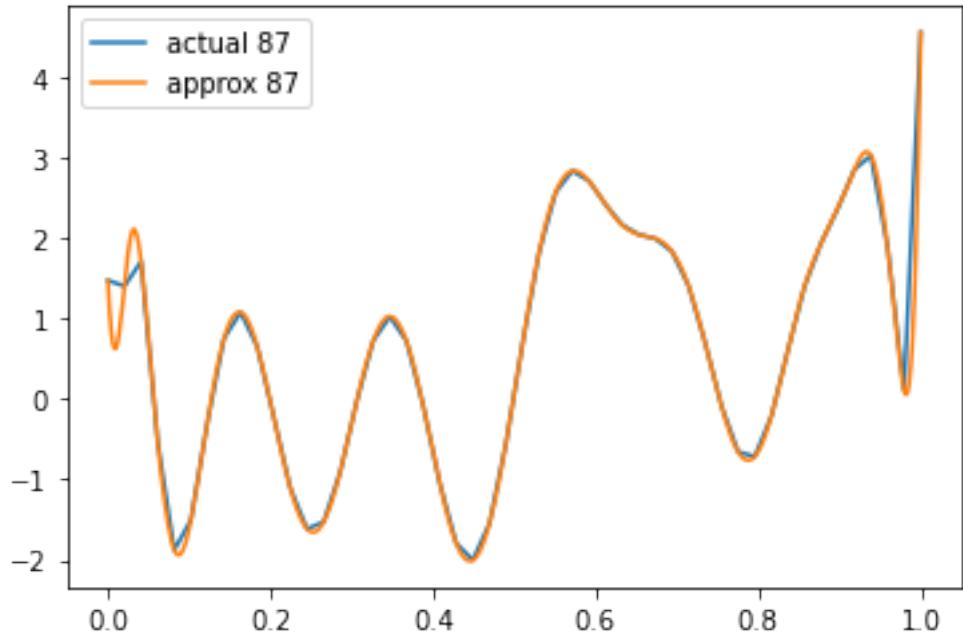


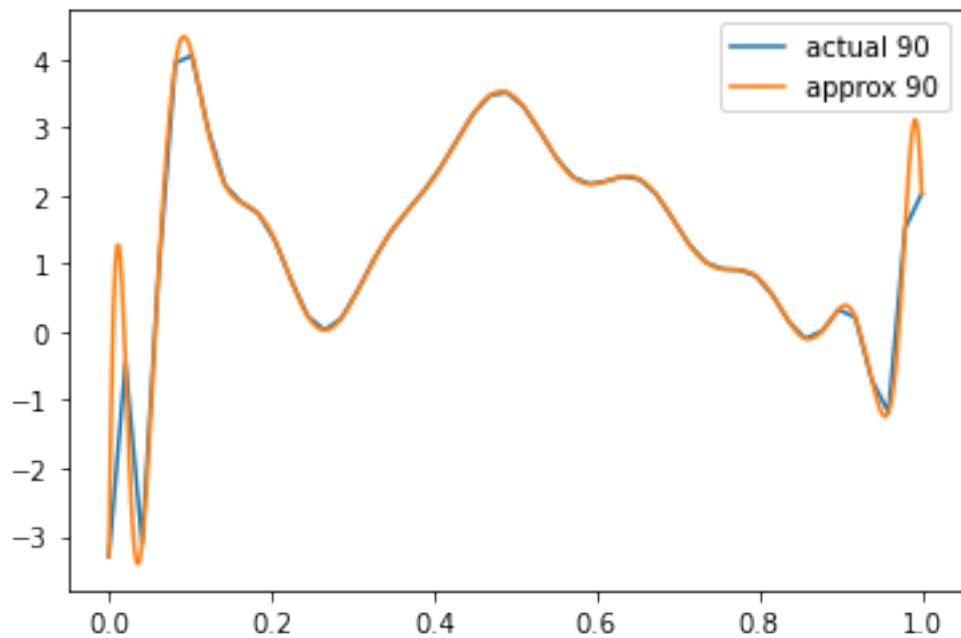
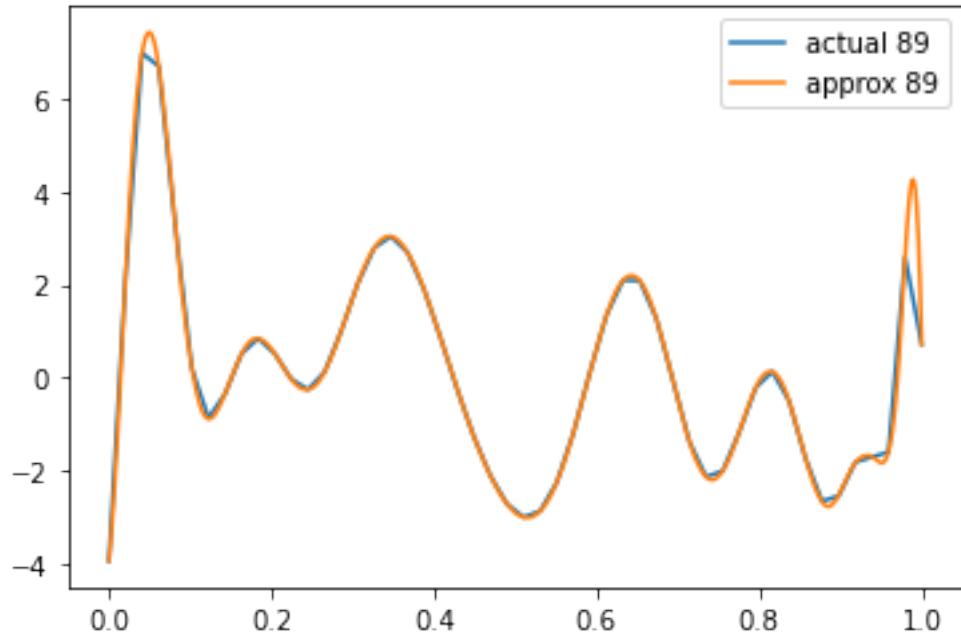


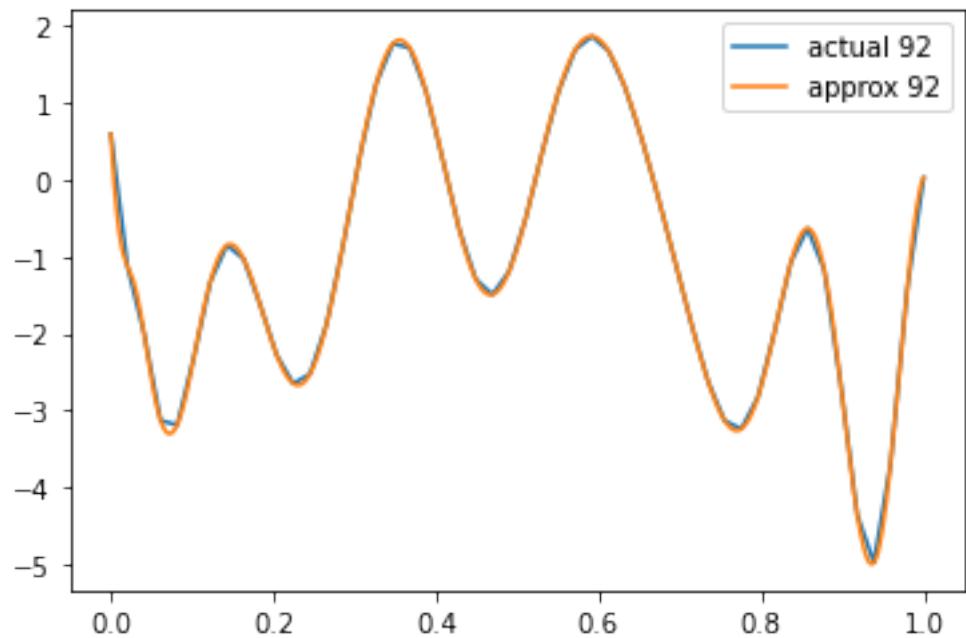
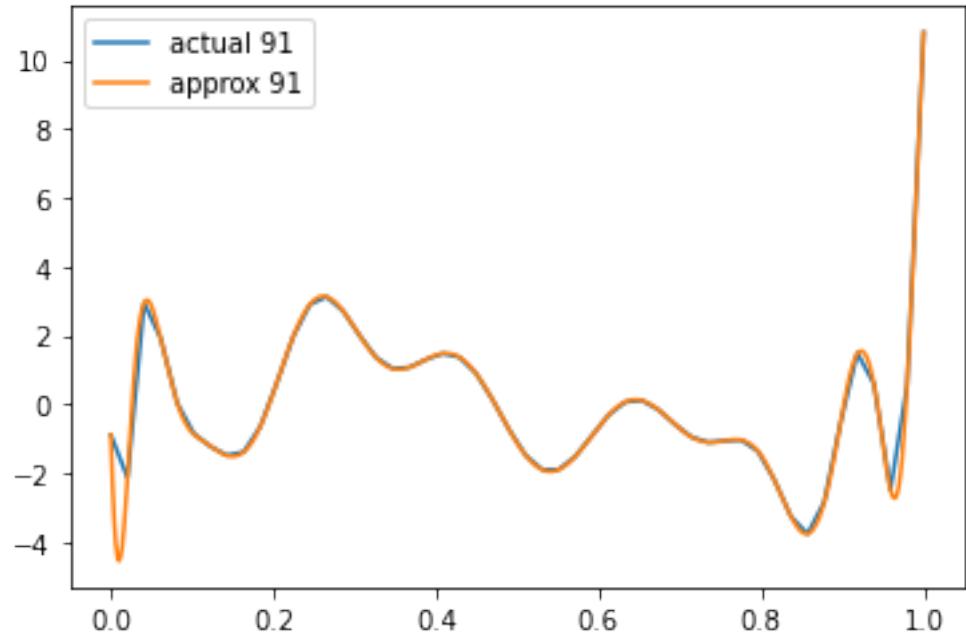


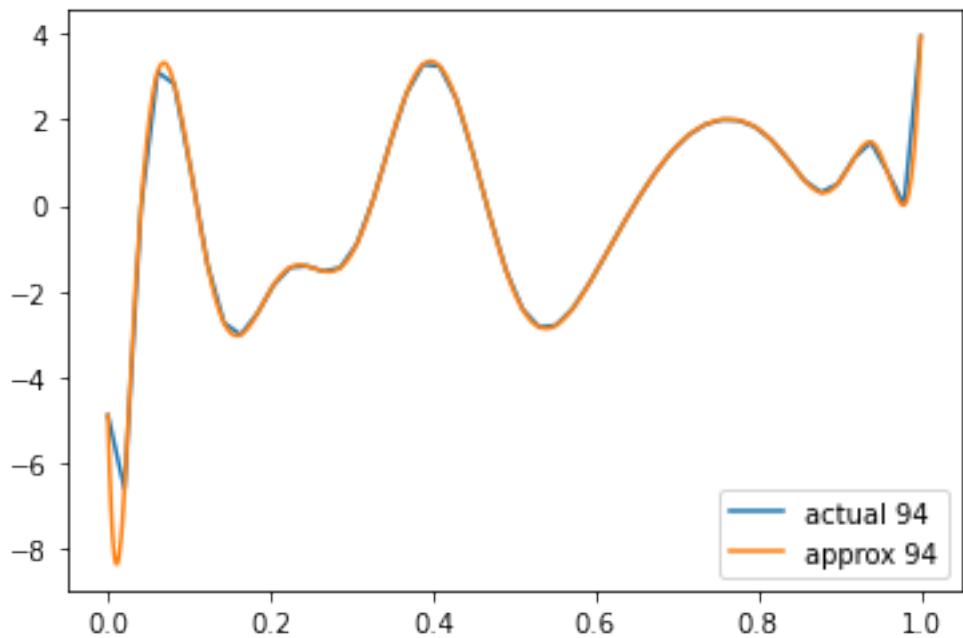
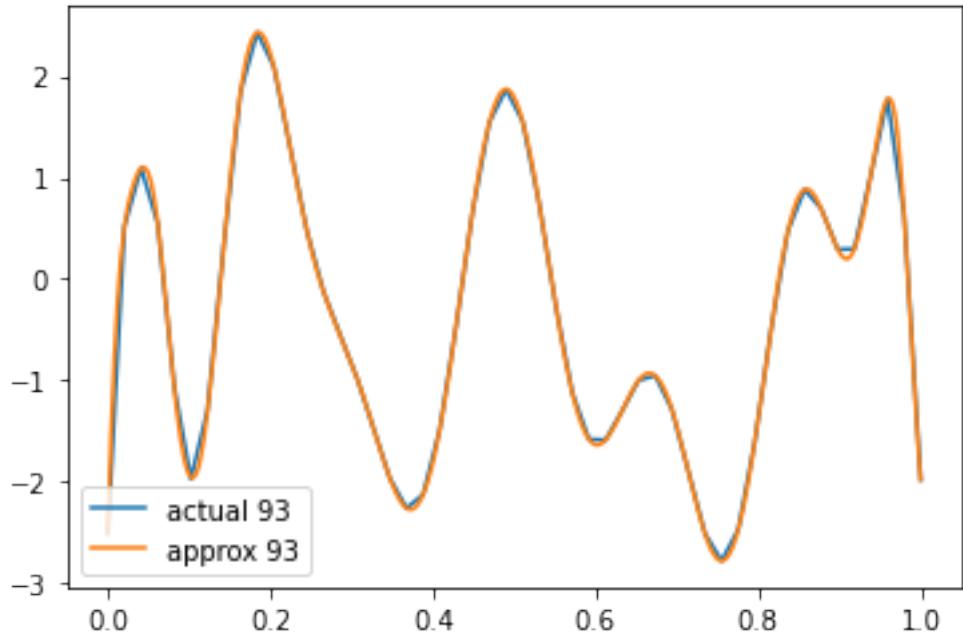


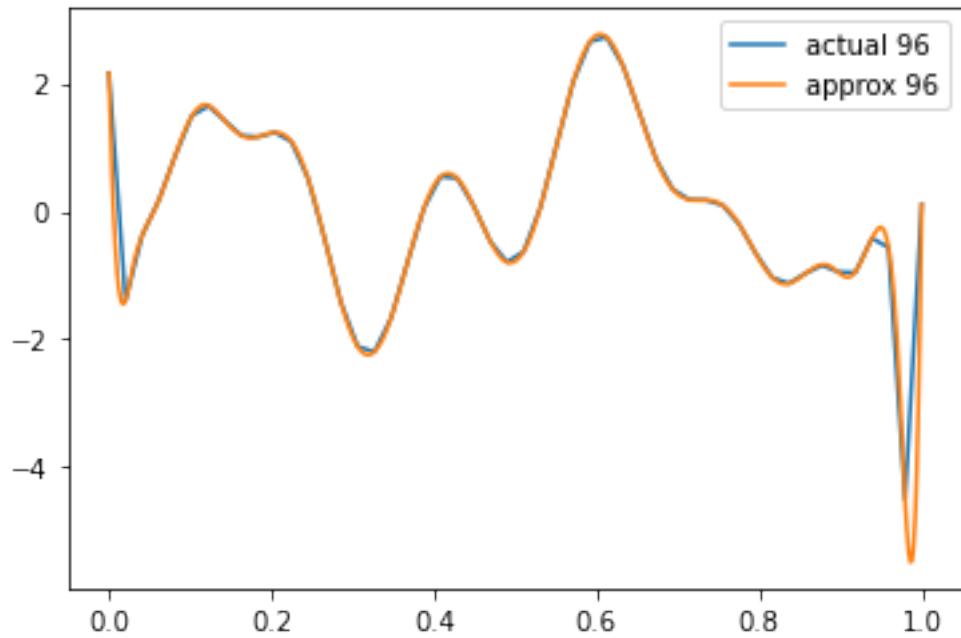
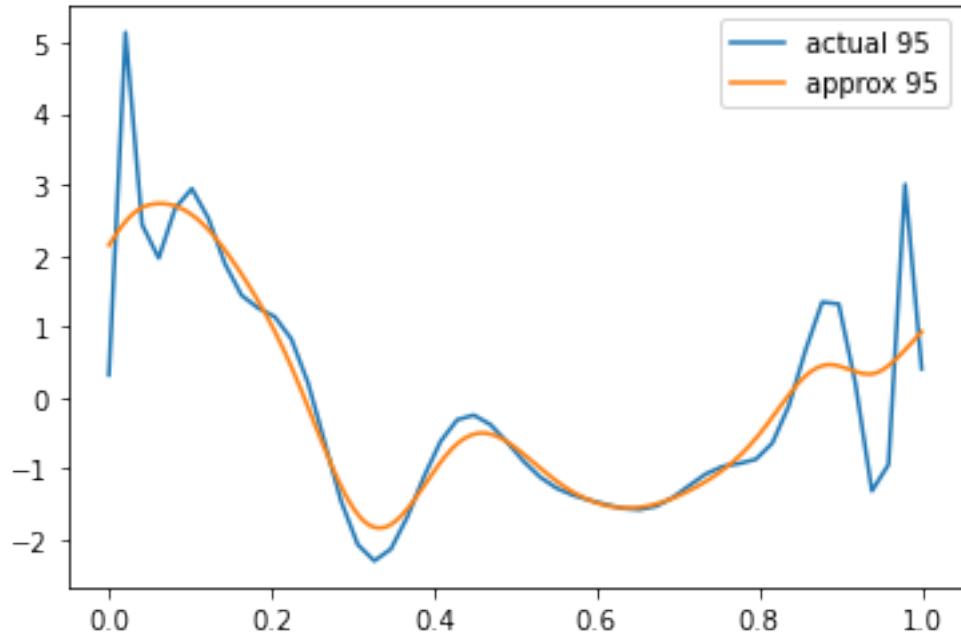


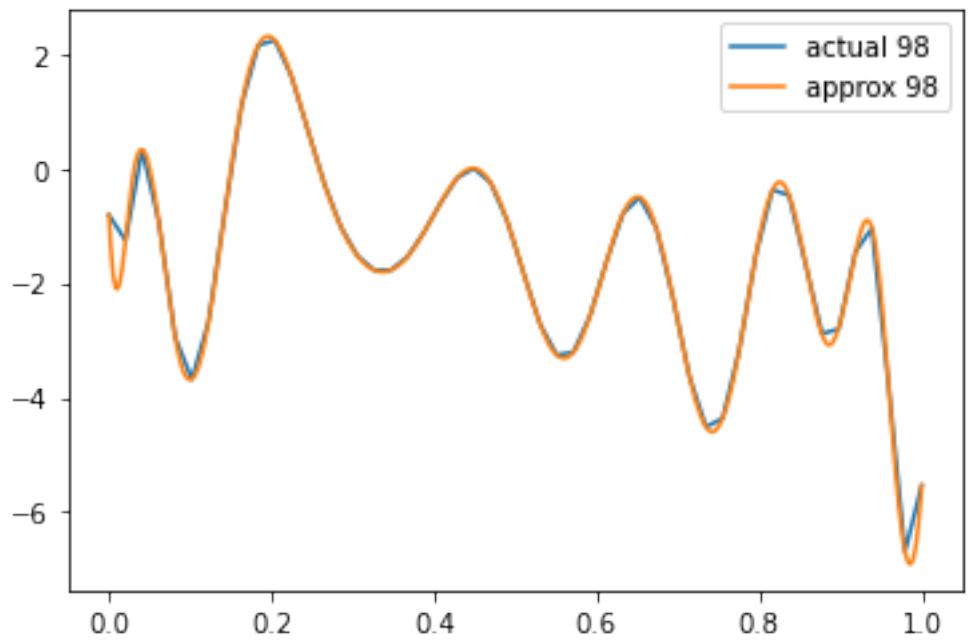
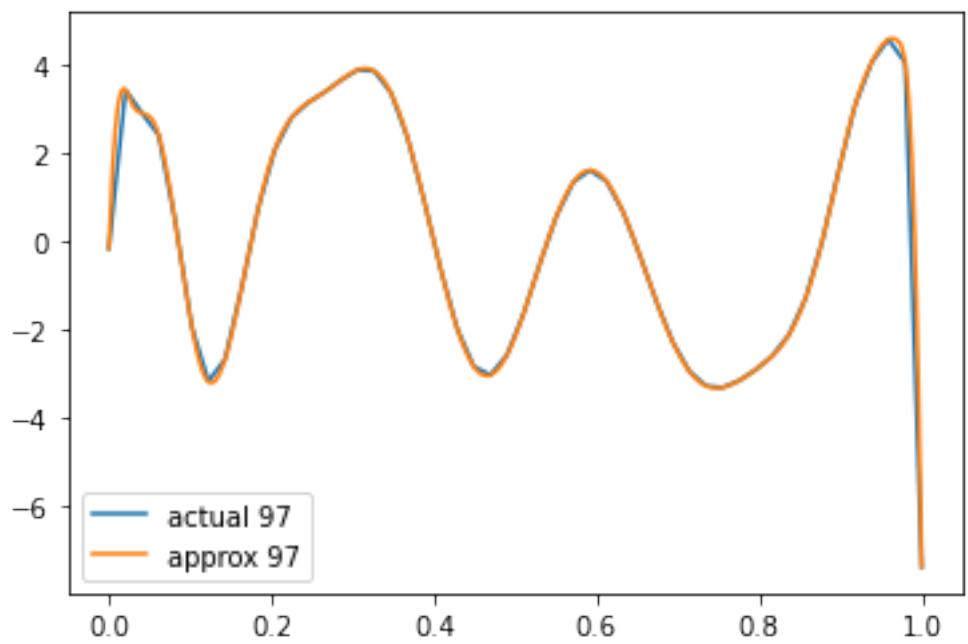


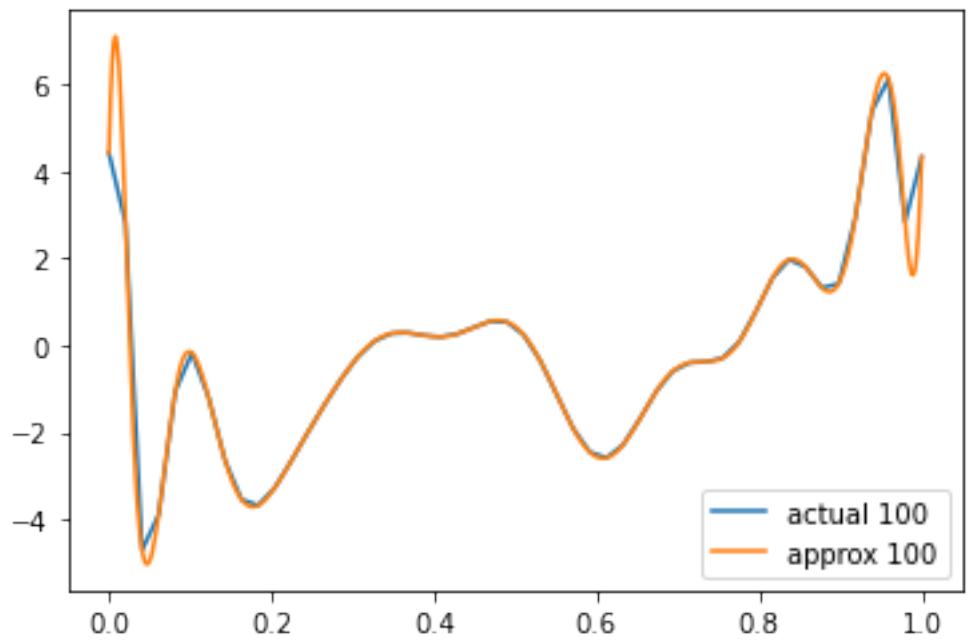
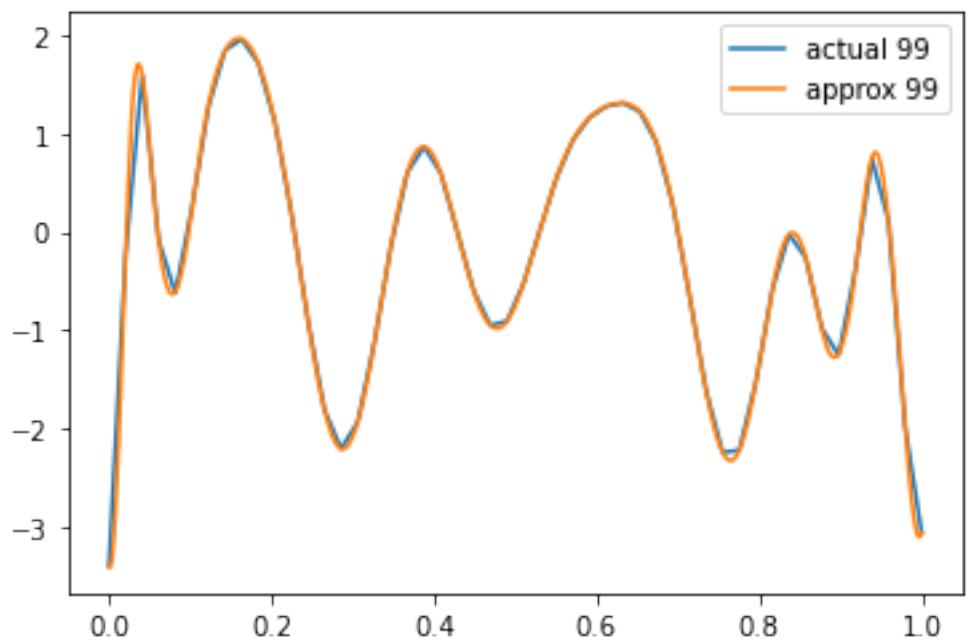


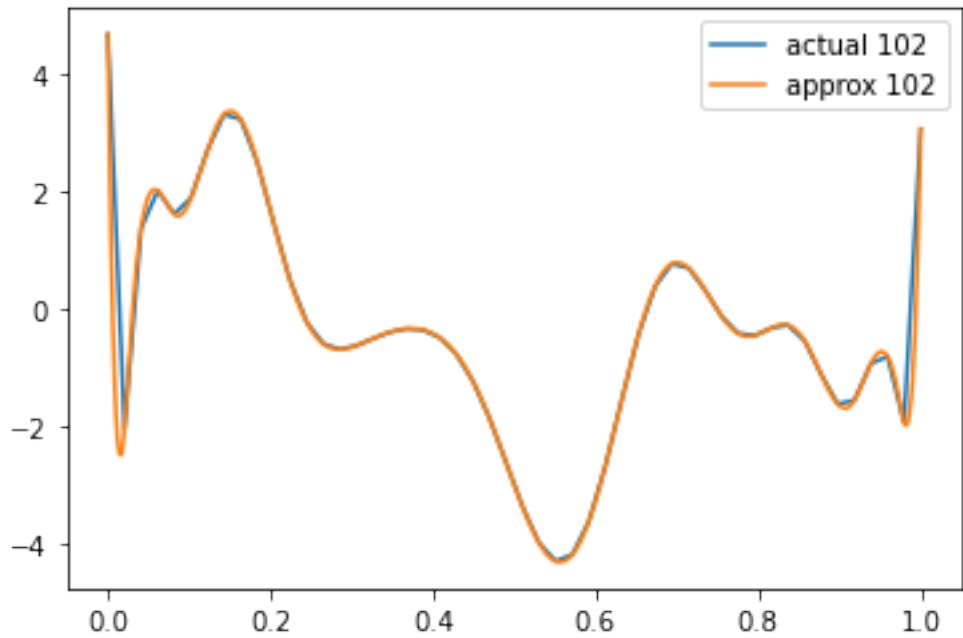
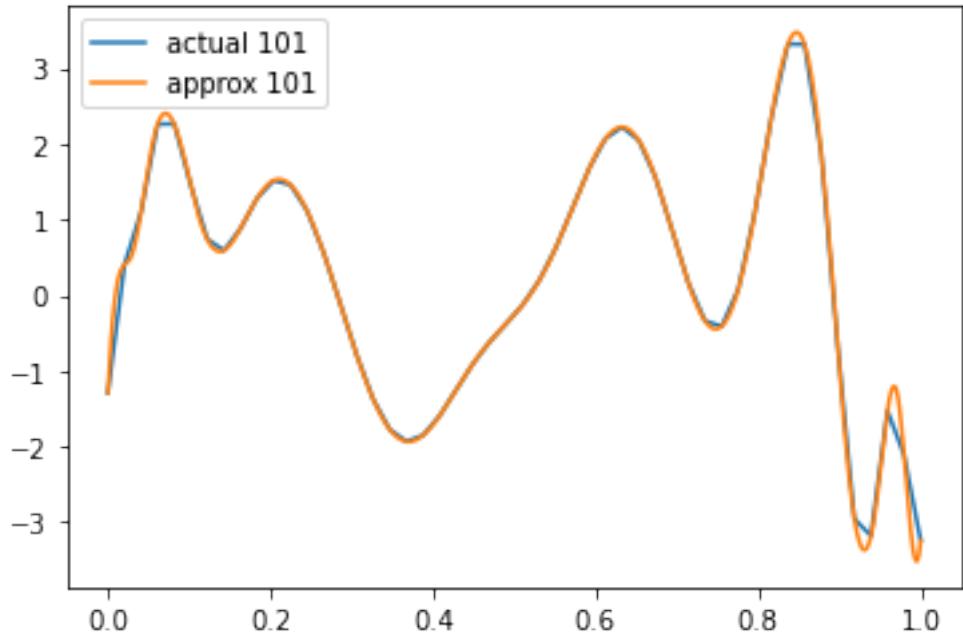


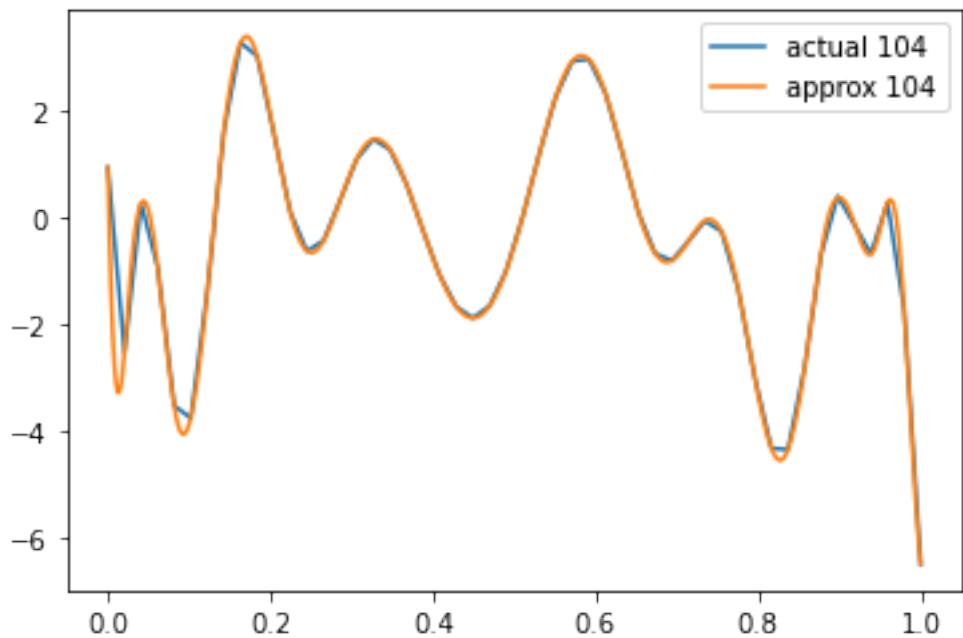
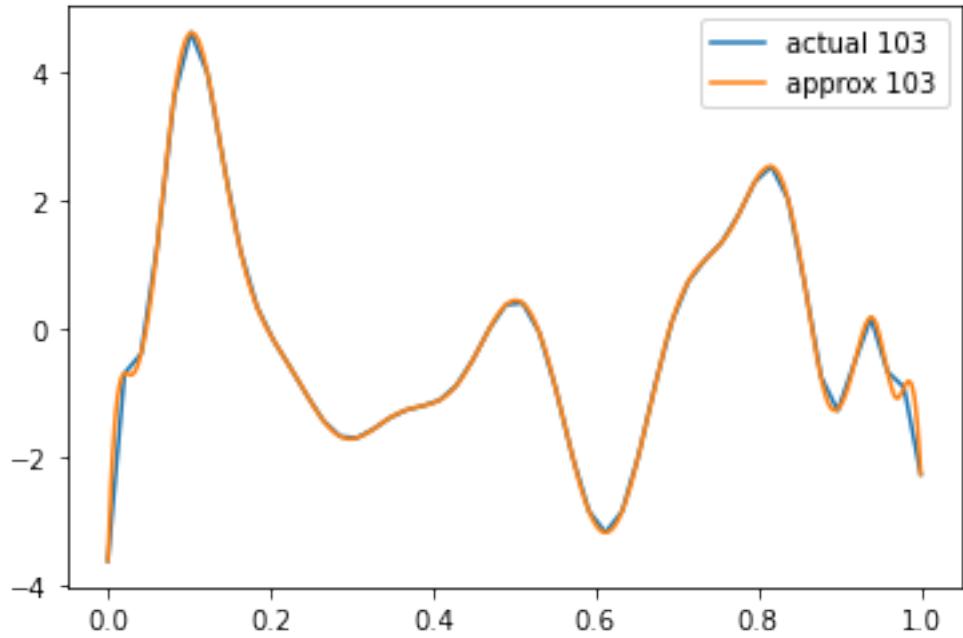


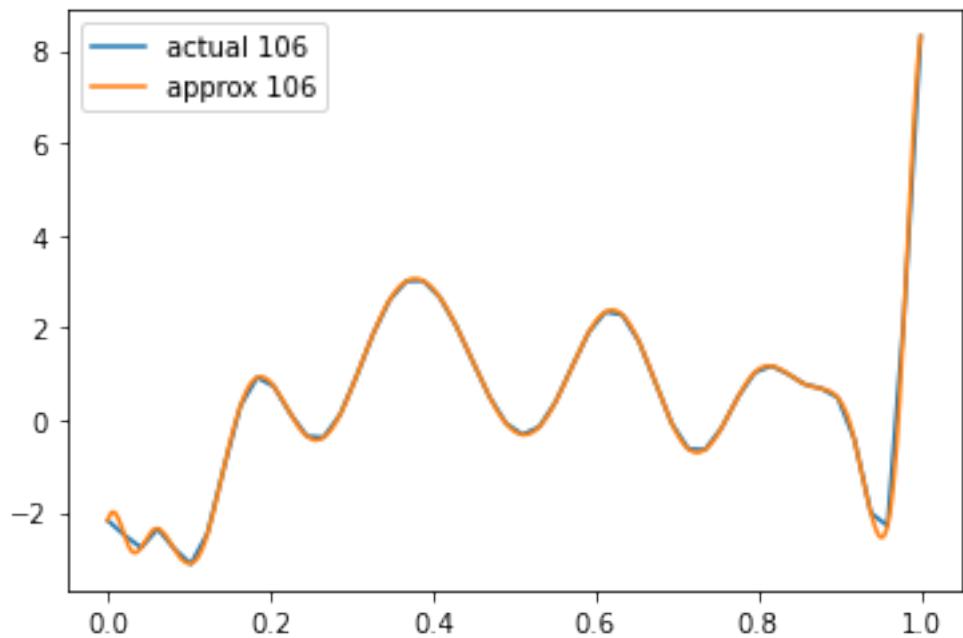
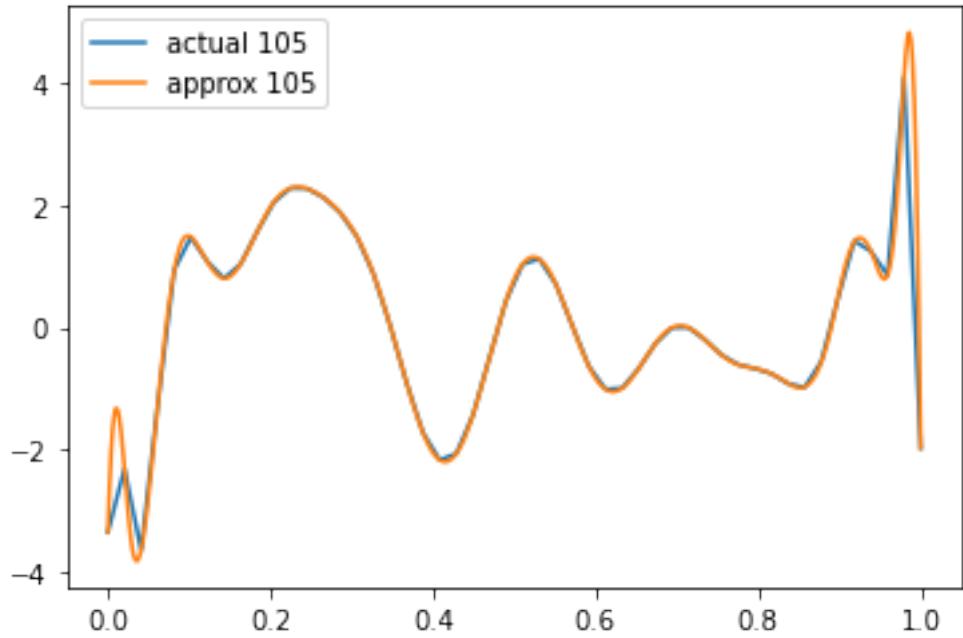


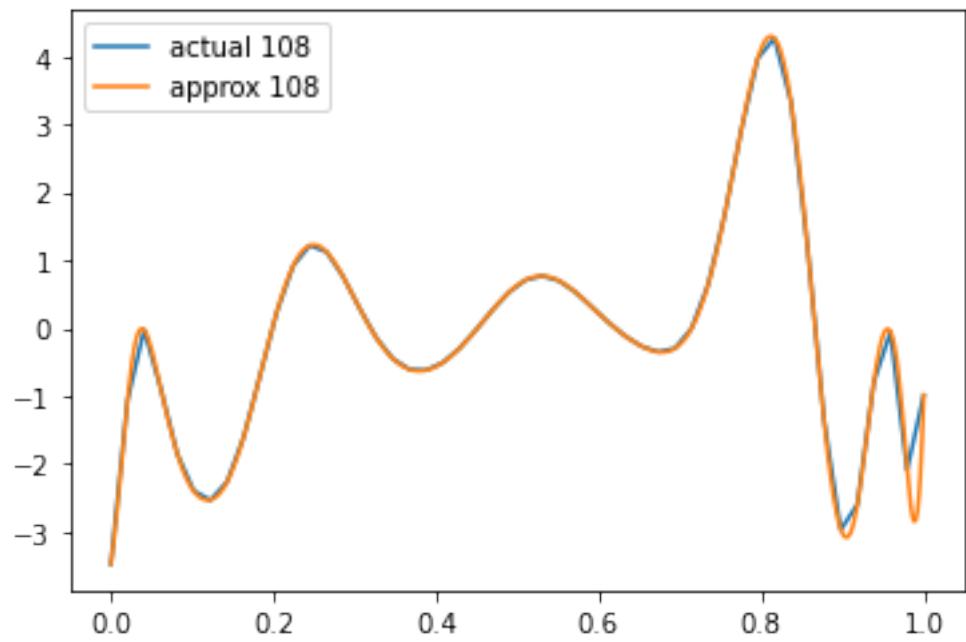
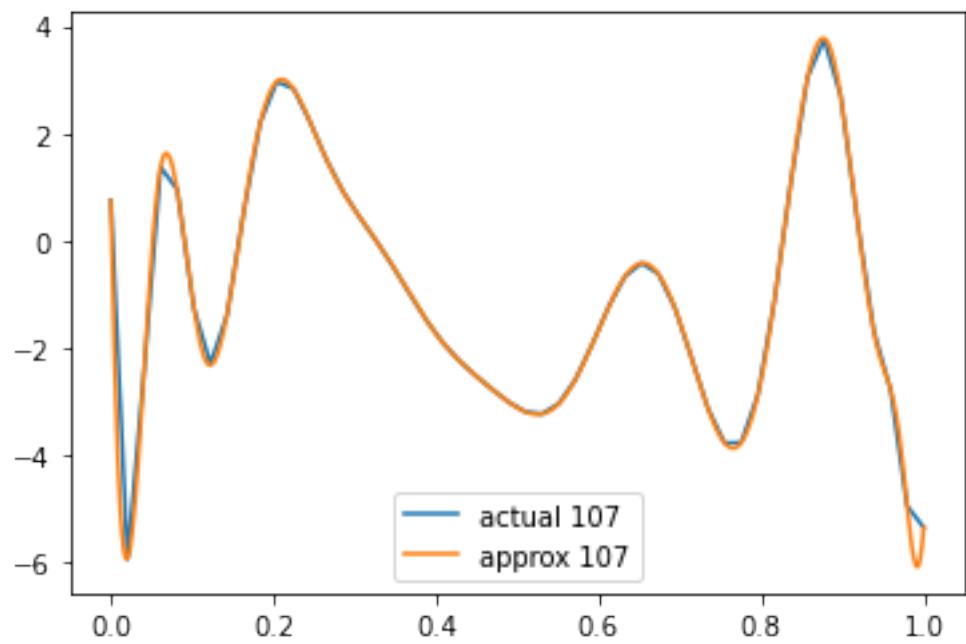


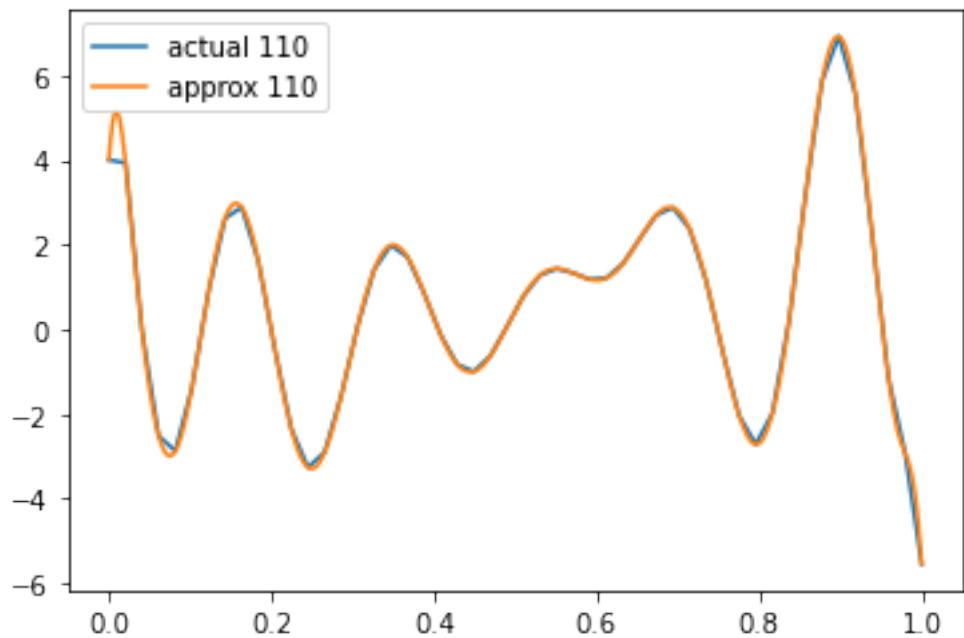
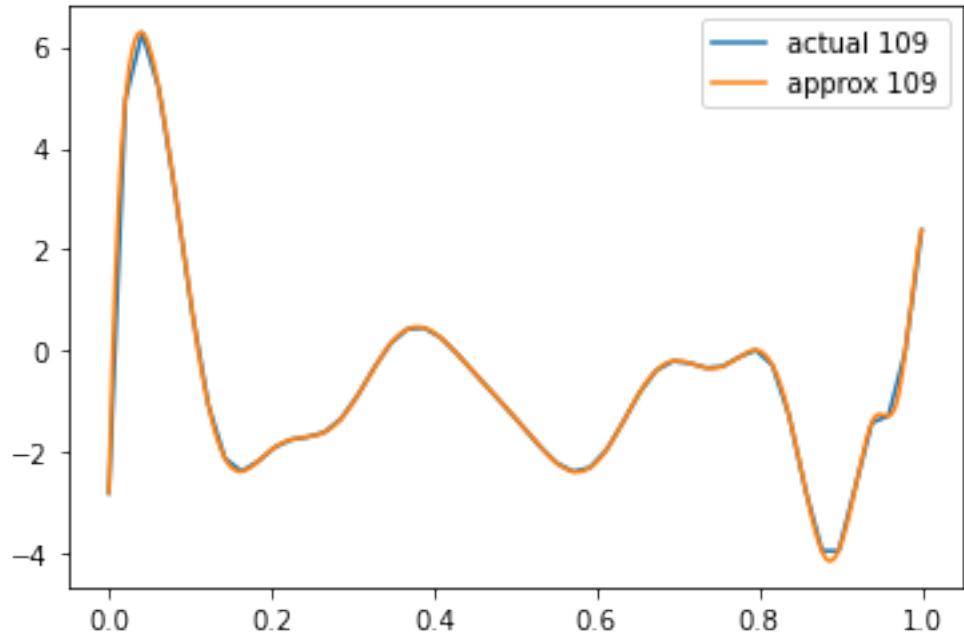


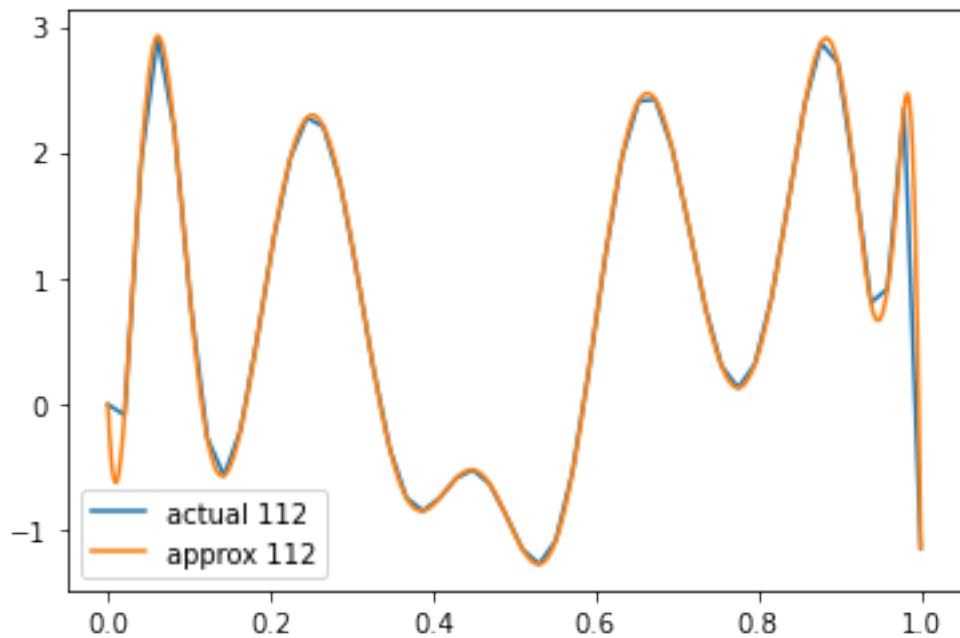
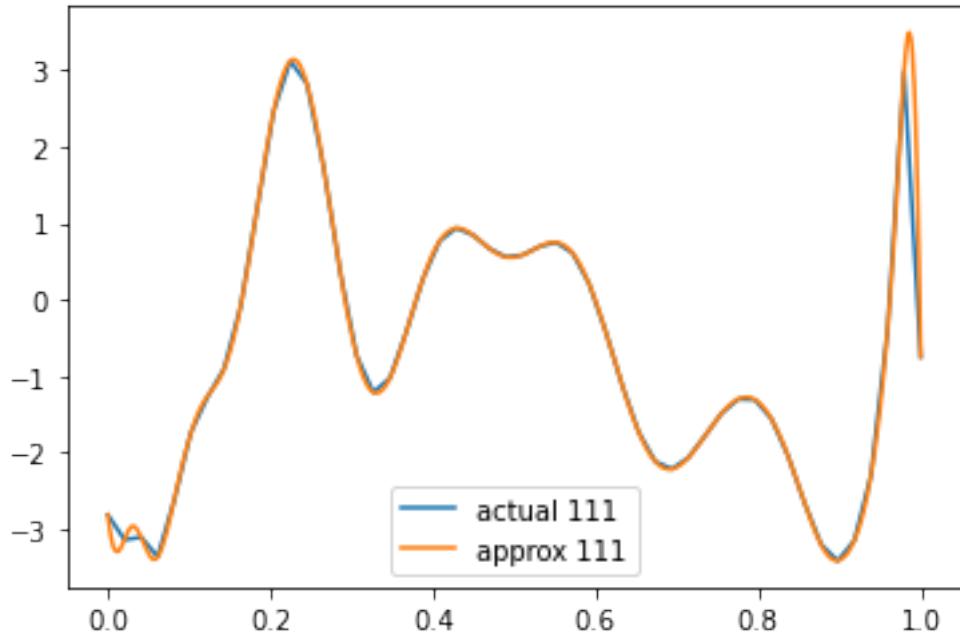


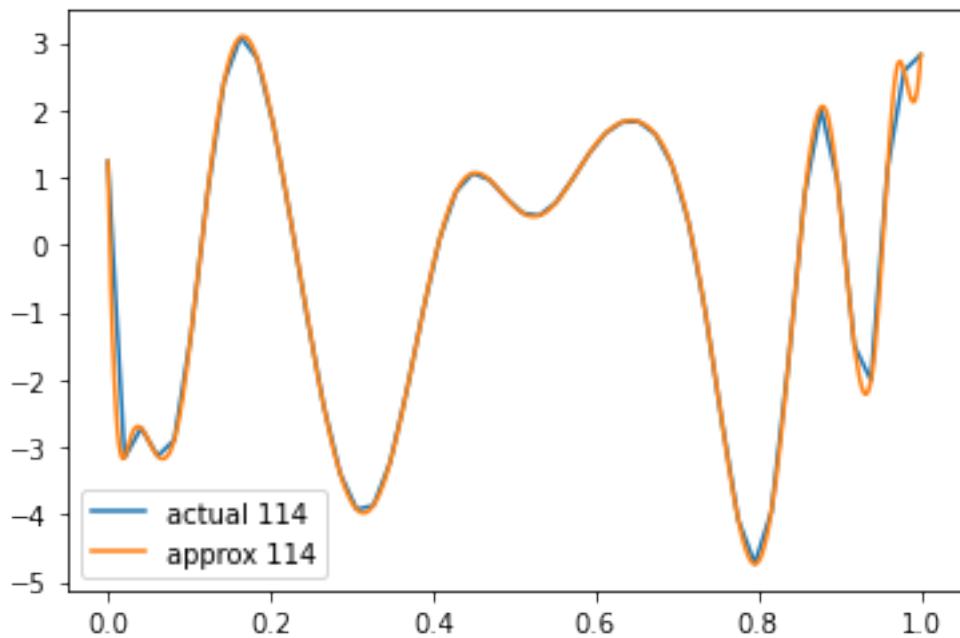
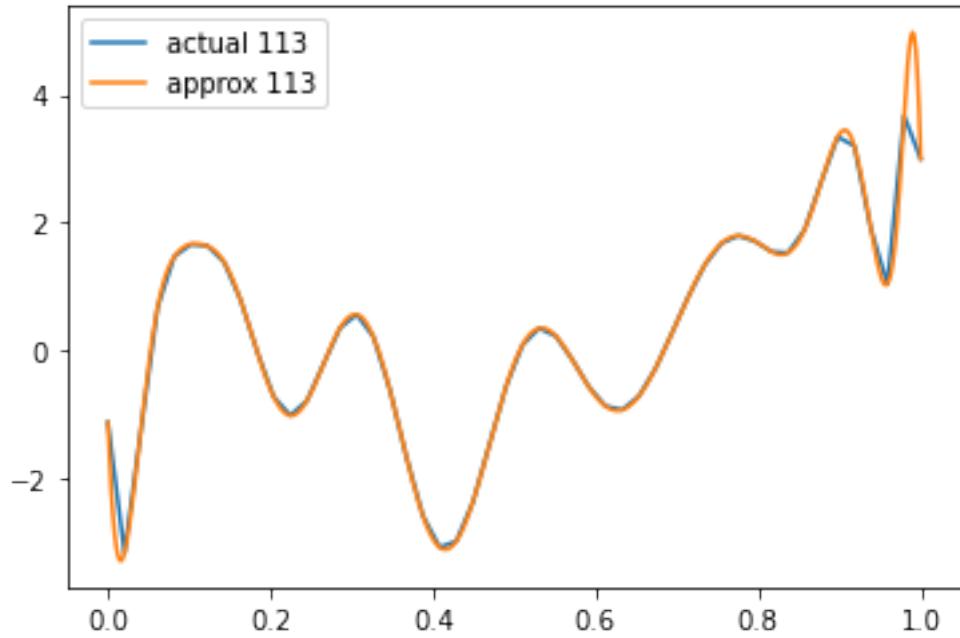


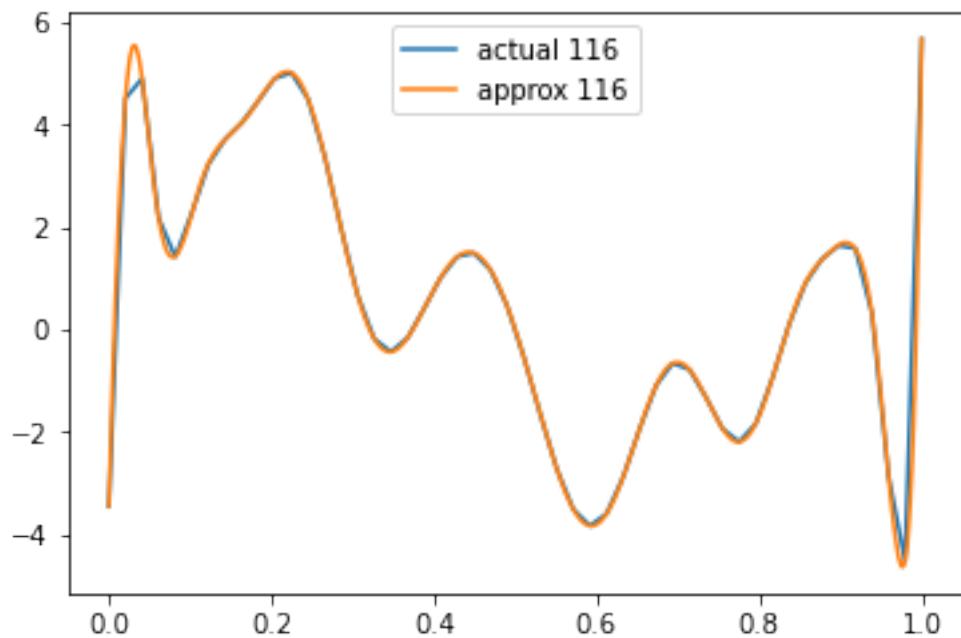
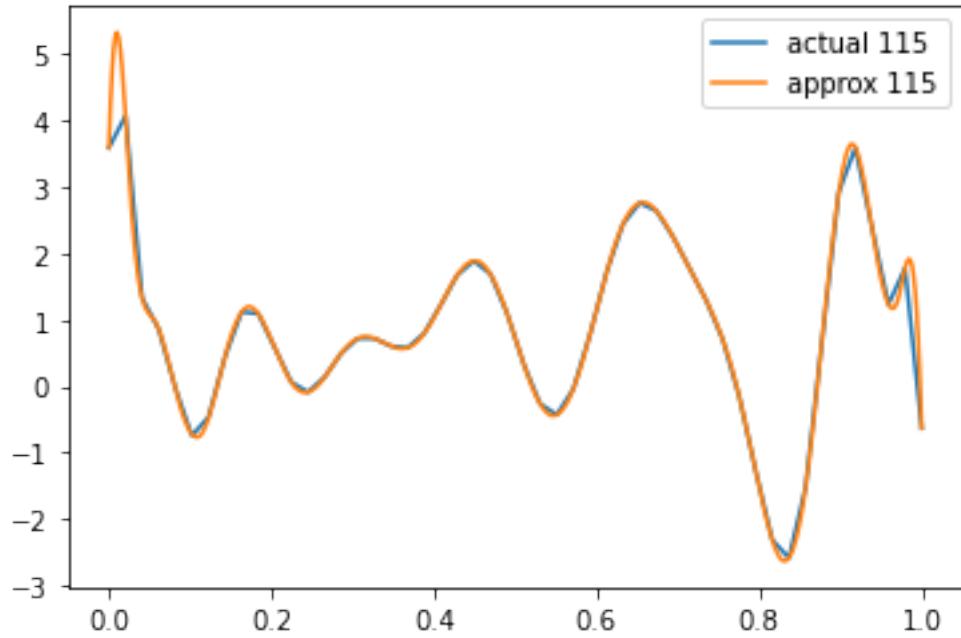


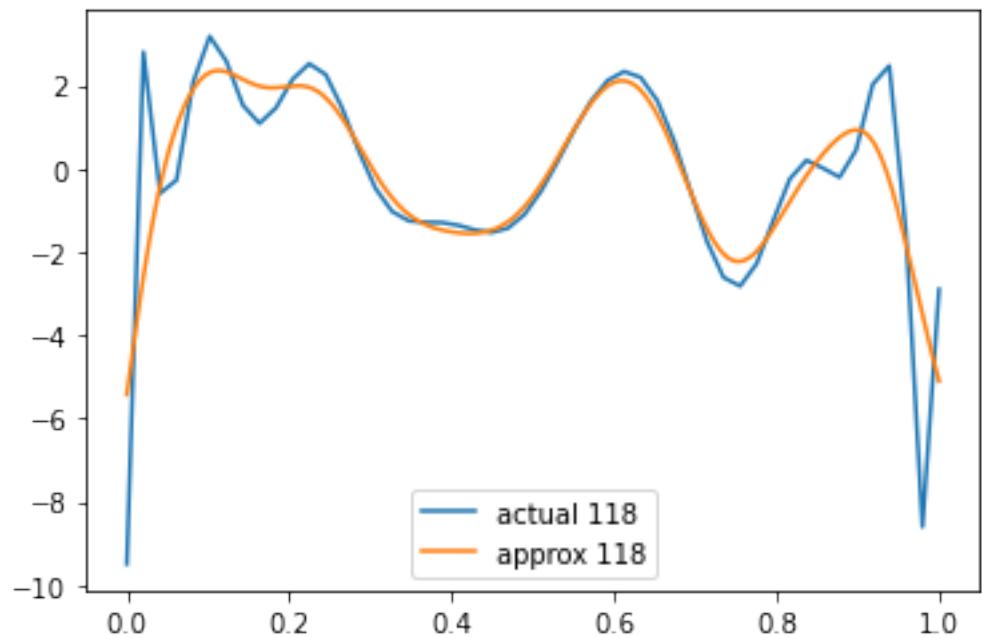
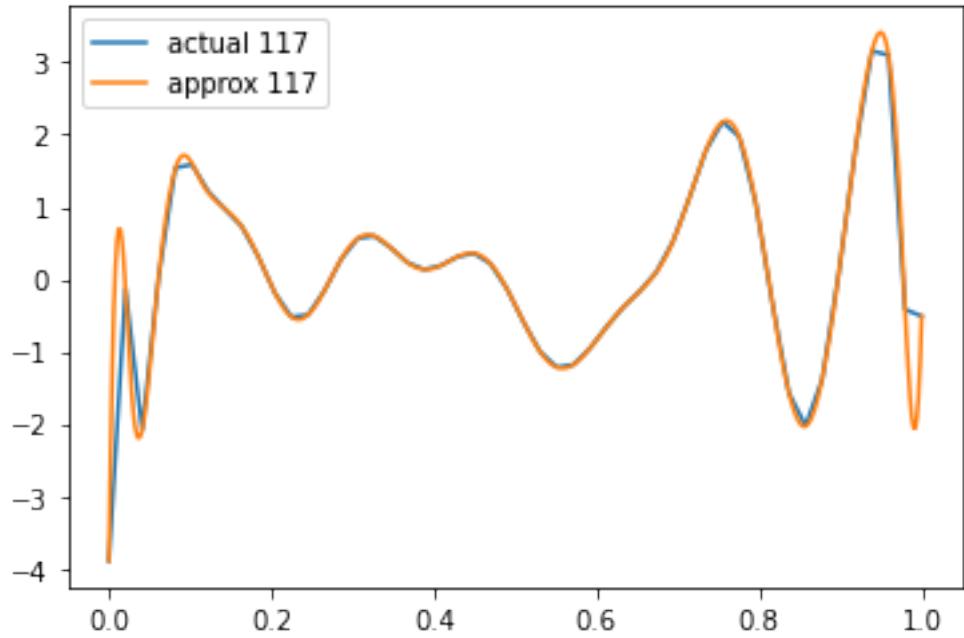


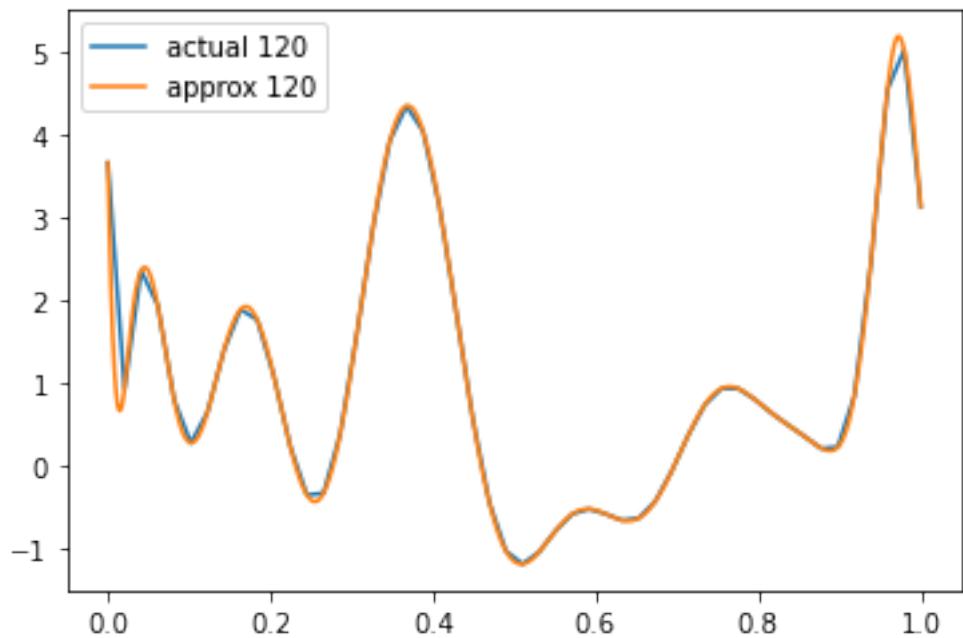
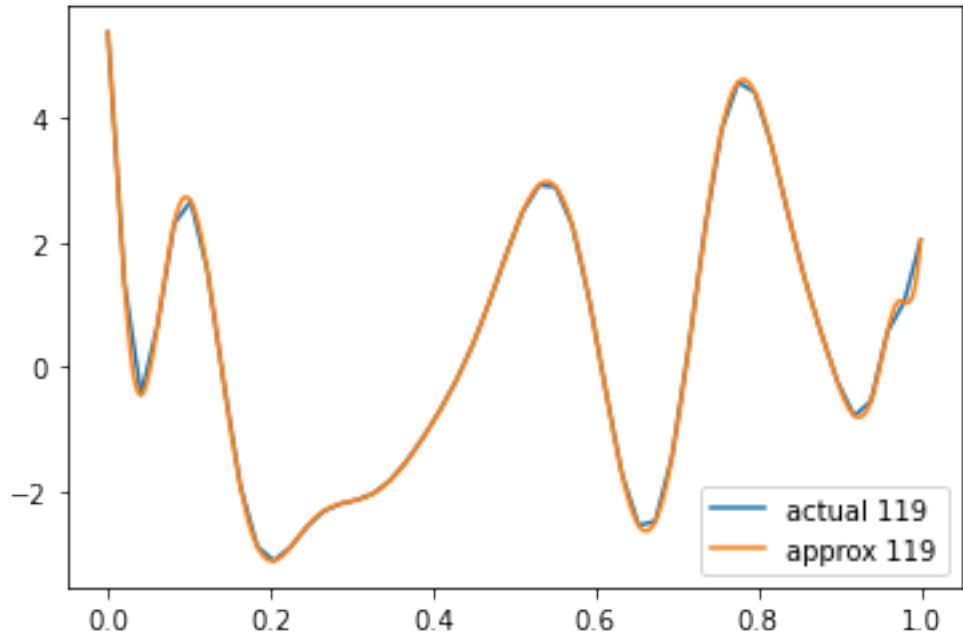


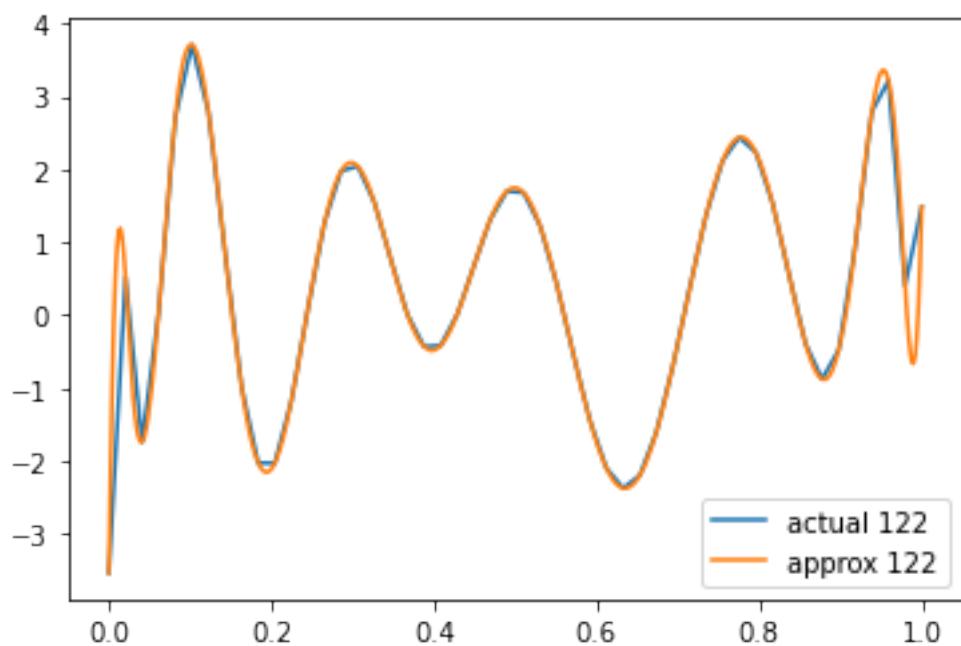
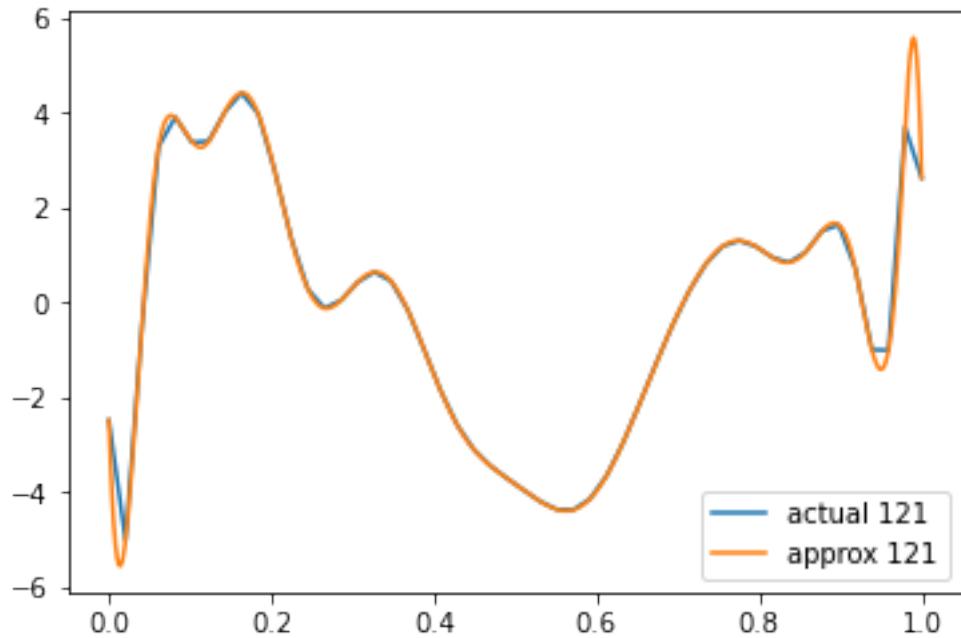




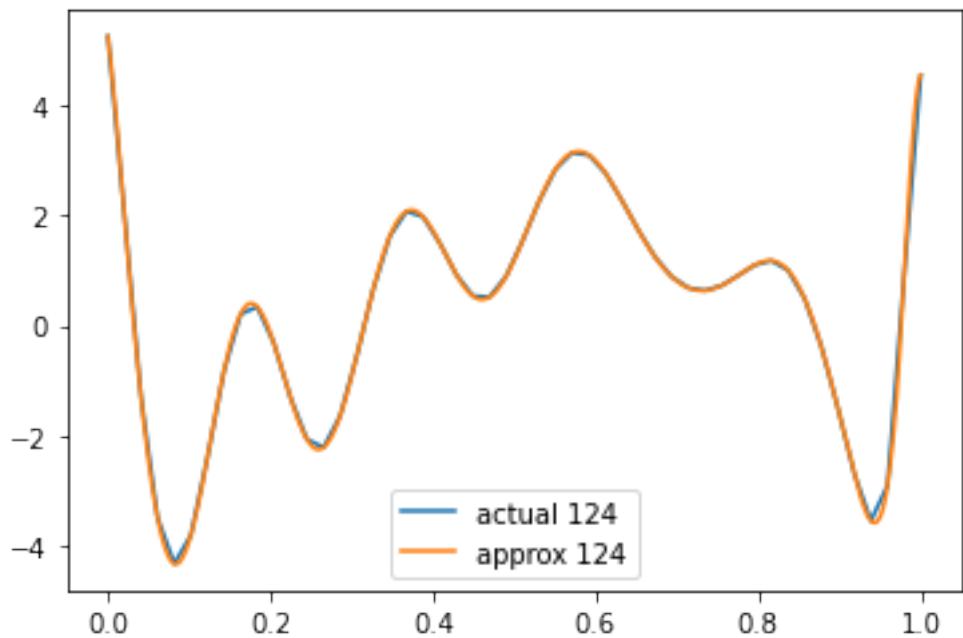
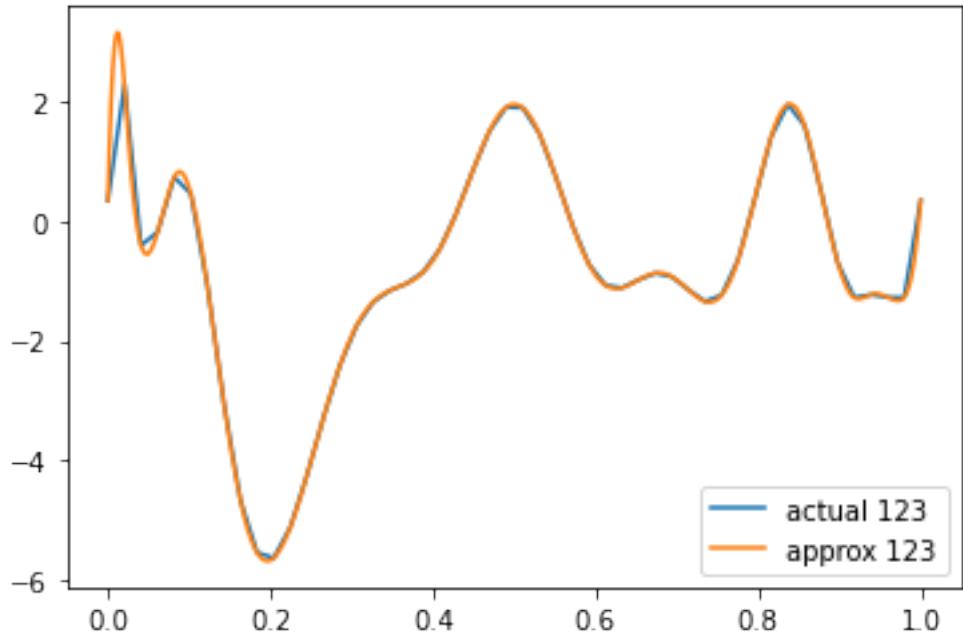


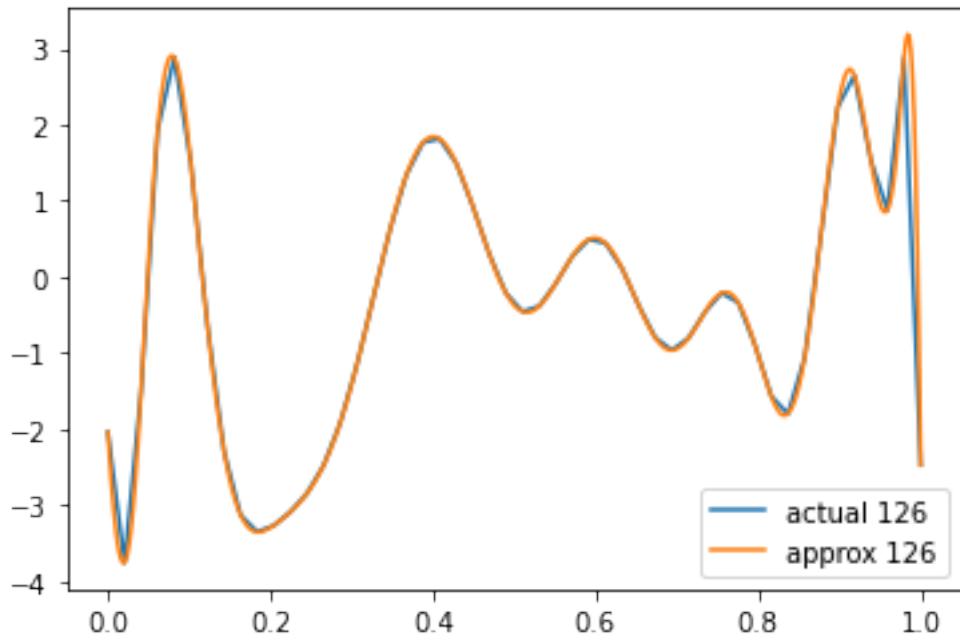
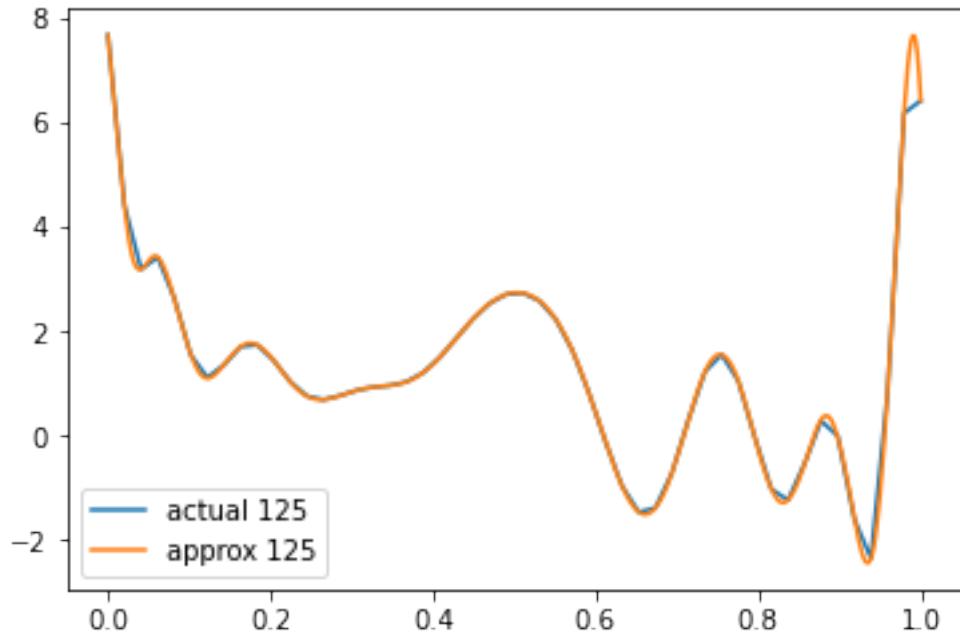




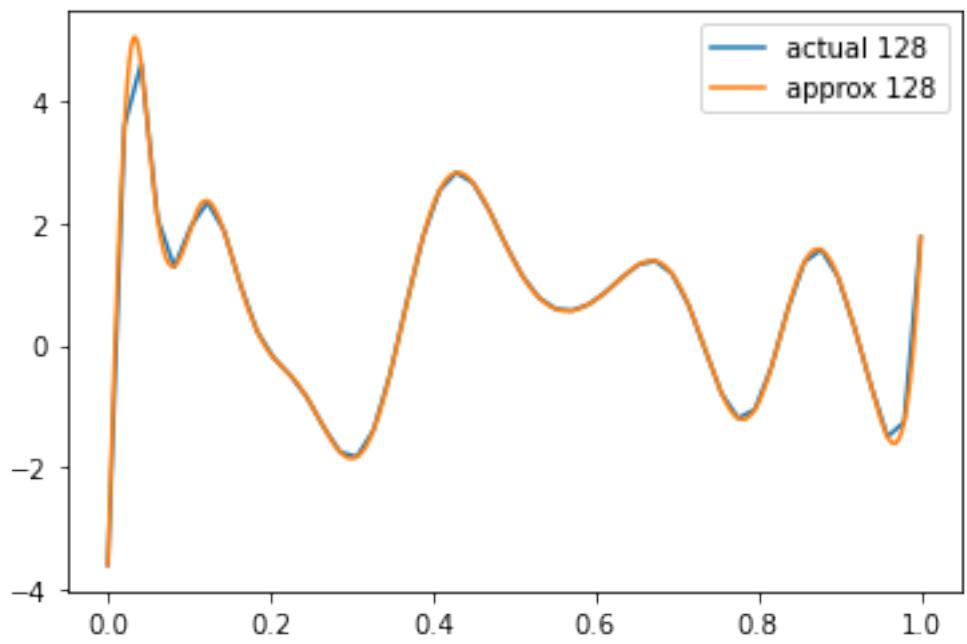
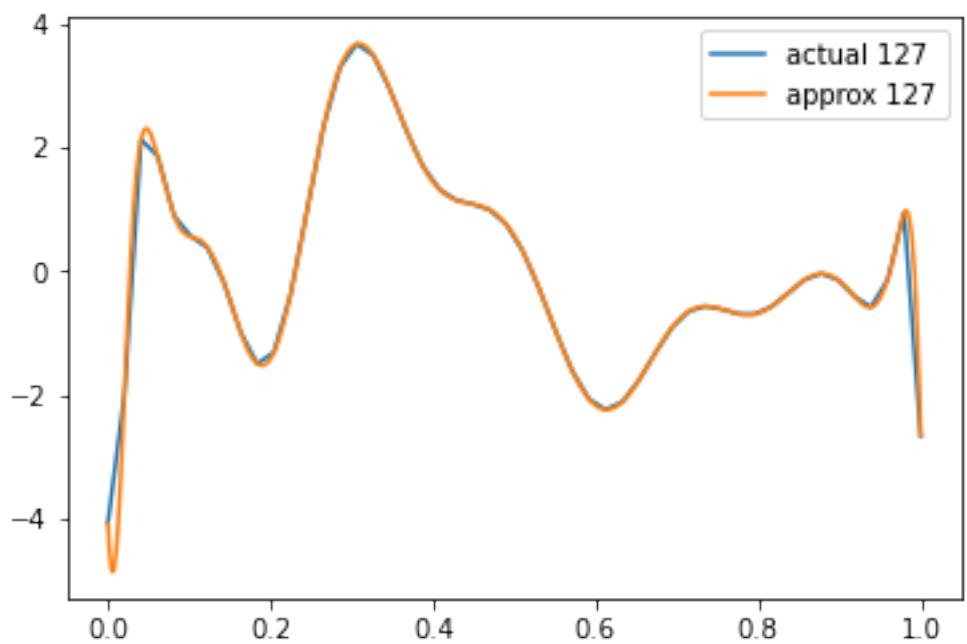


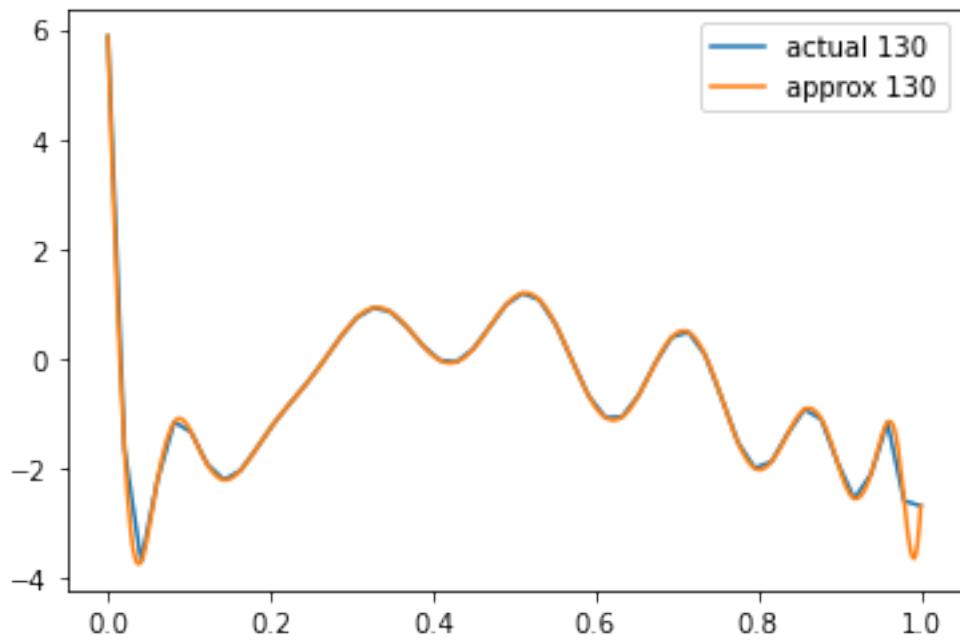
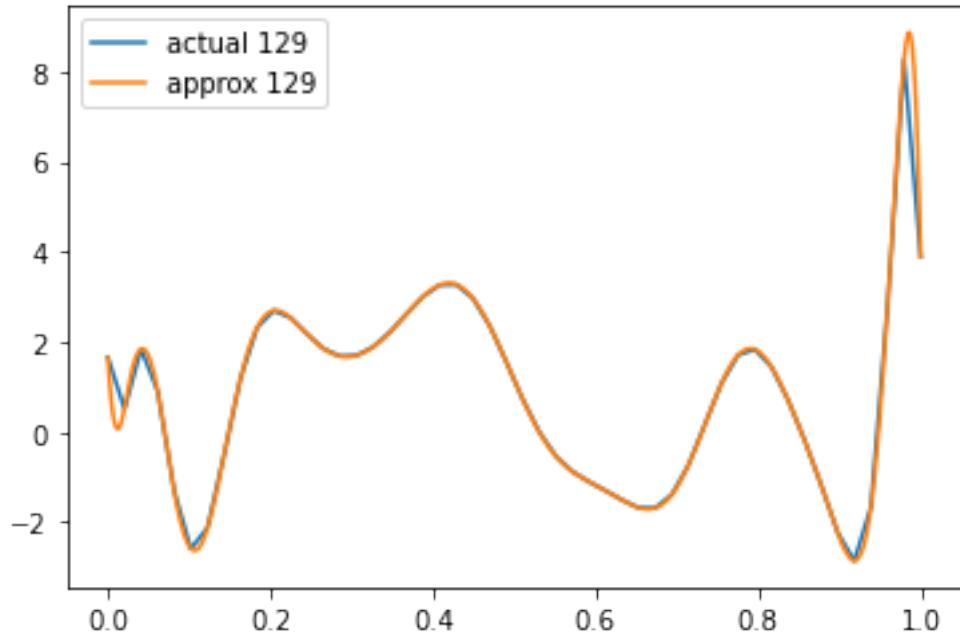
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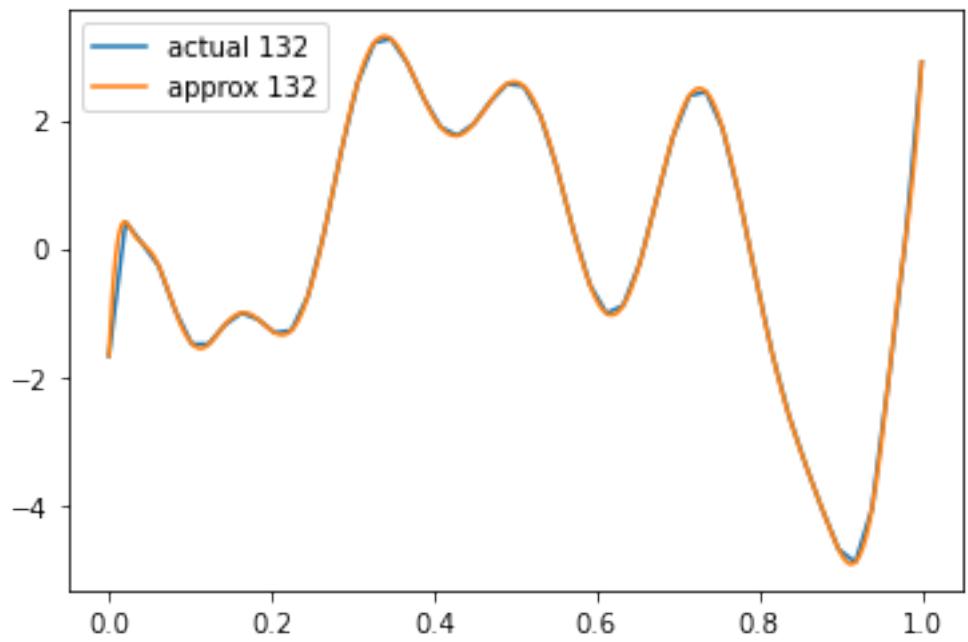
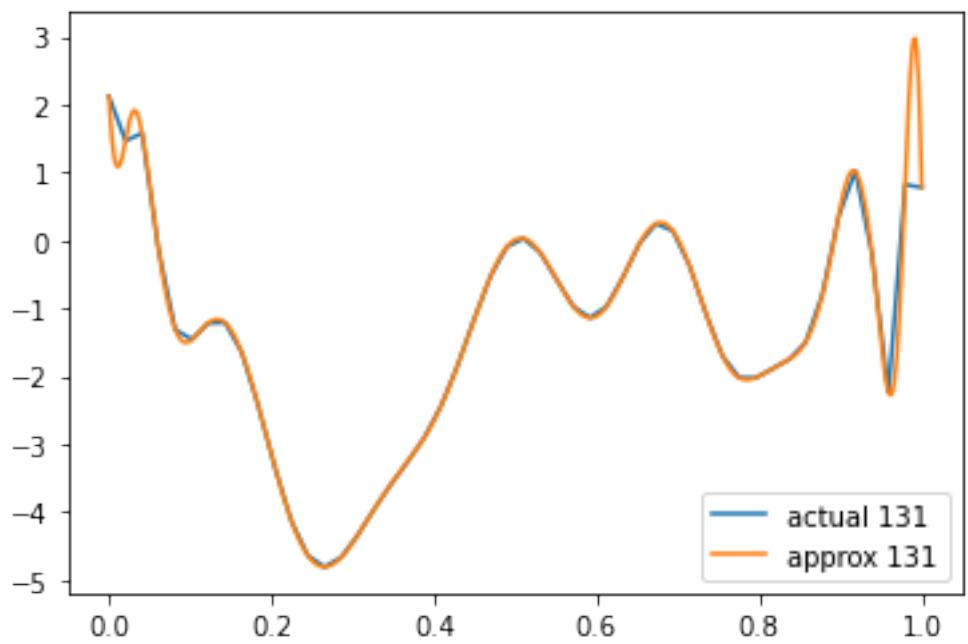


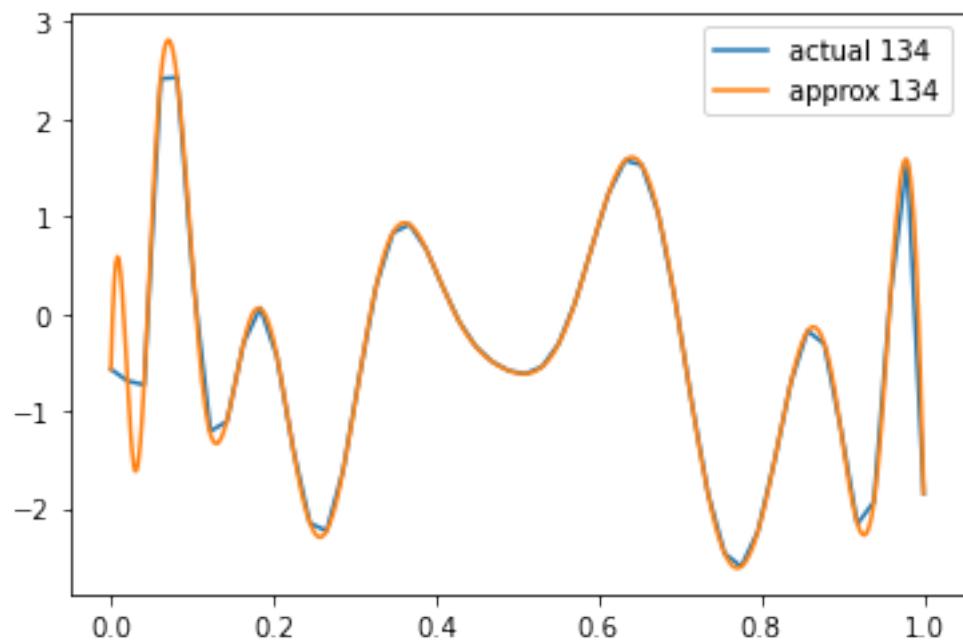
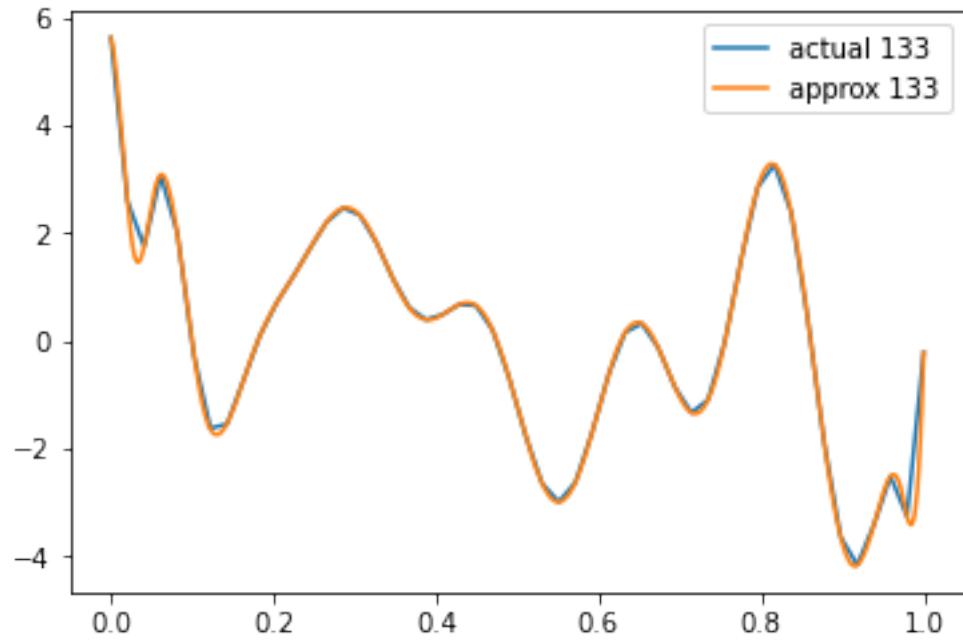


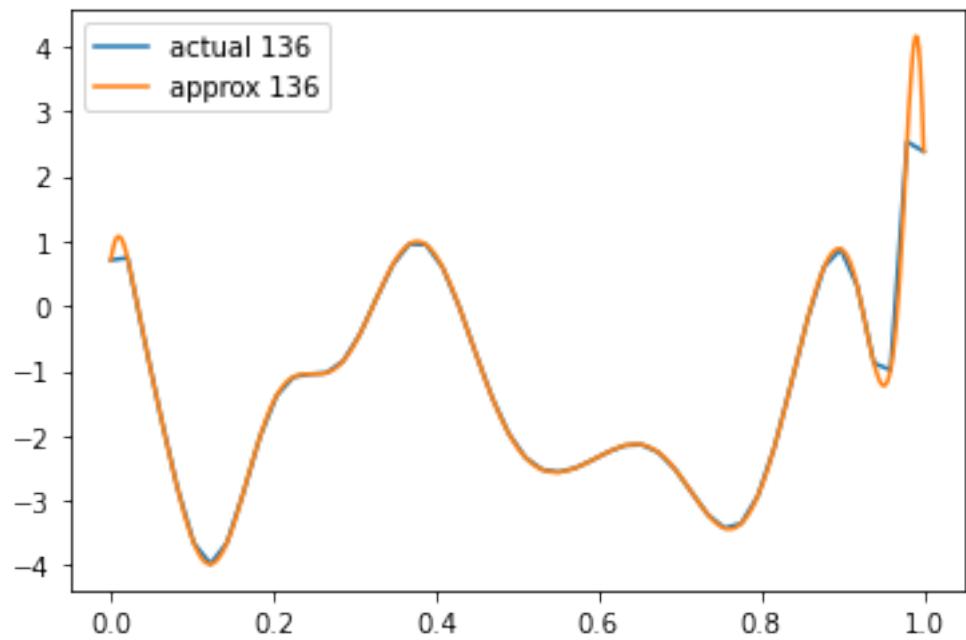
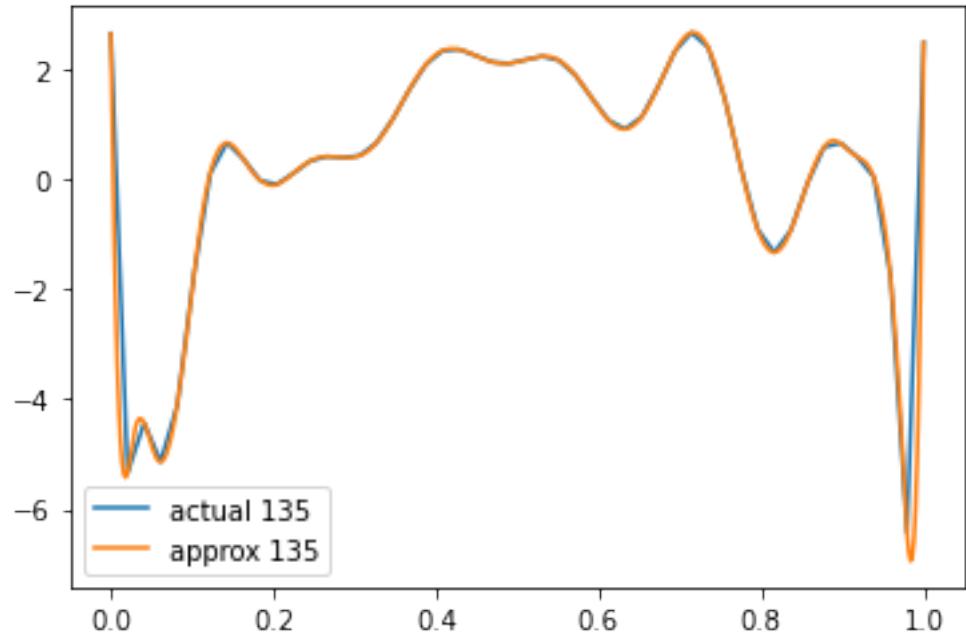
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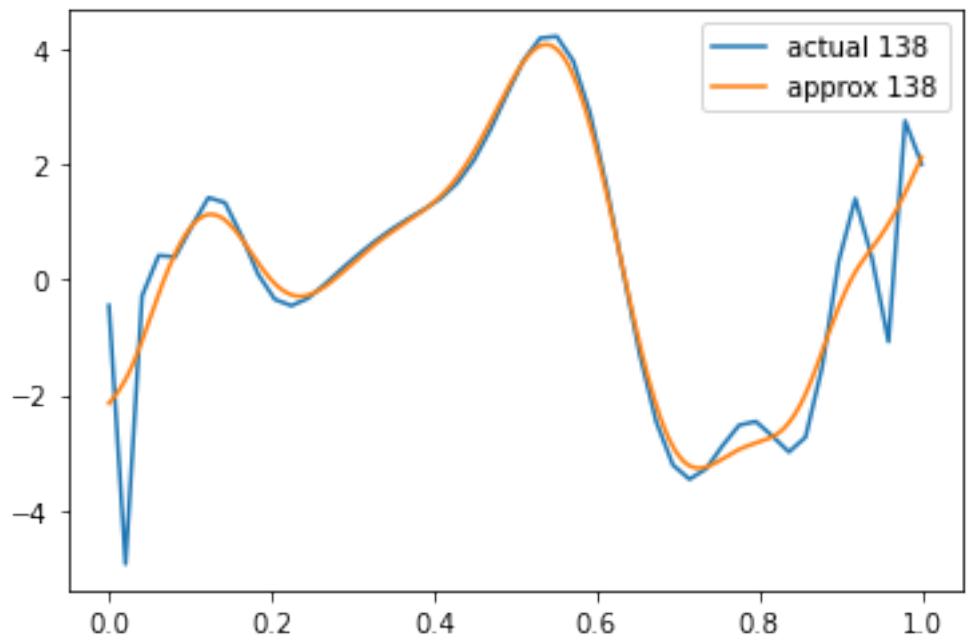
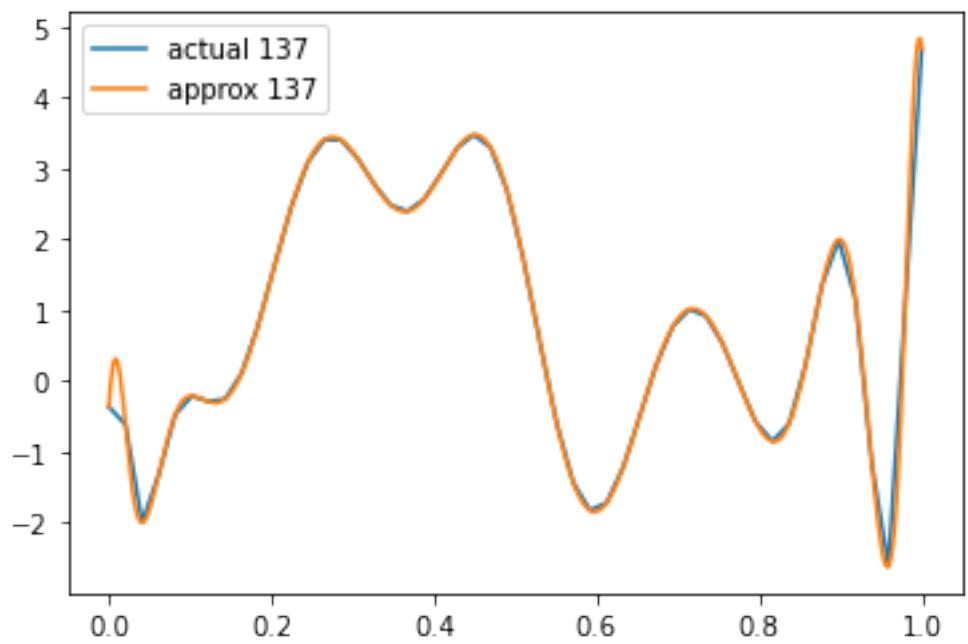


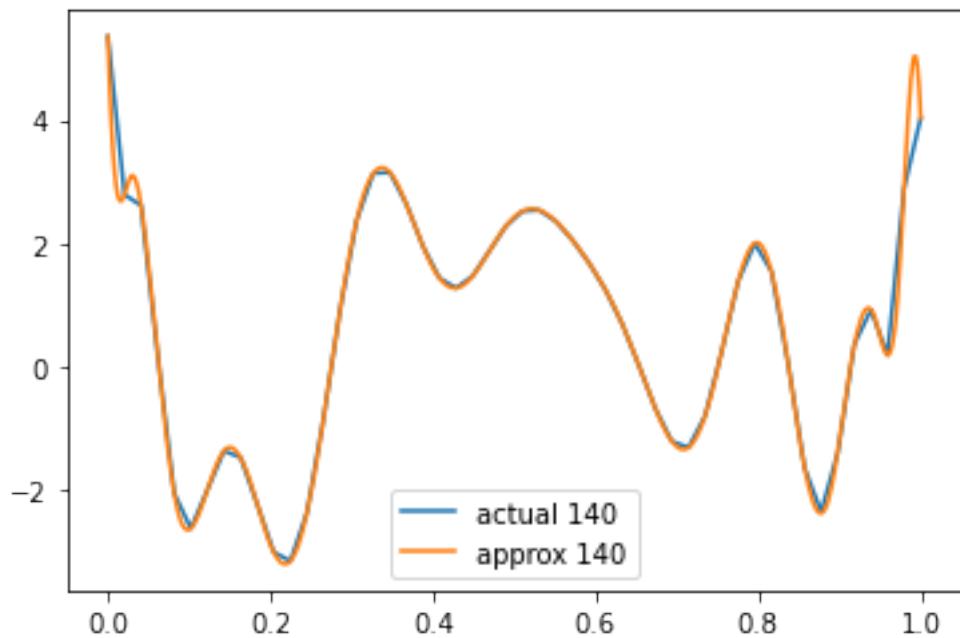
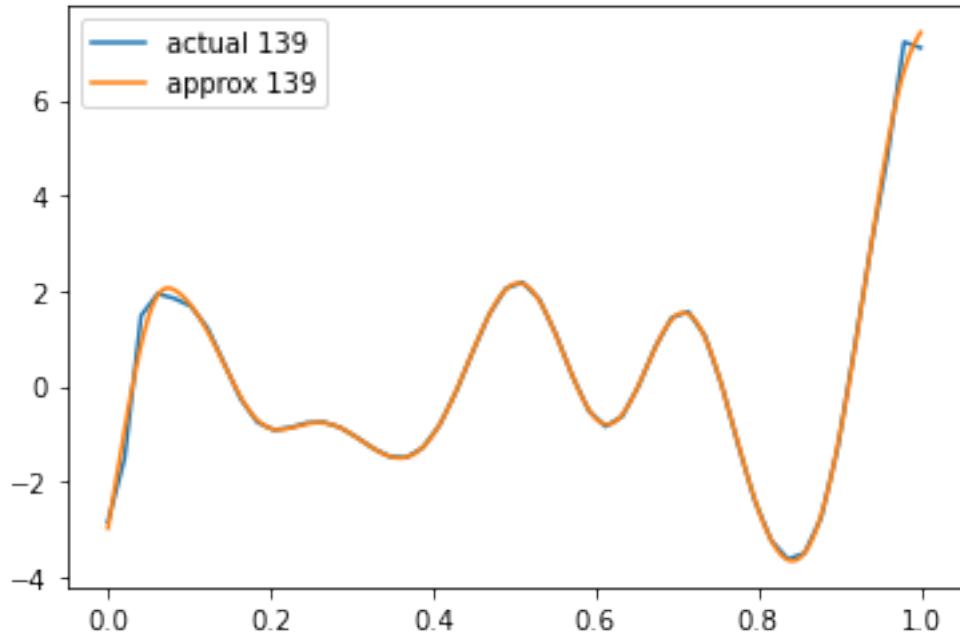


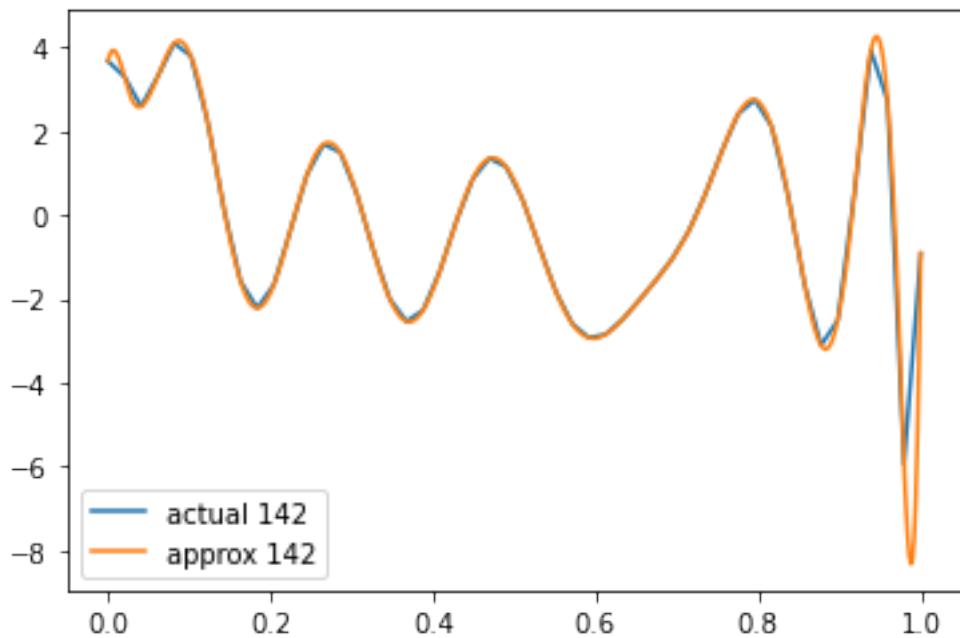
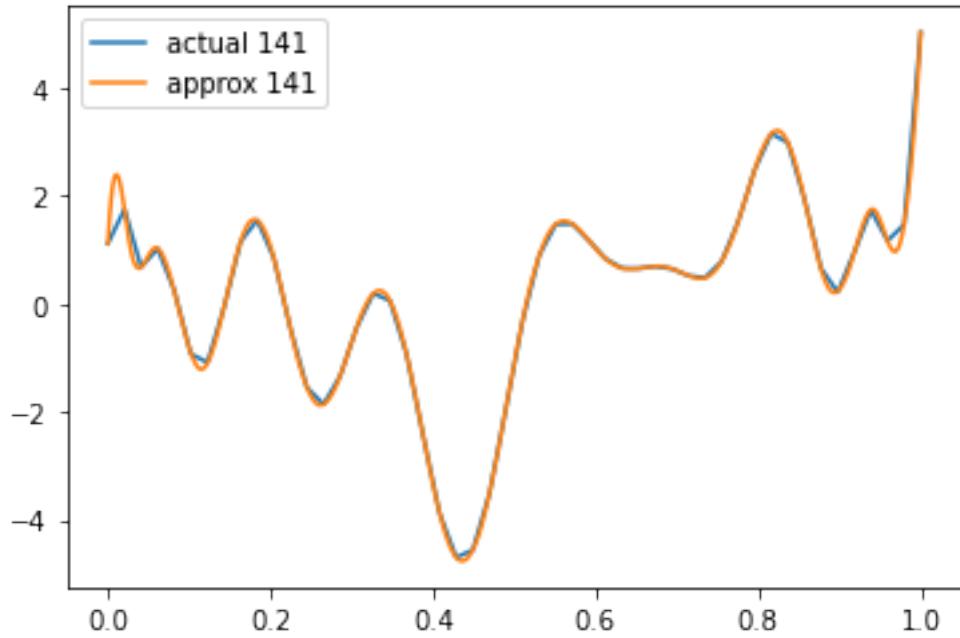


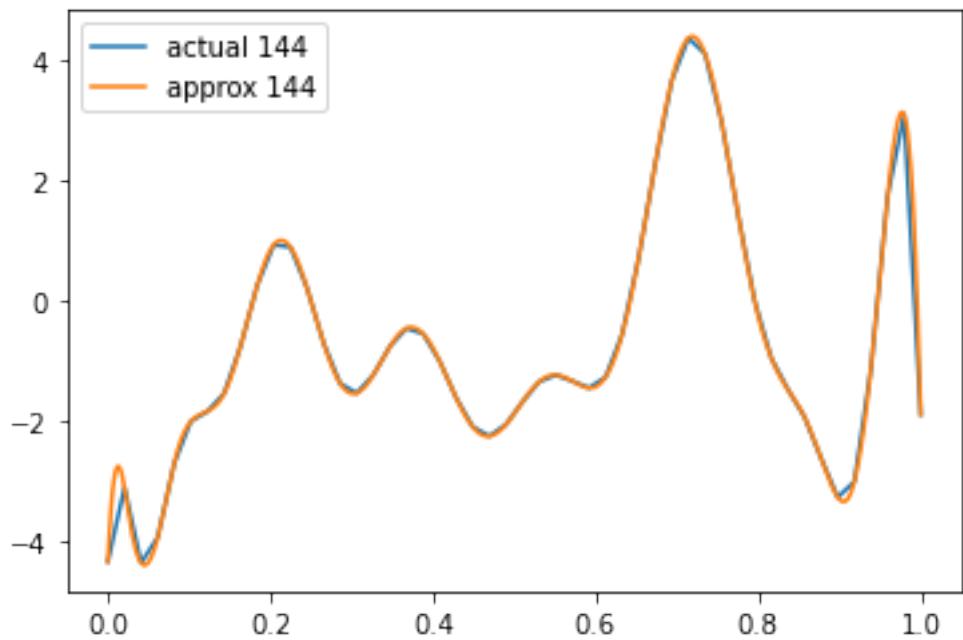
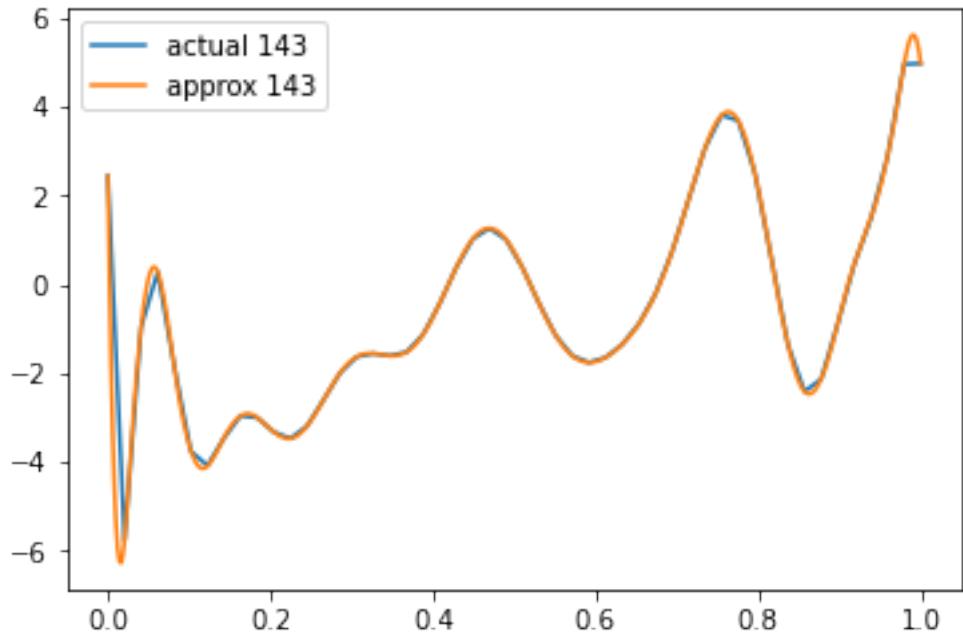


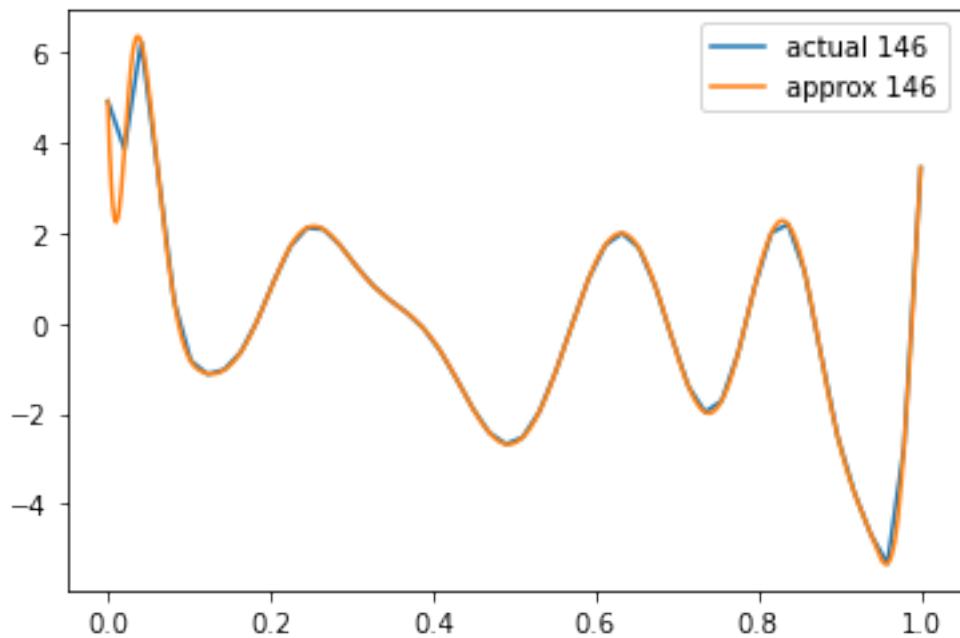
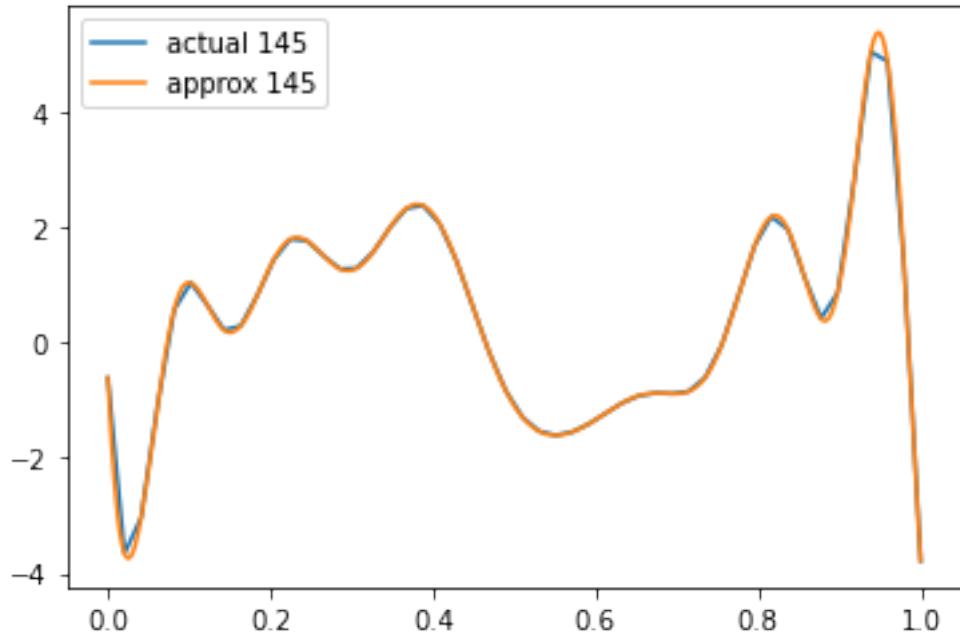


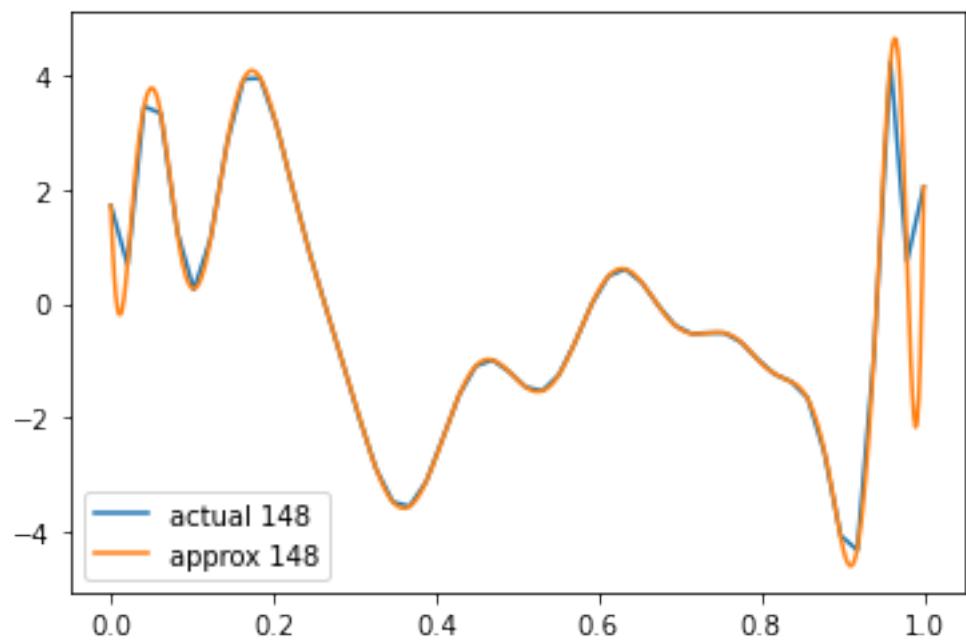
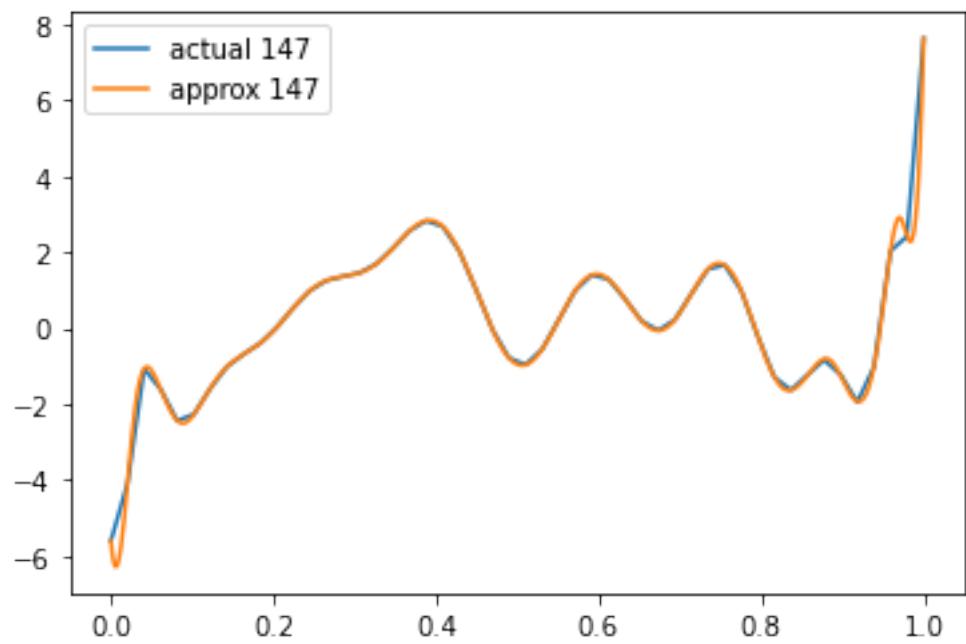


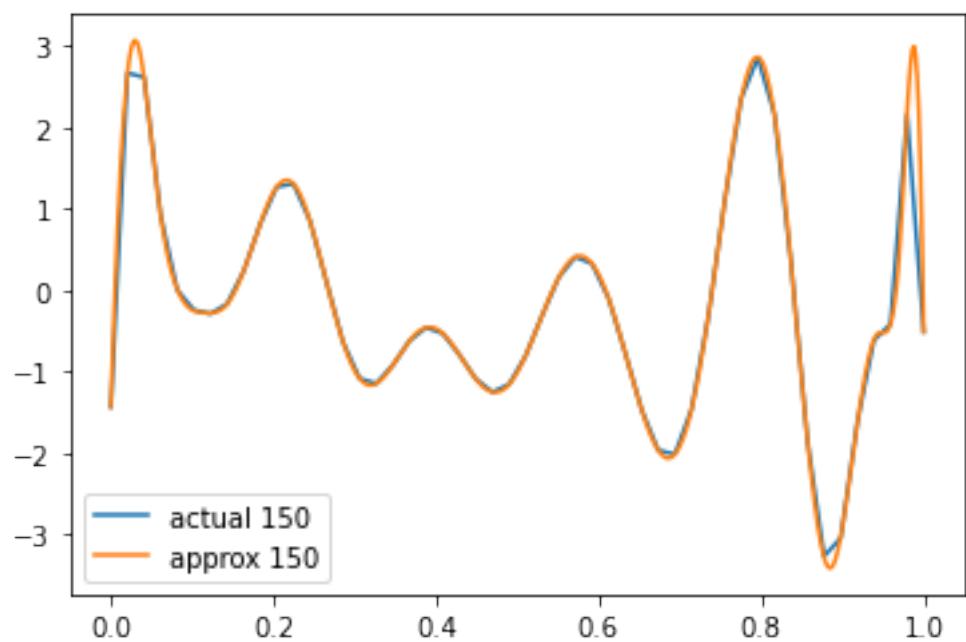
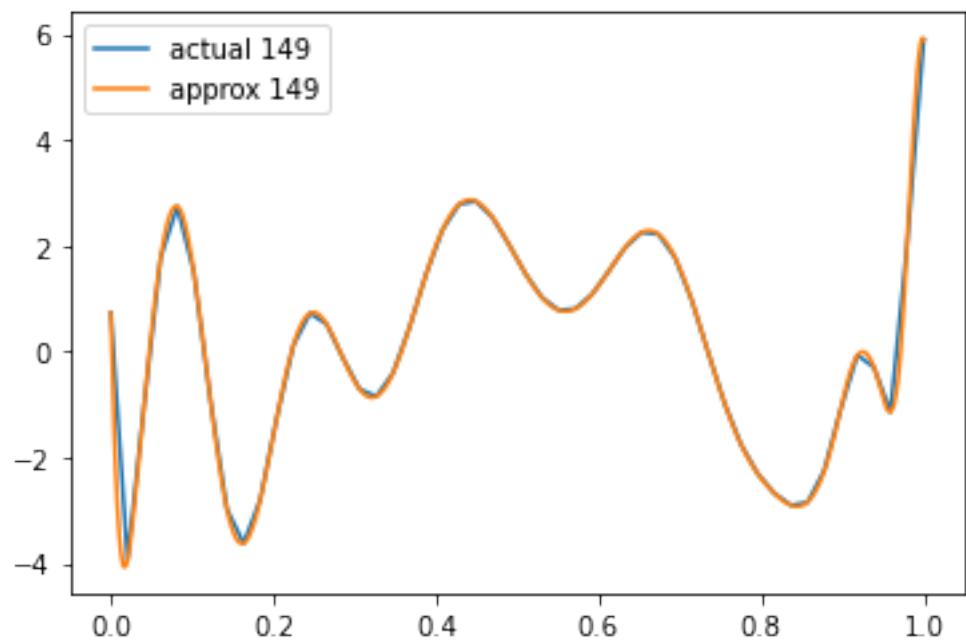


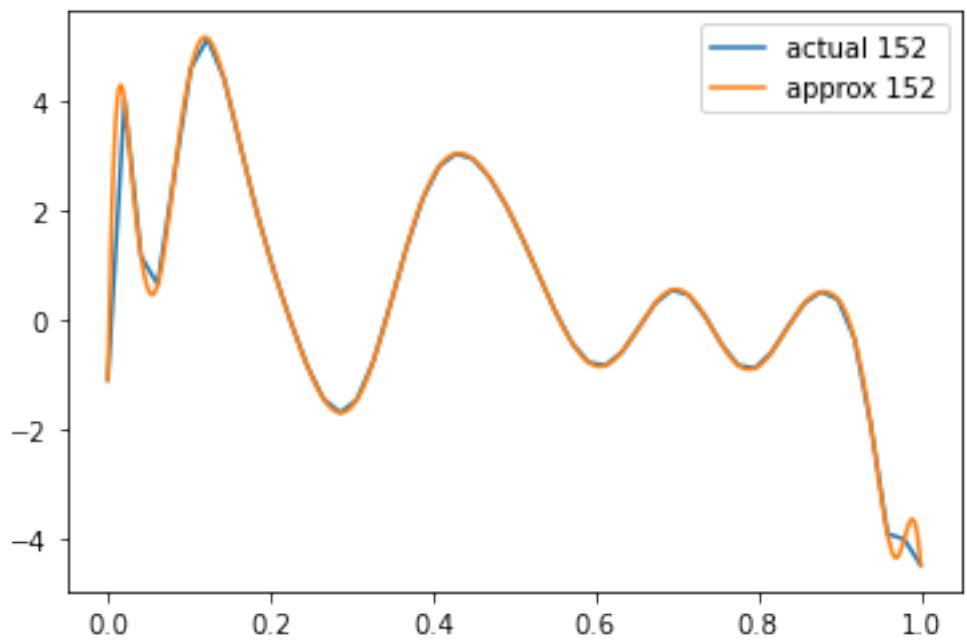
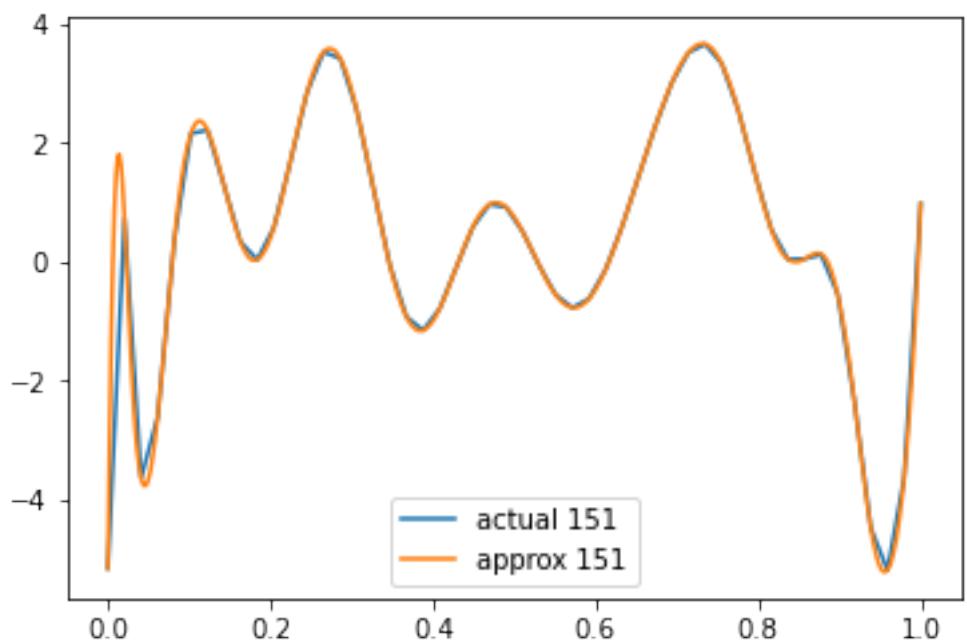


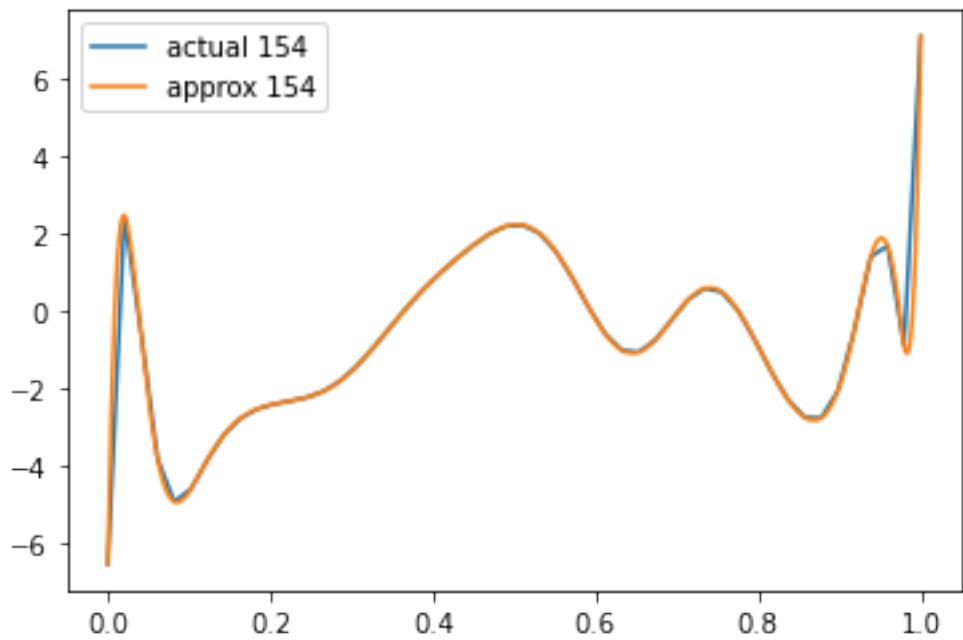
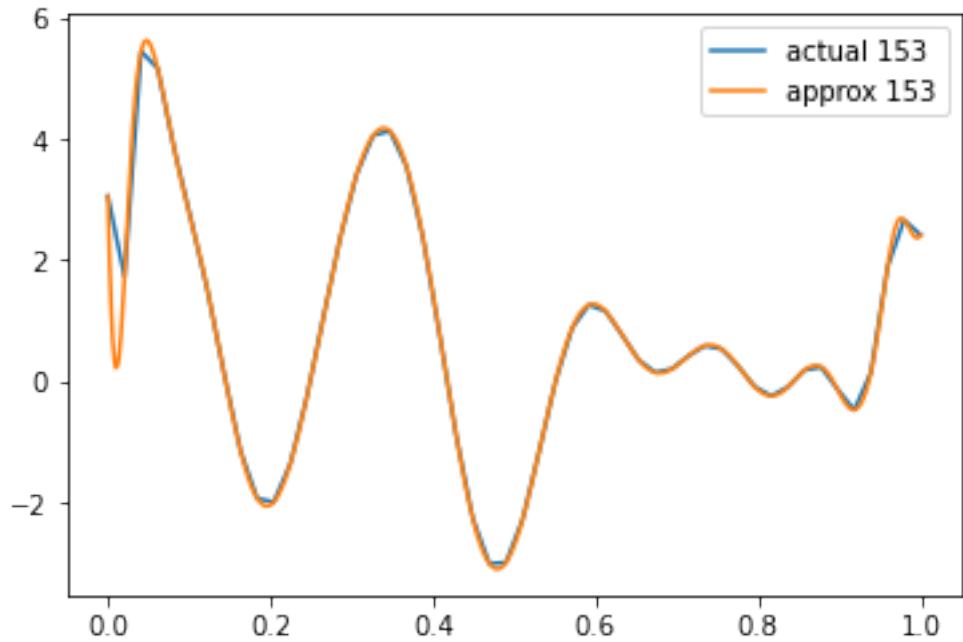


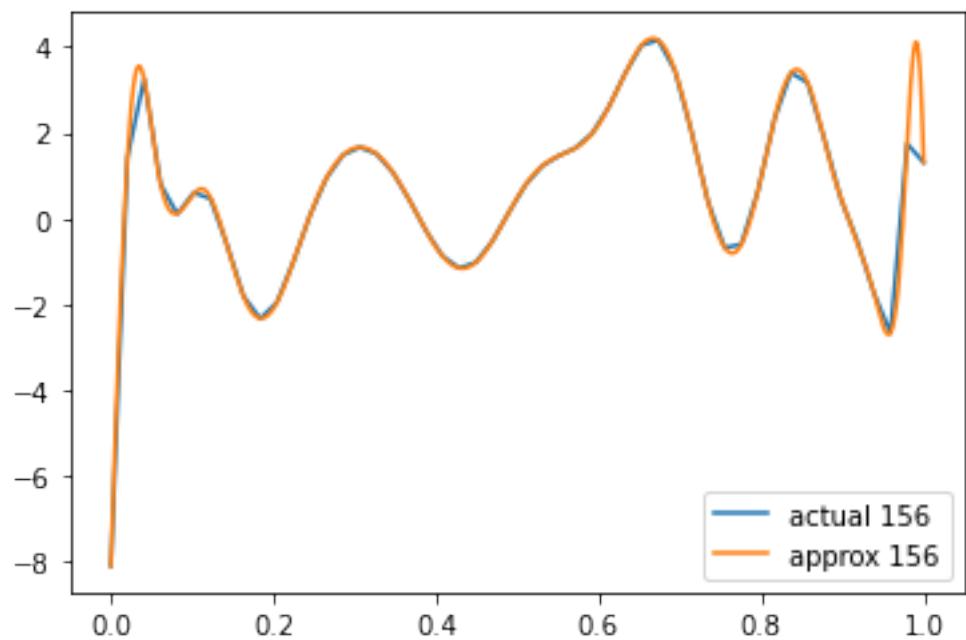
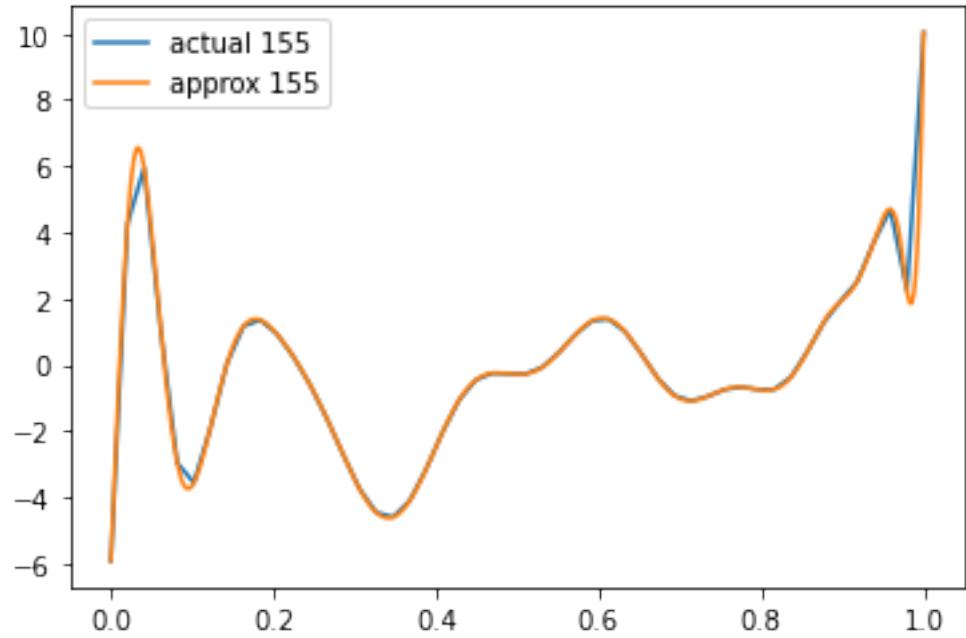


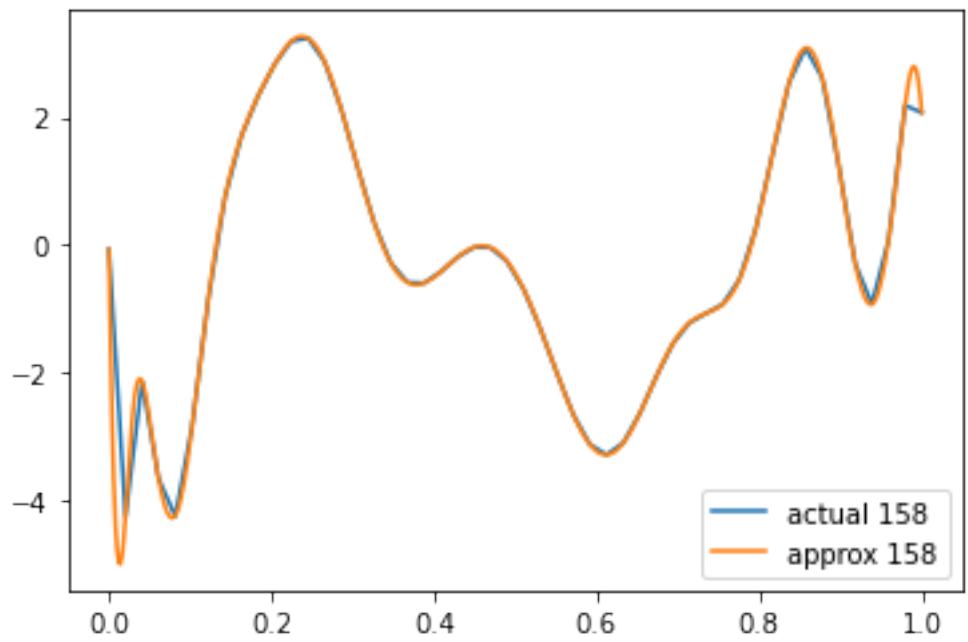
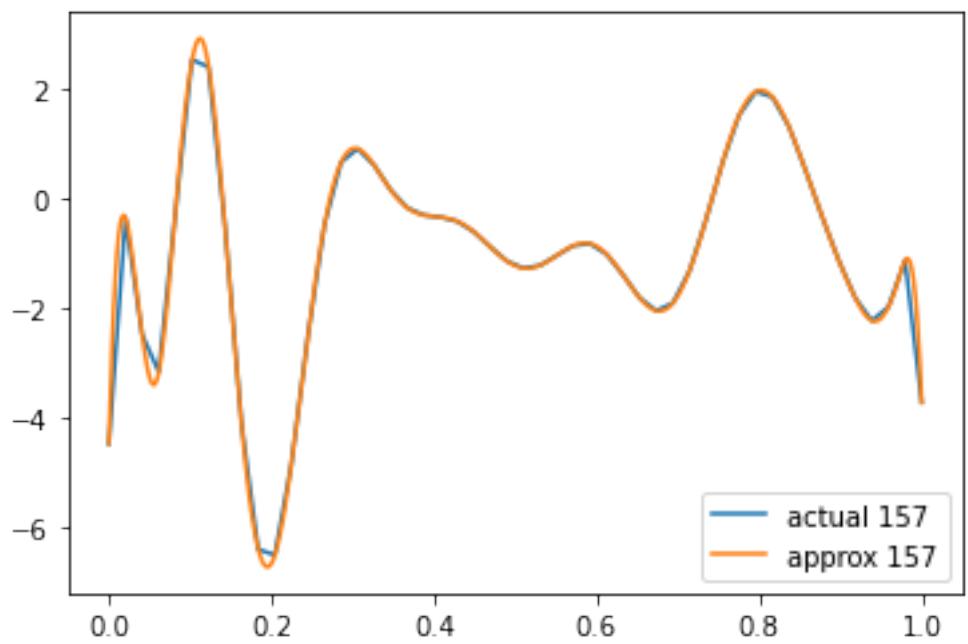


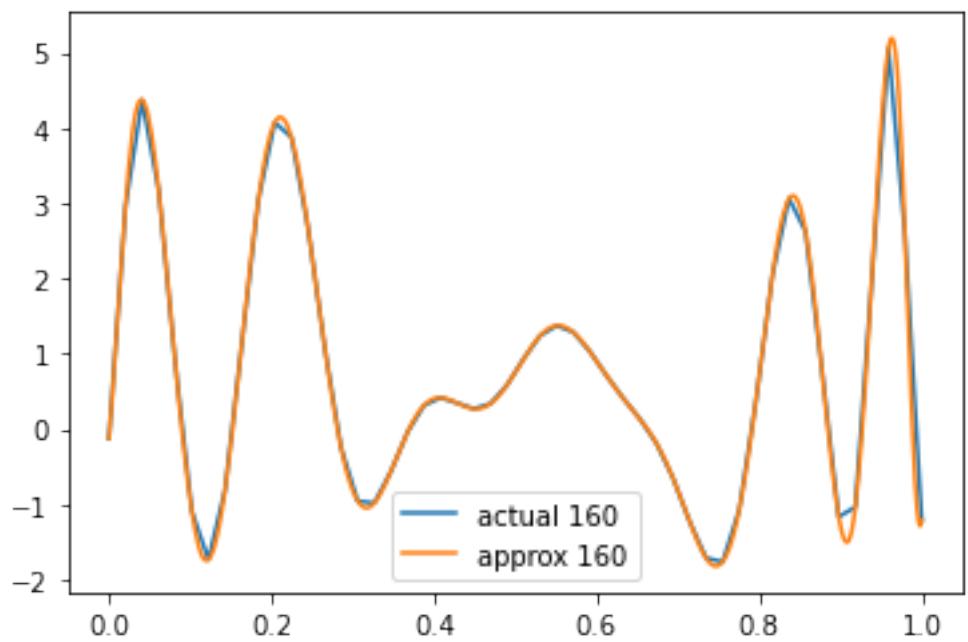
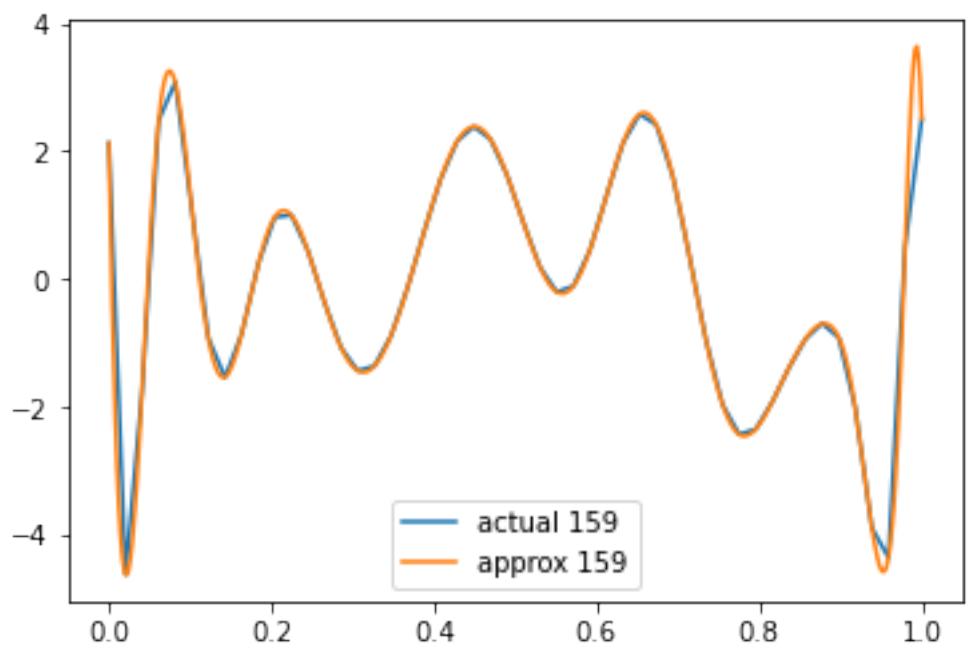


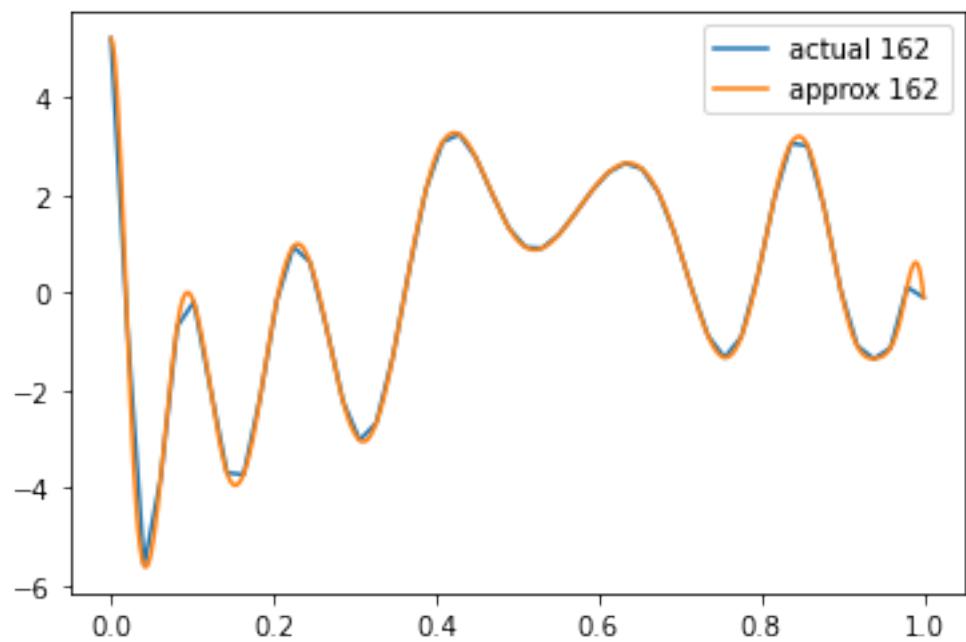
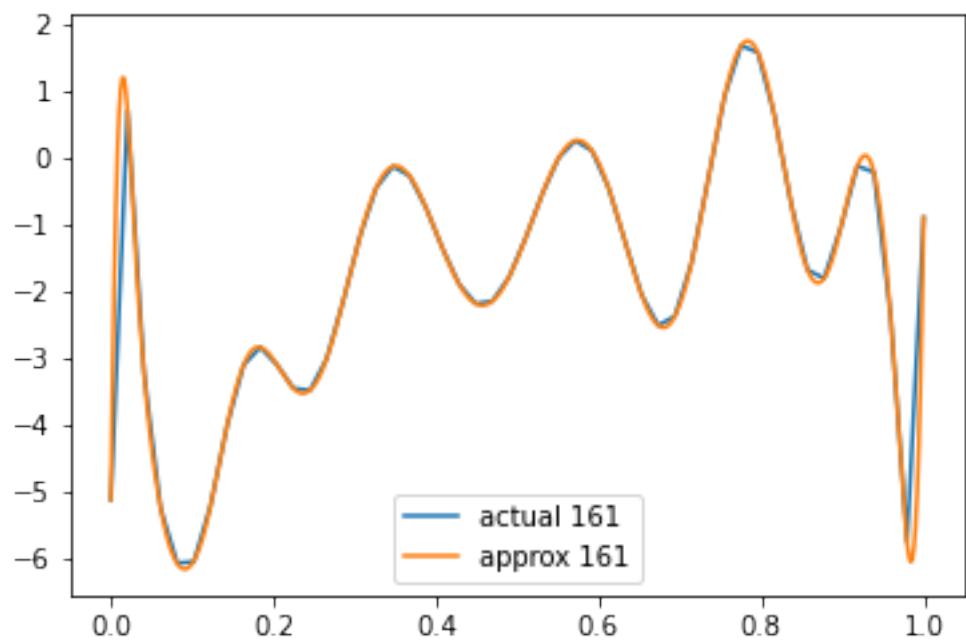


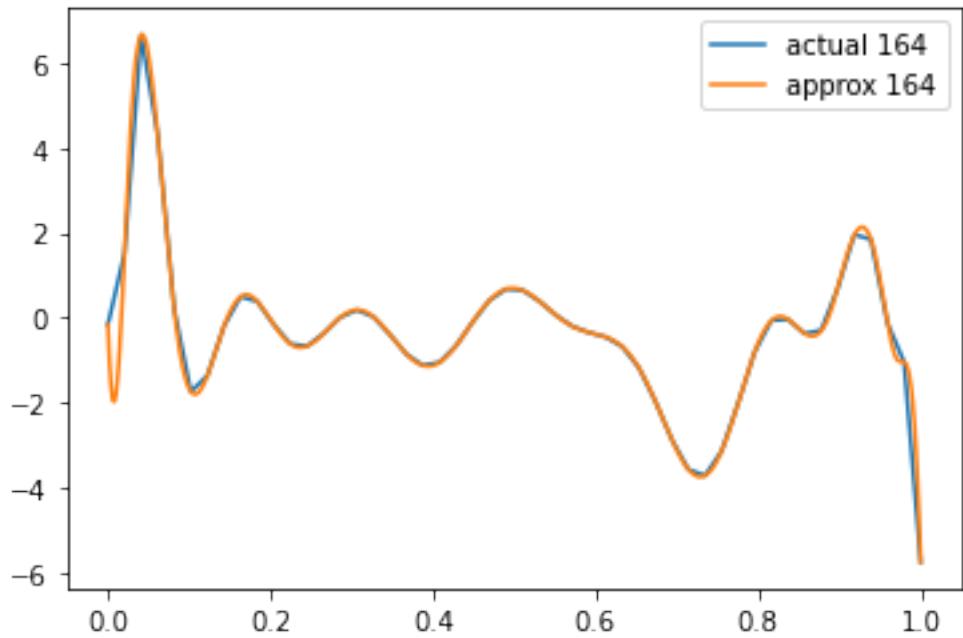
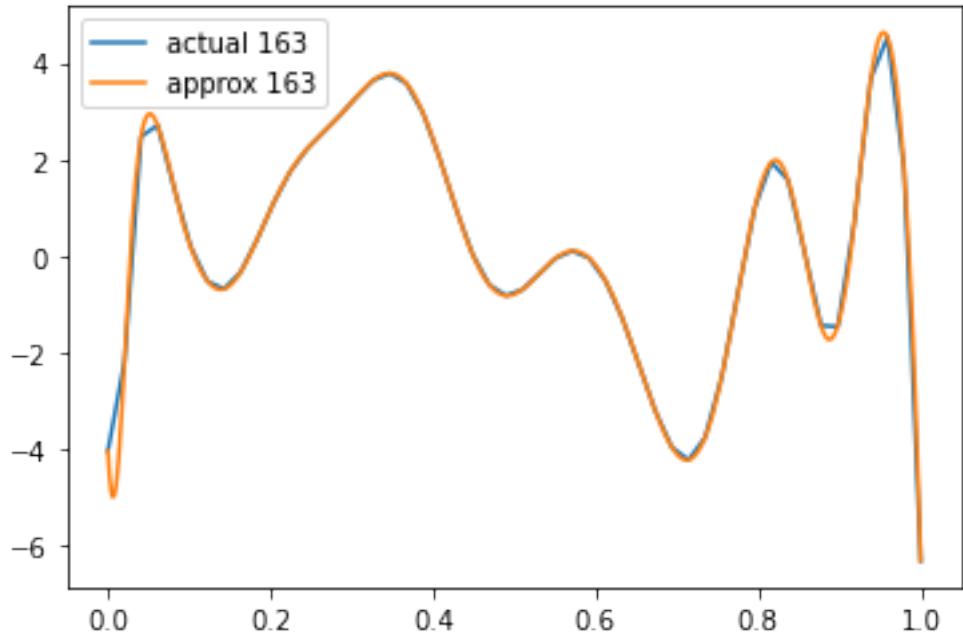


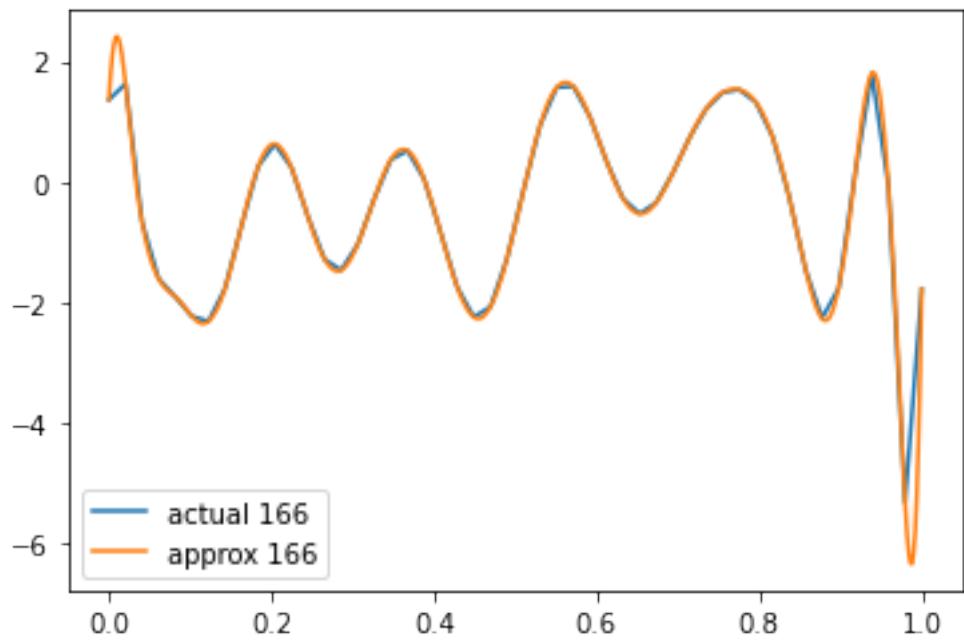
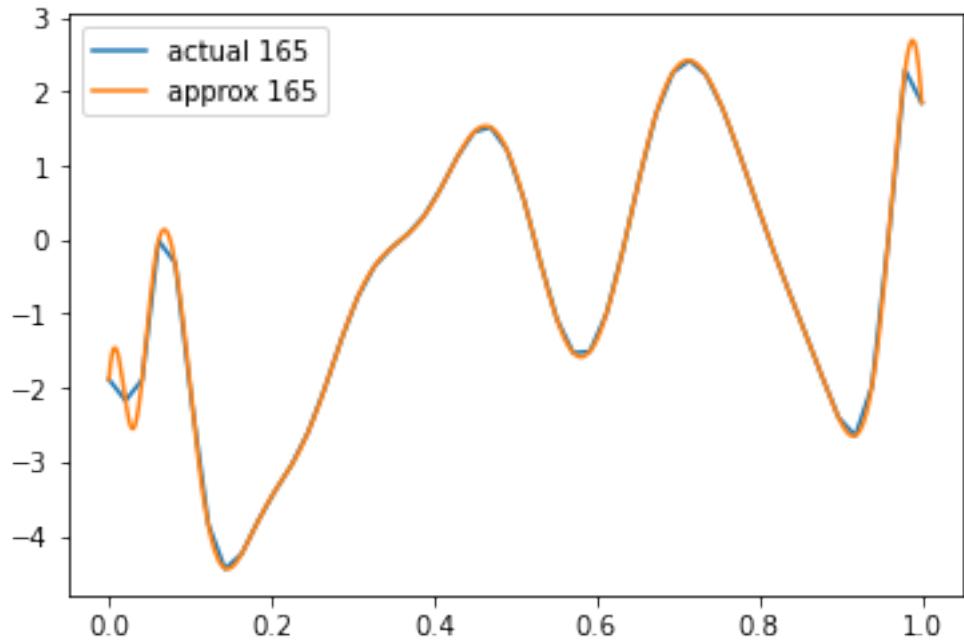


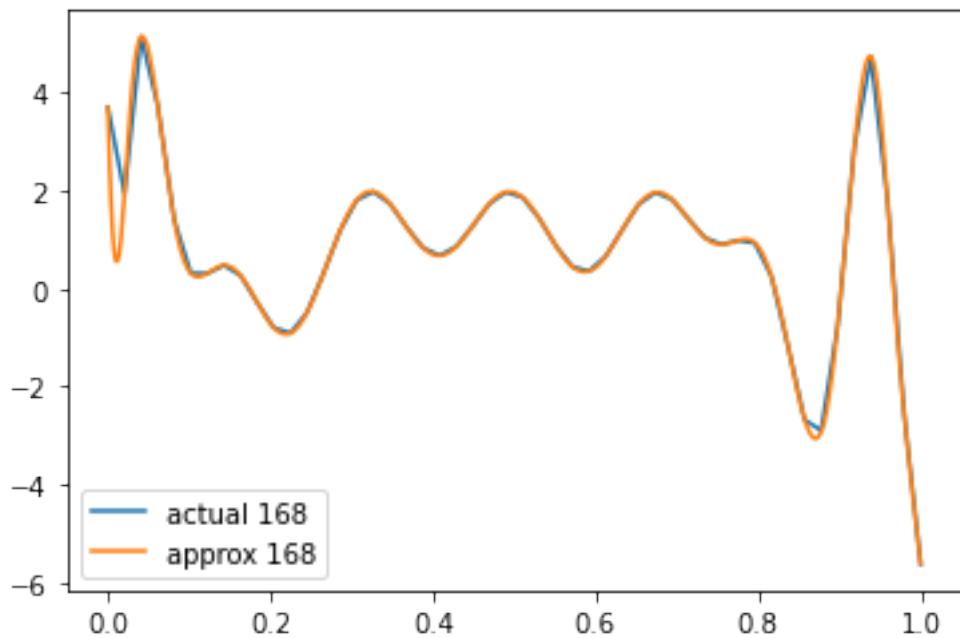
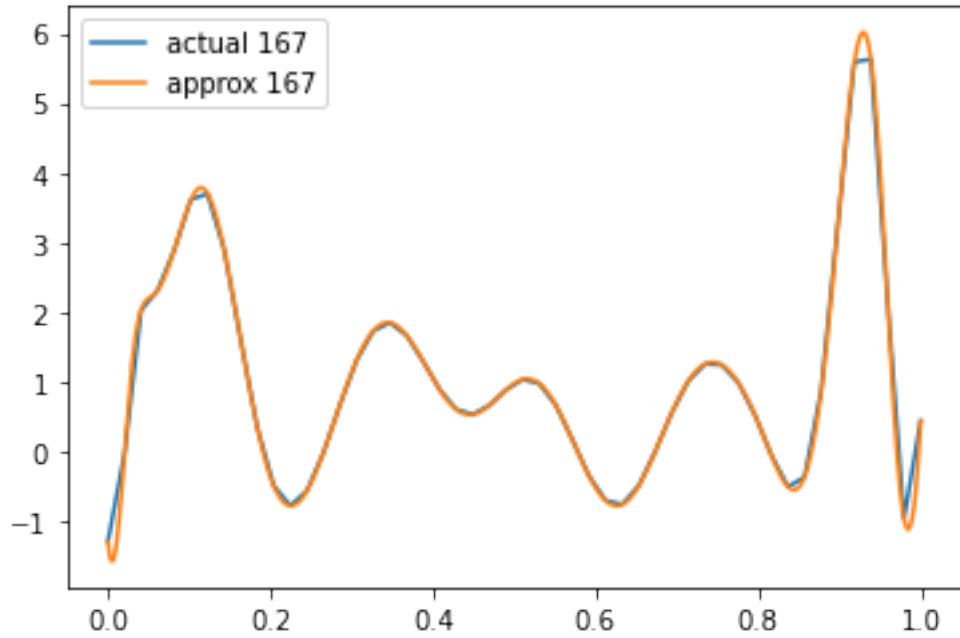


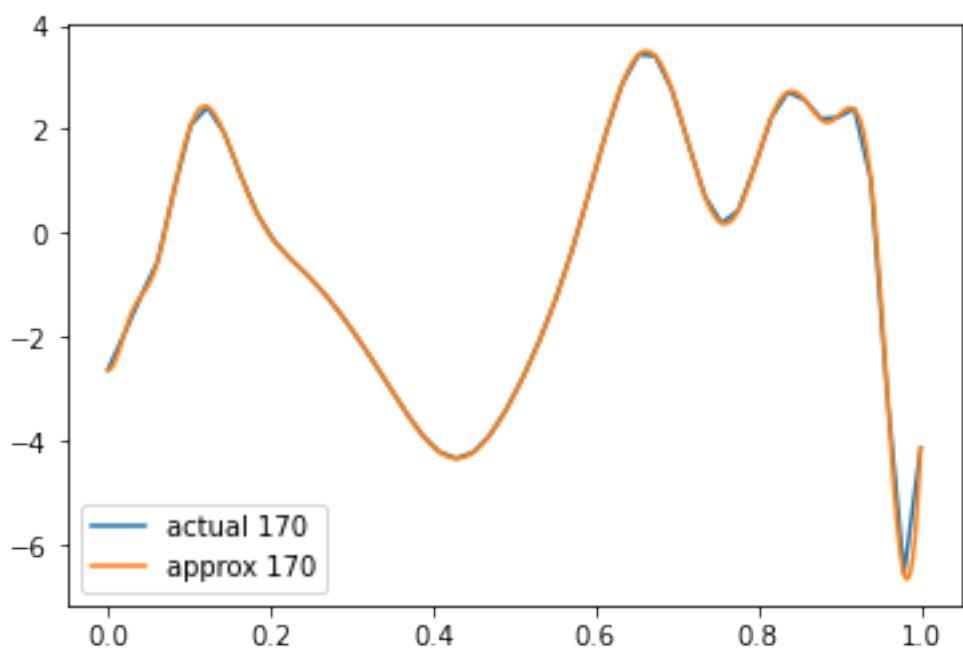
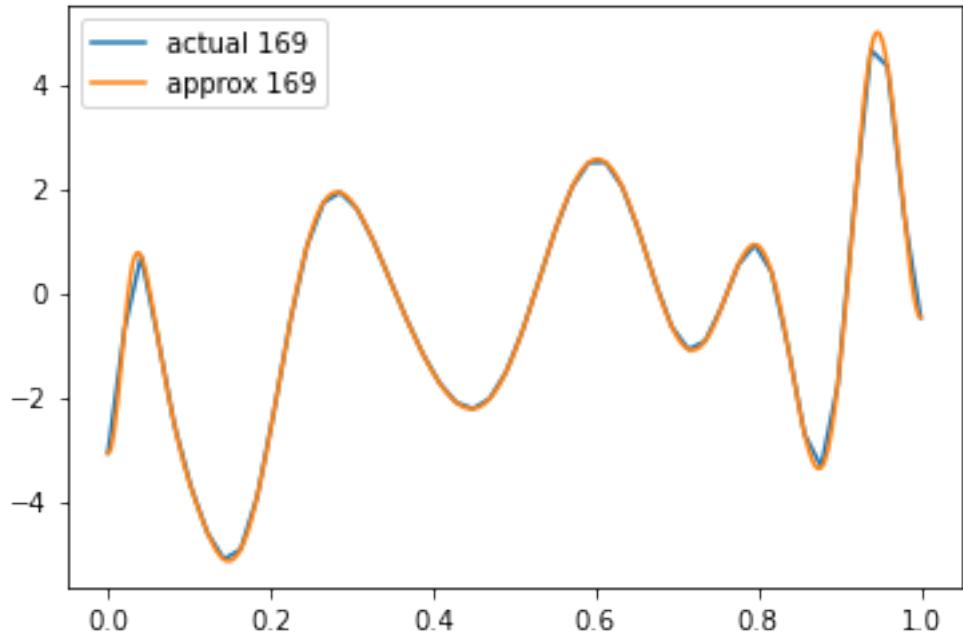


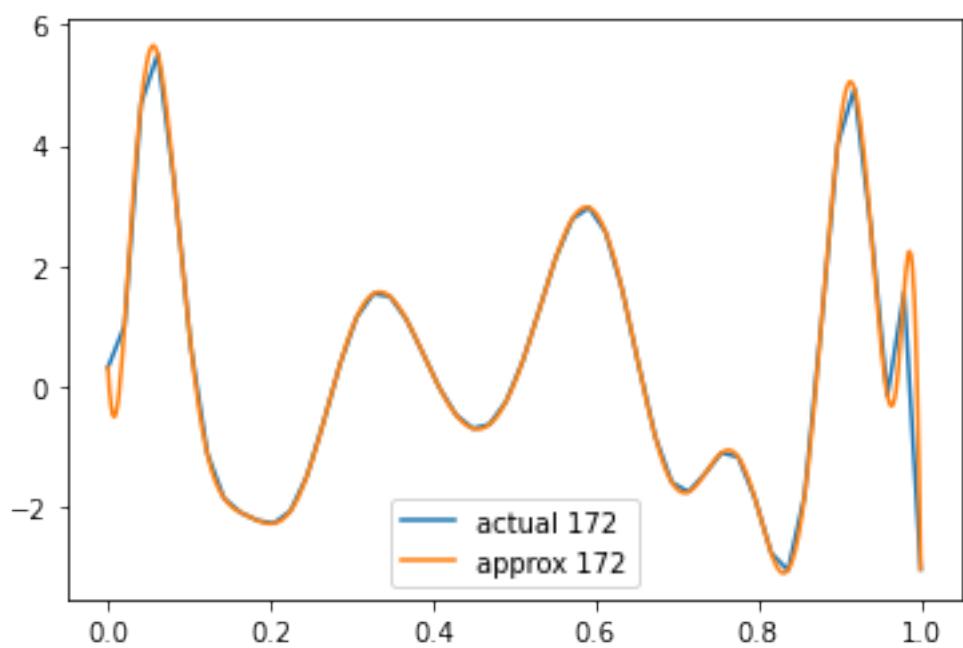
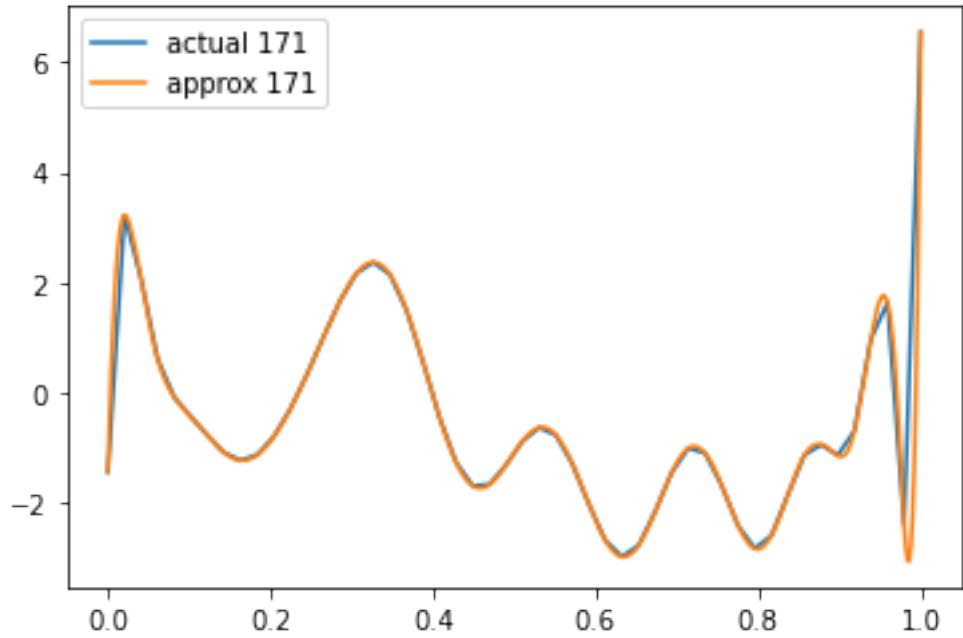


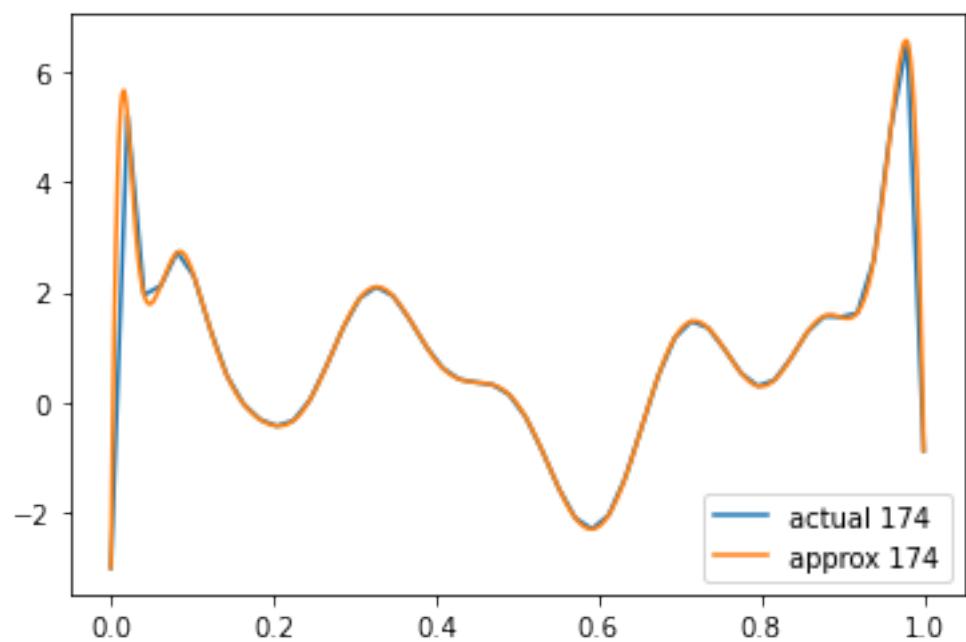
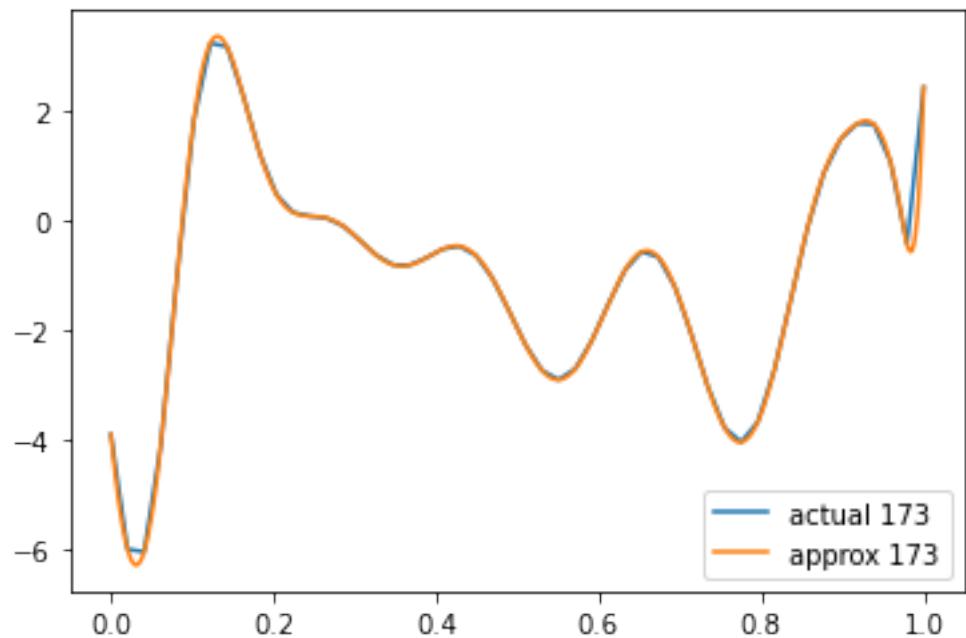


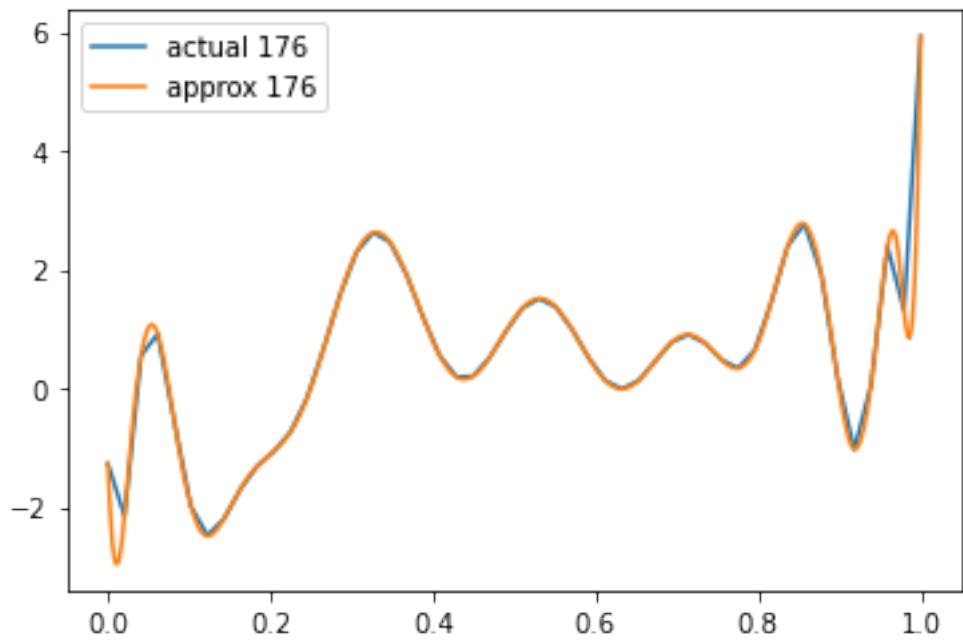
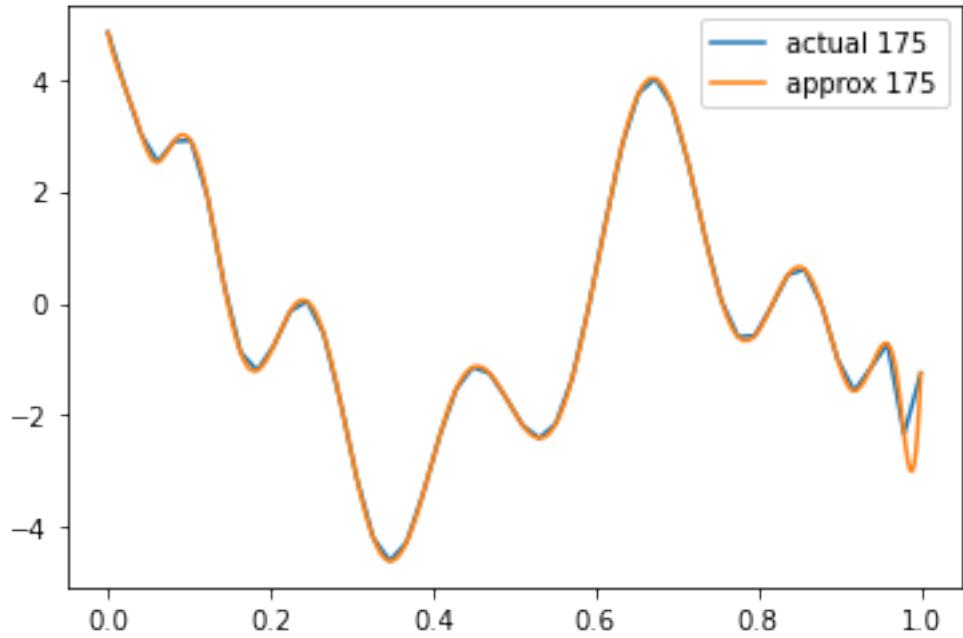


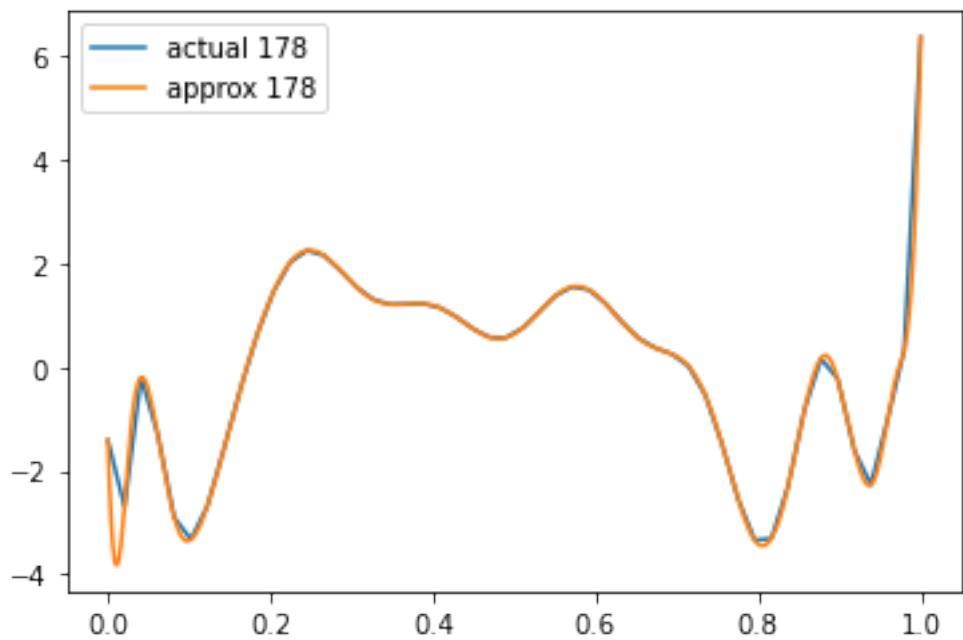
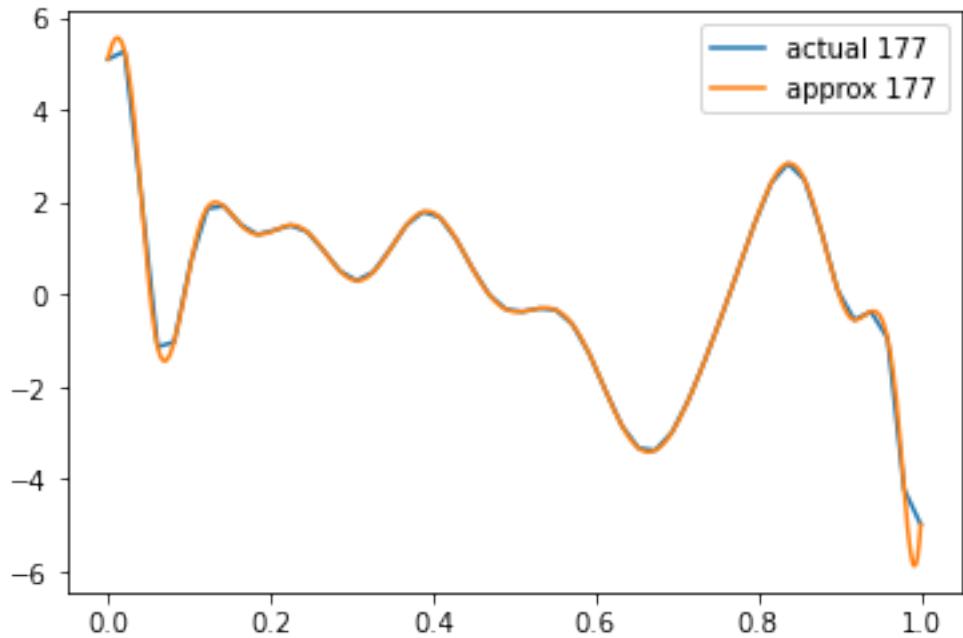


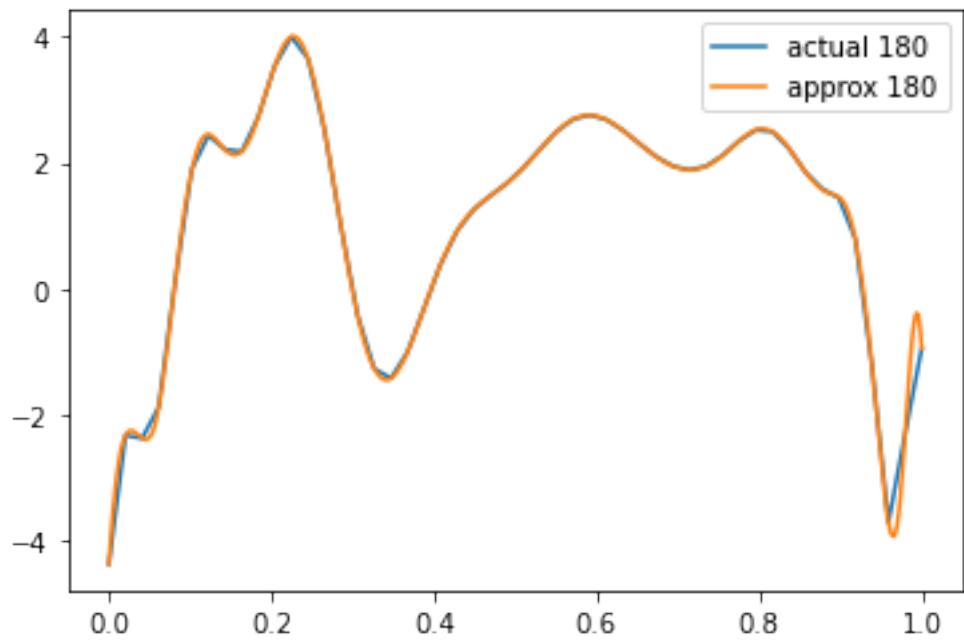
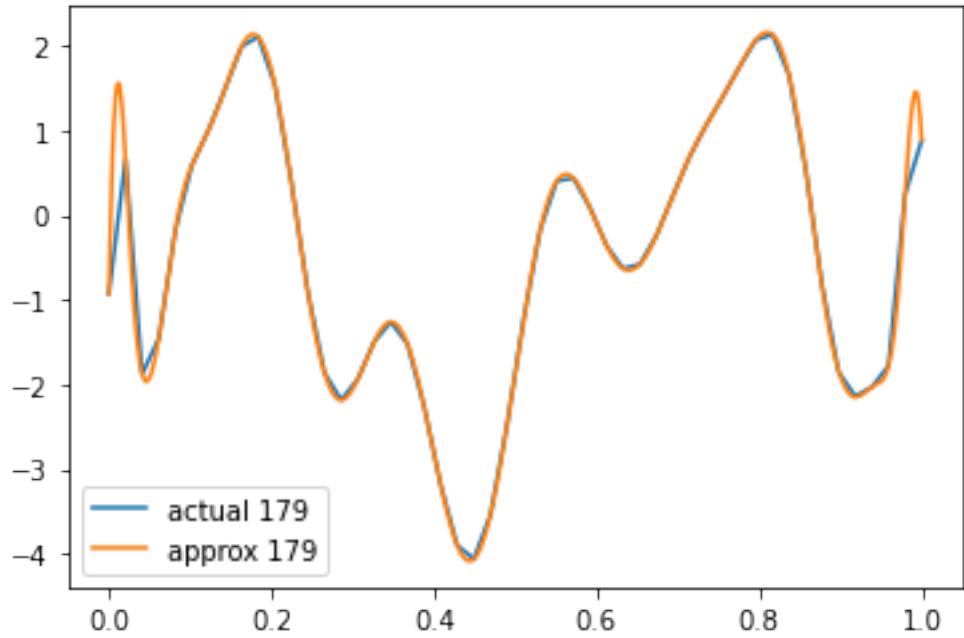


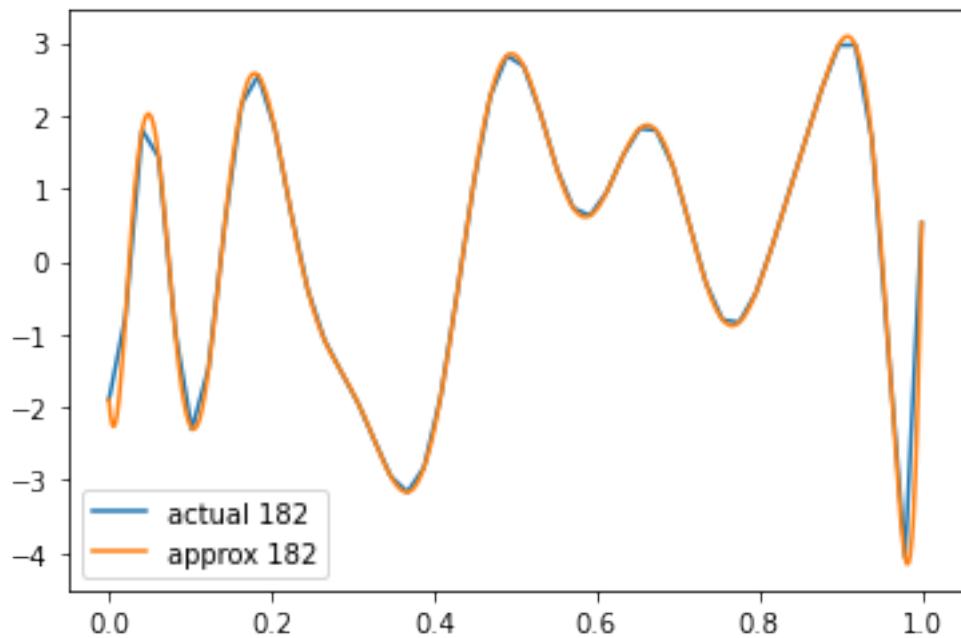
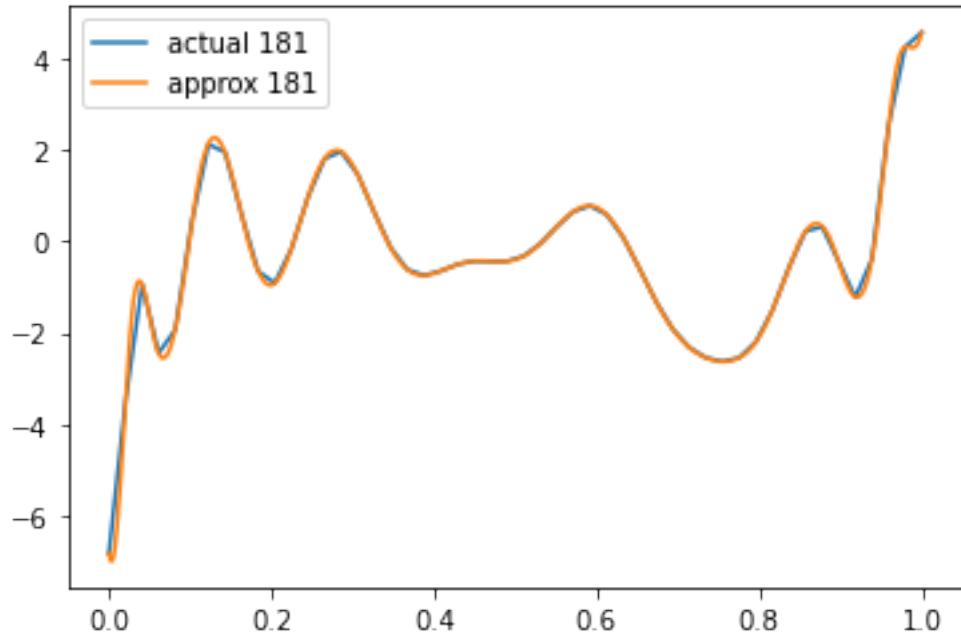




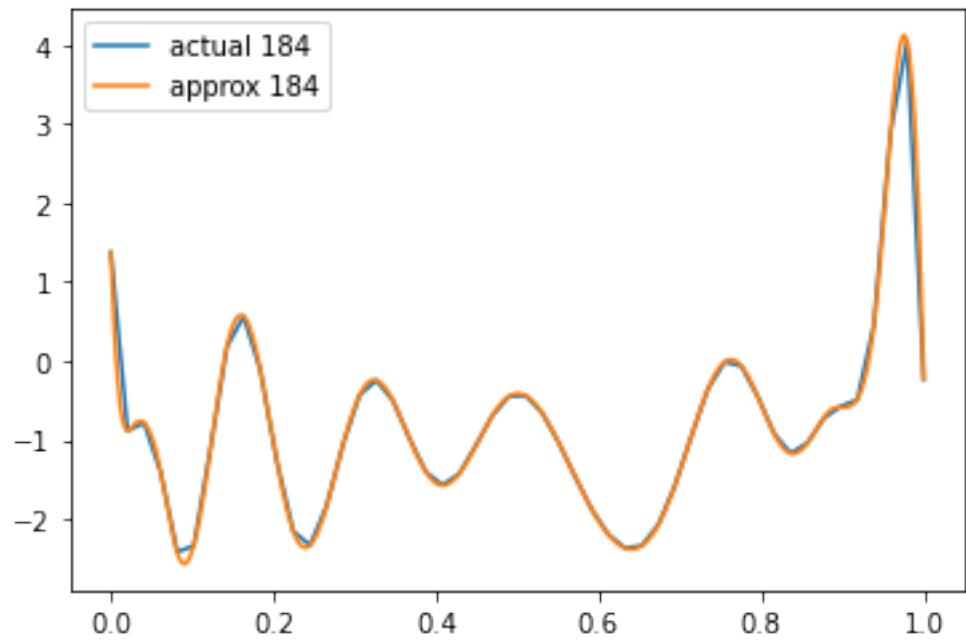
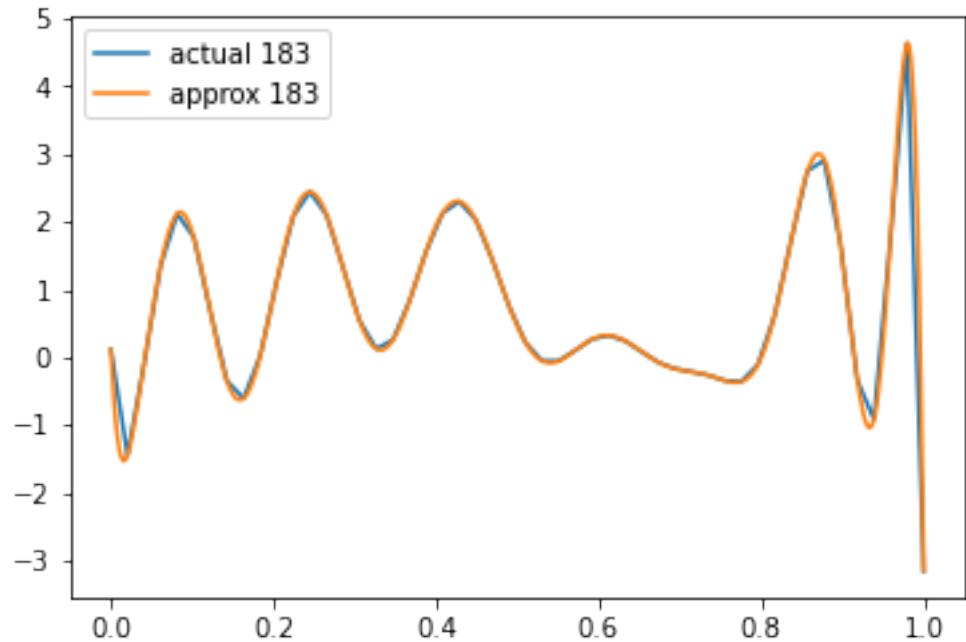


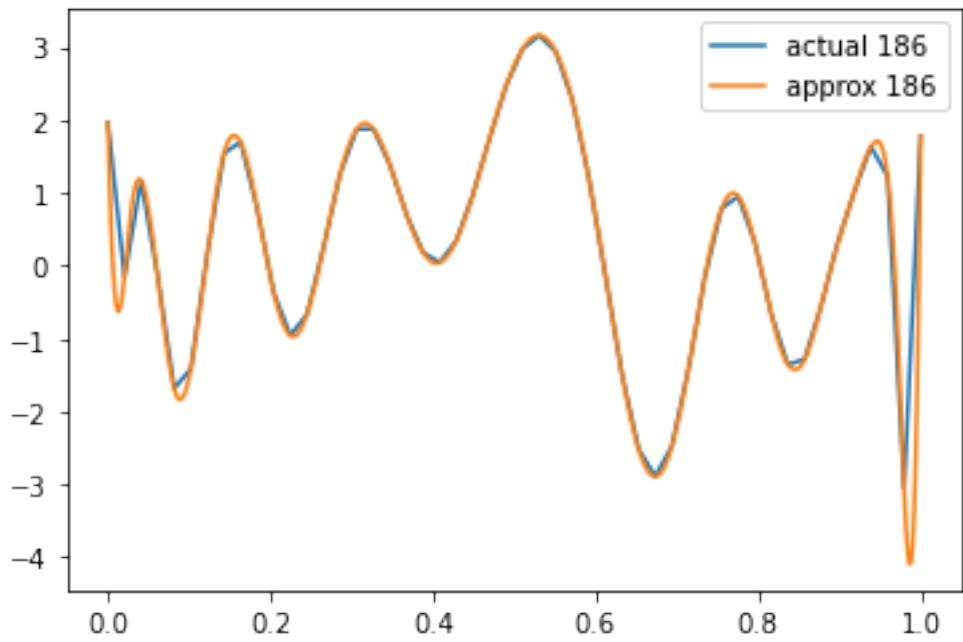
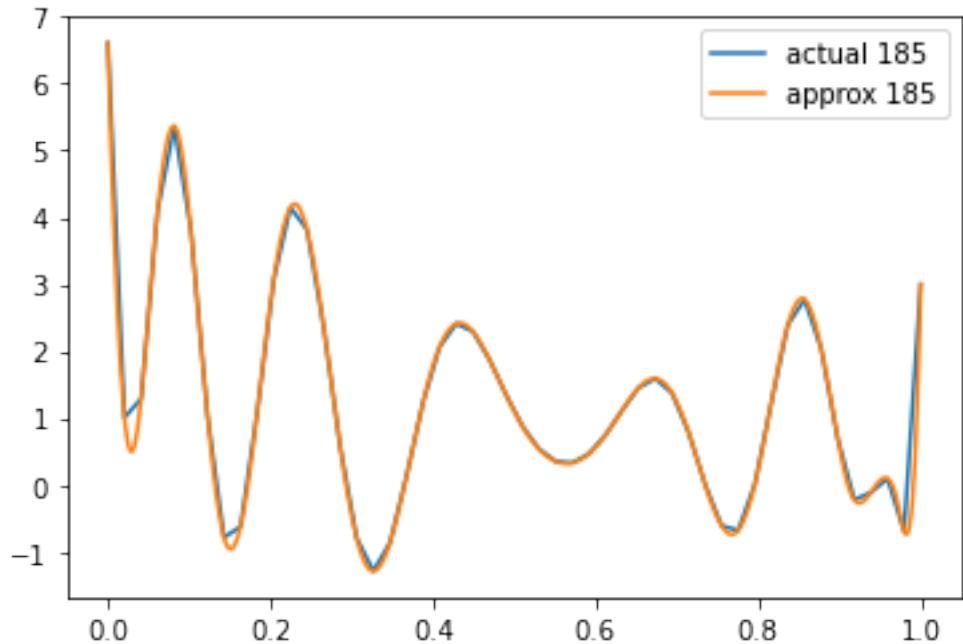


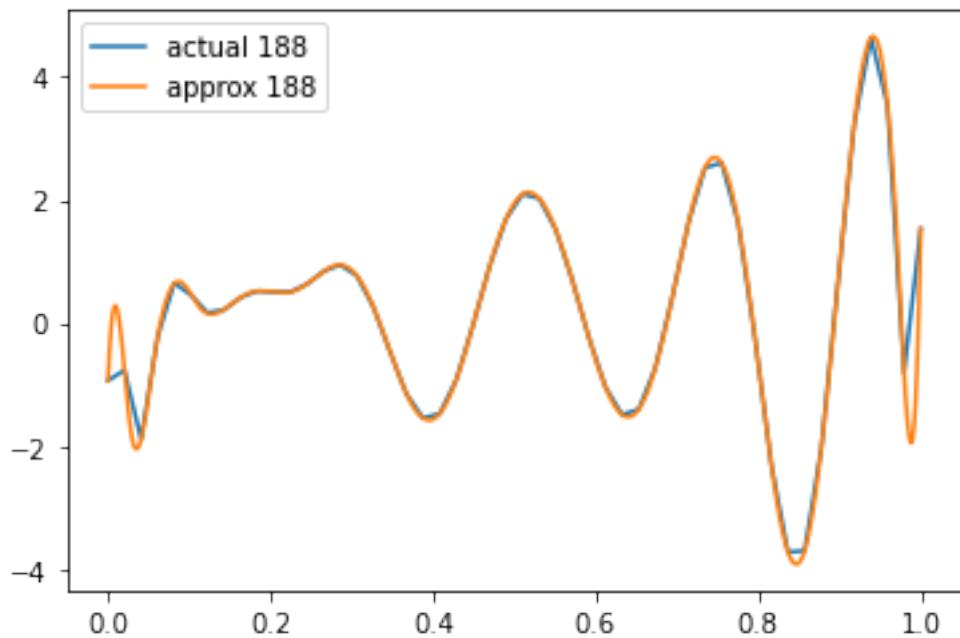
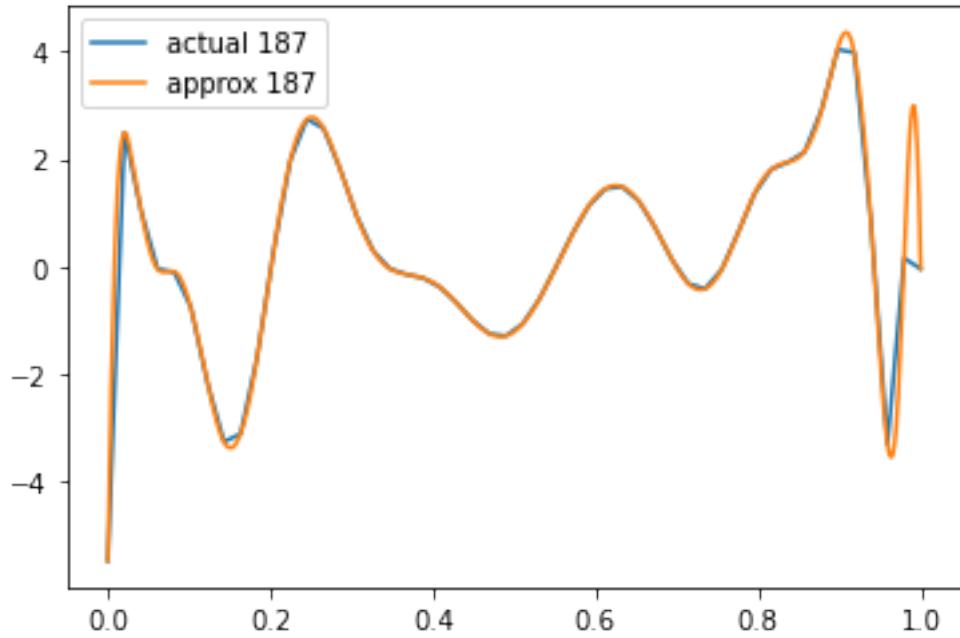


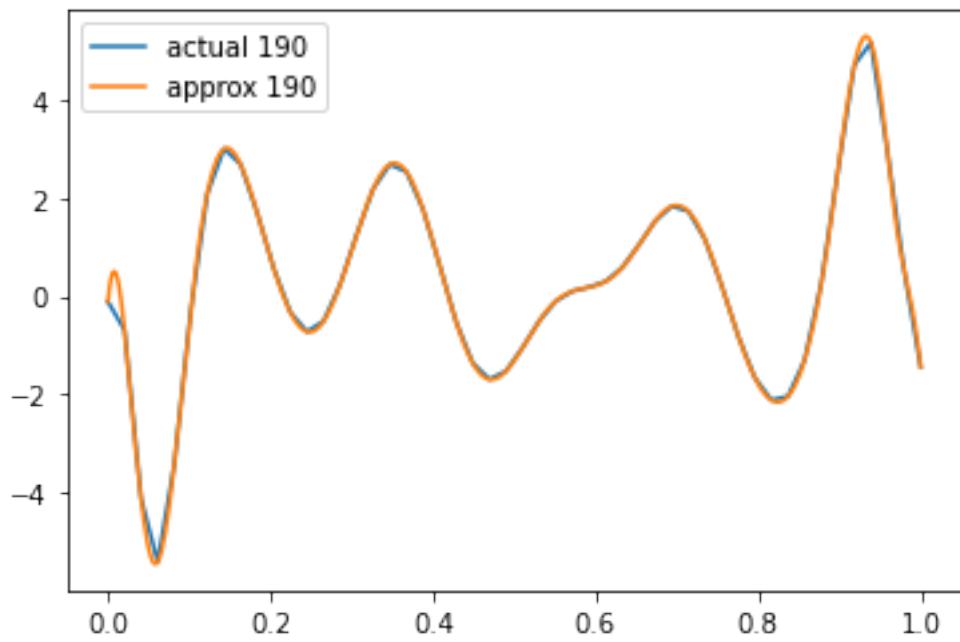
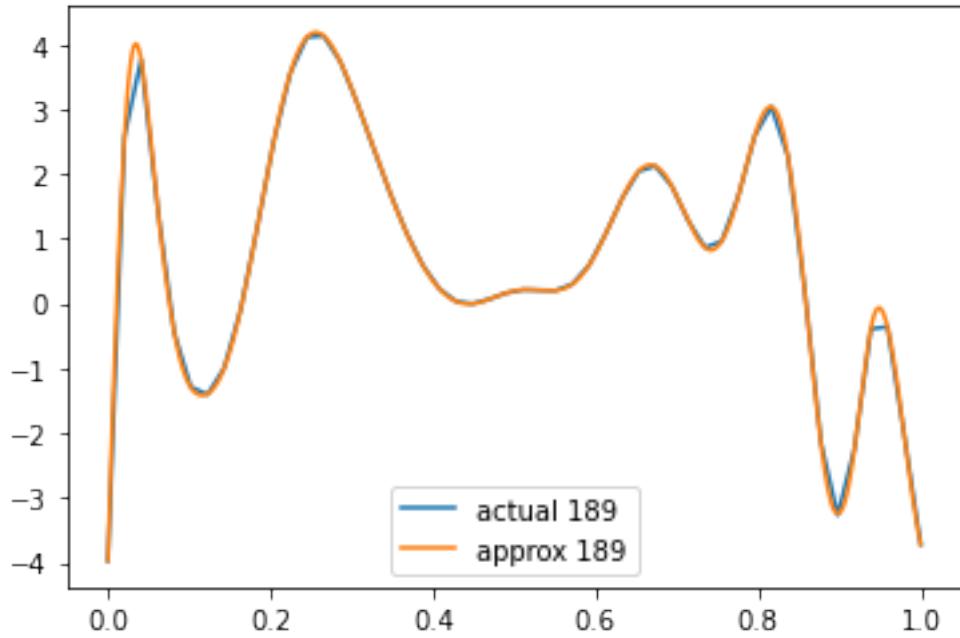


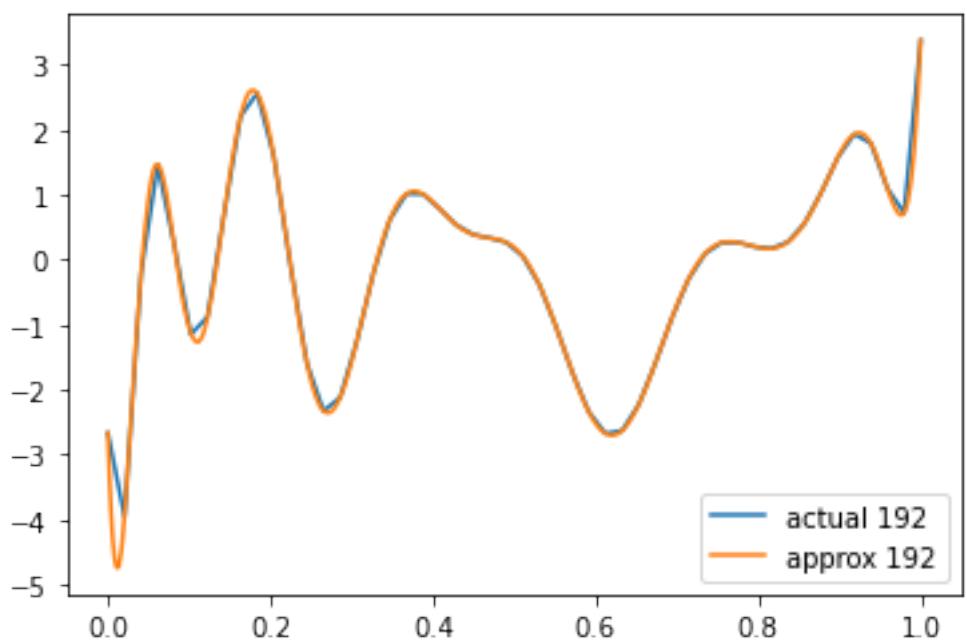
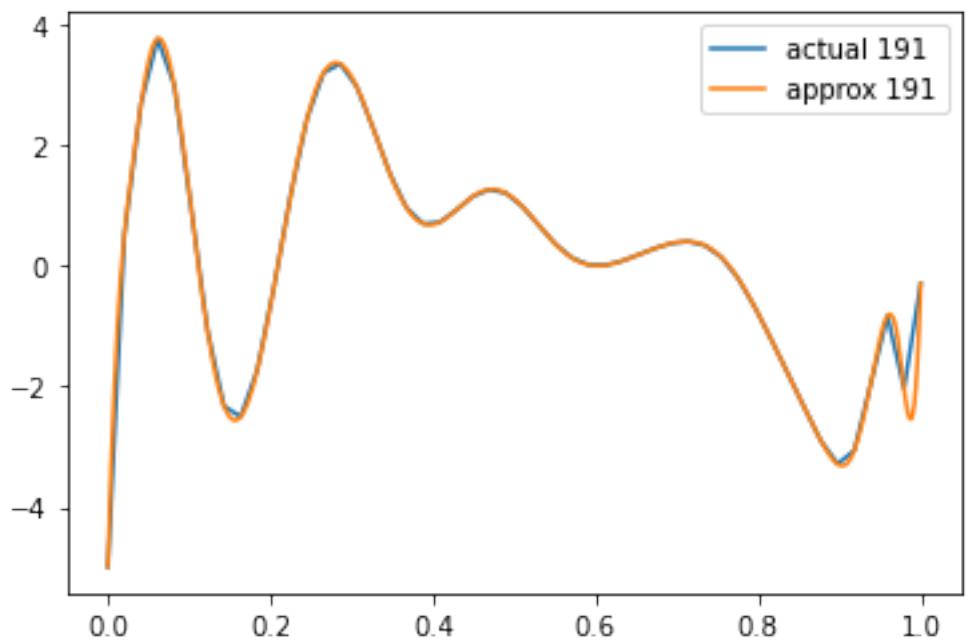
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c:\Users\Diego\anaconda3\lib\site-packages\scipy\optimize\optimize.py:282:  
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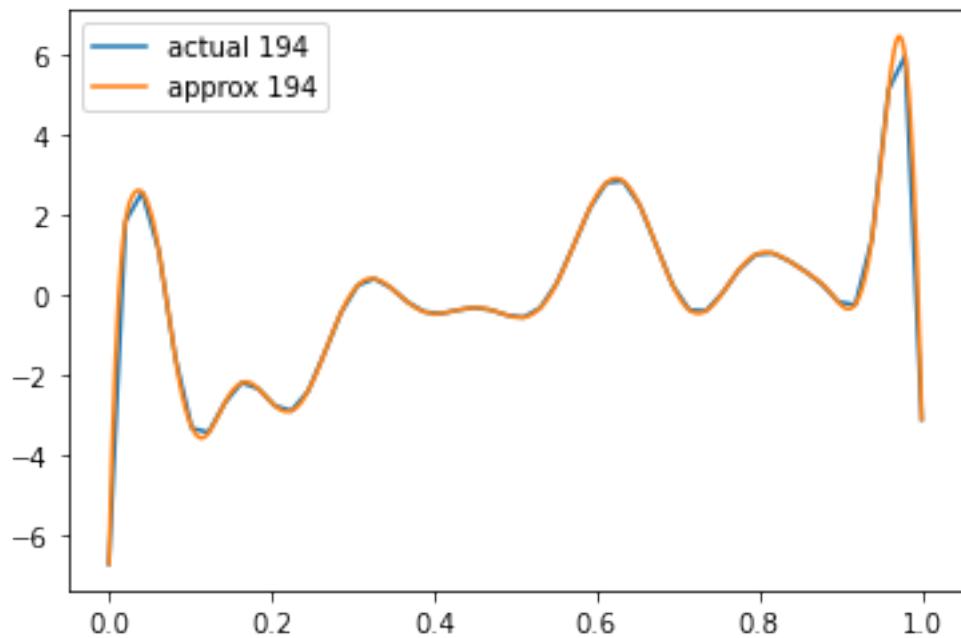
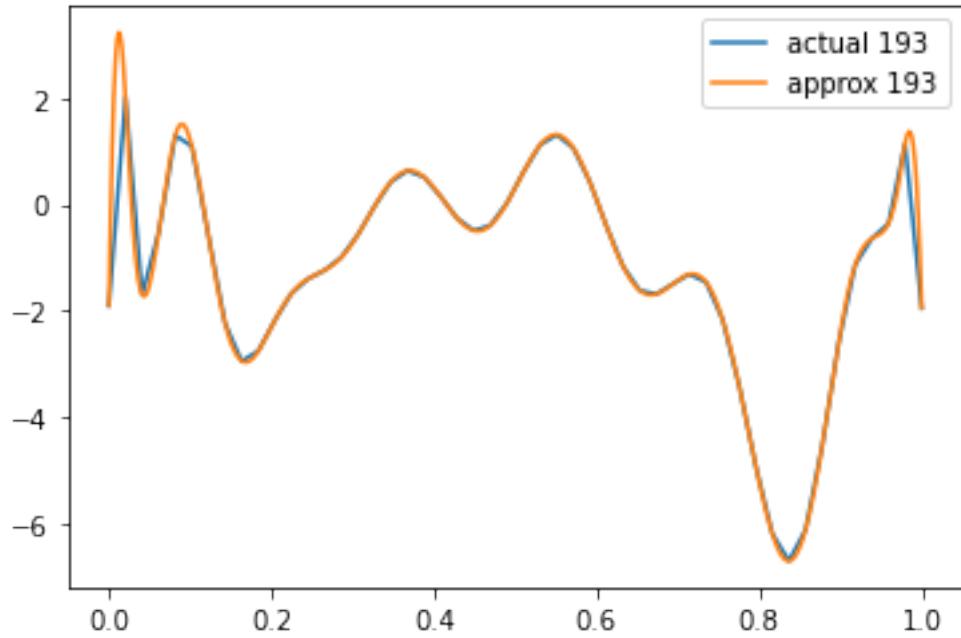


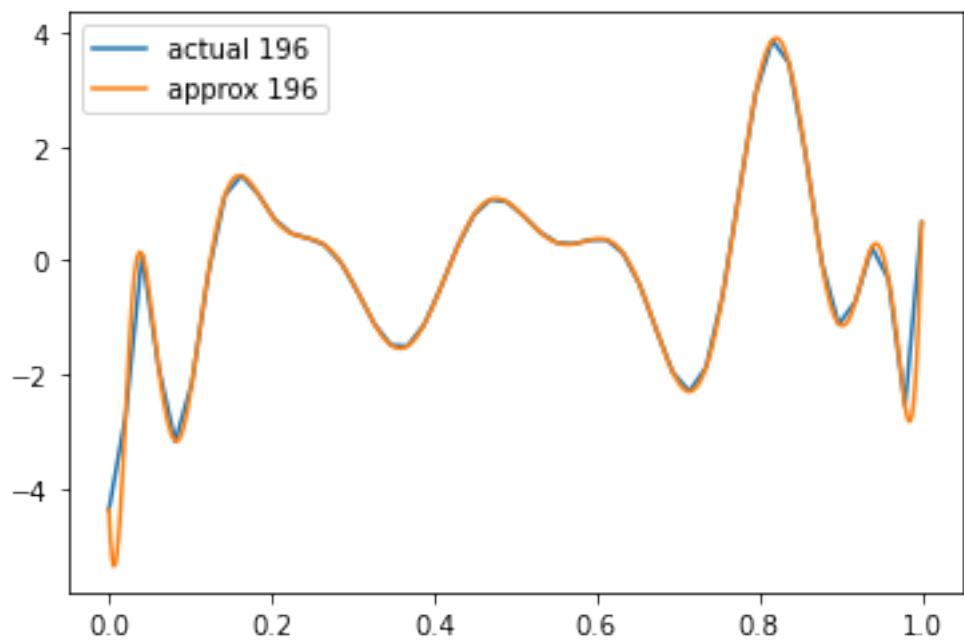
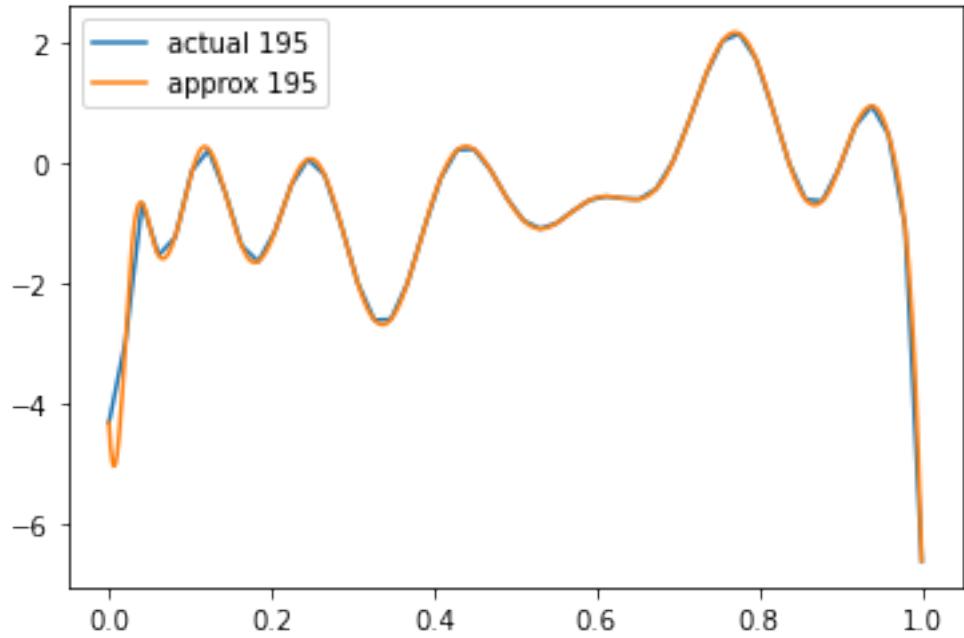


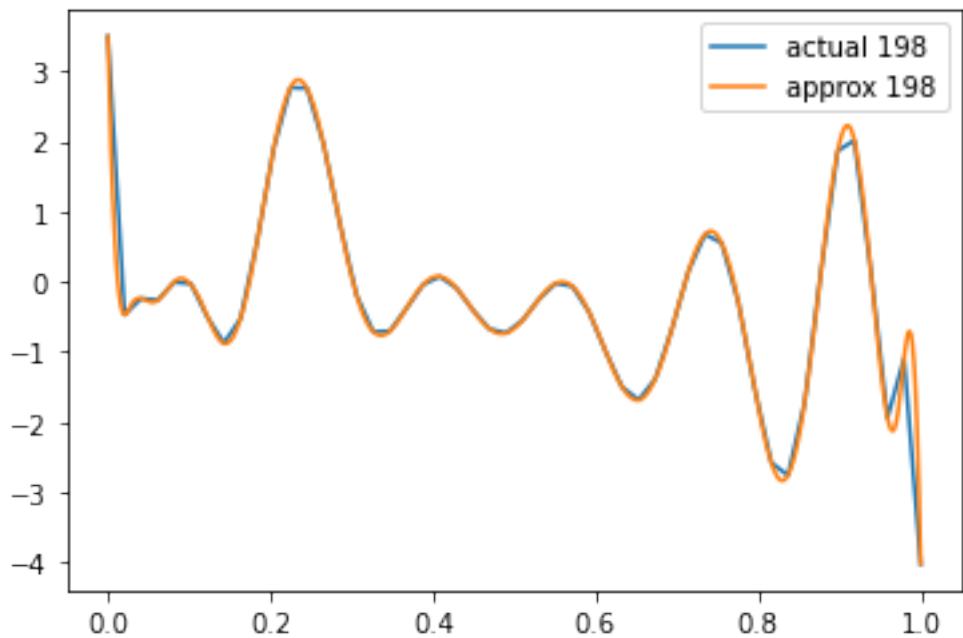
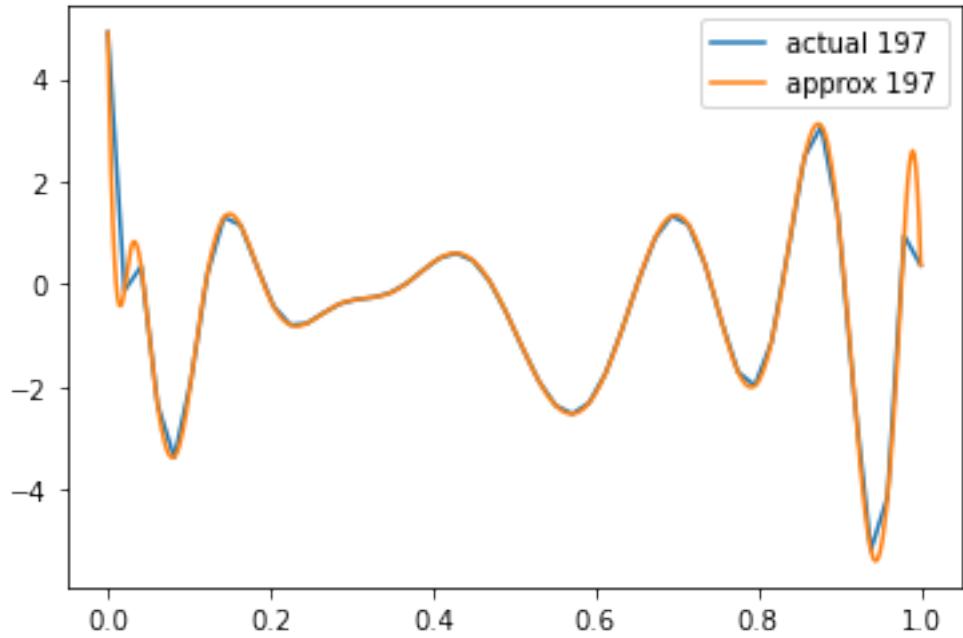


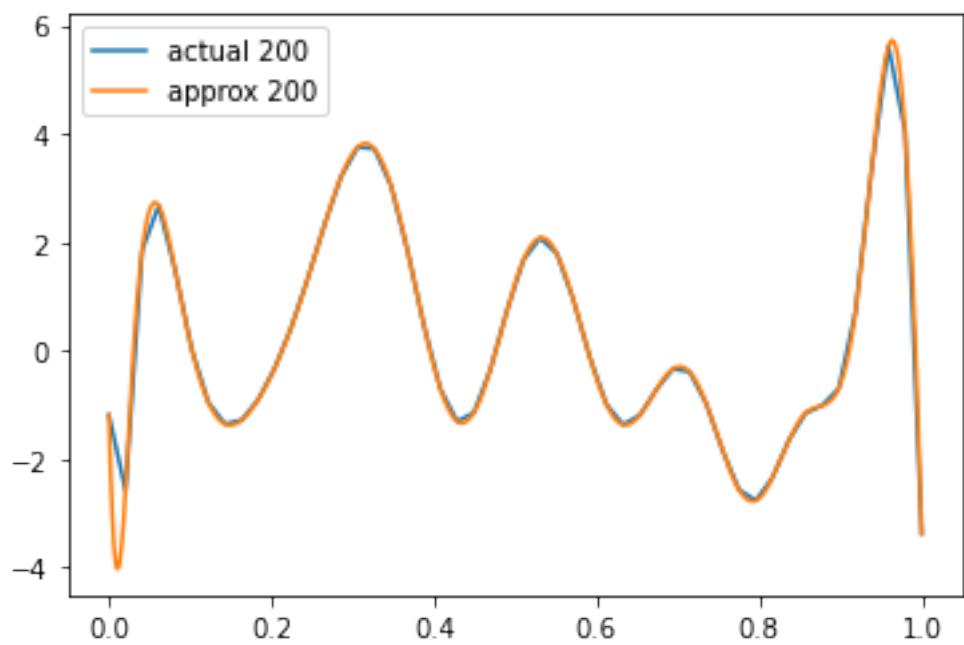
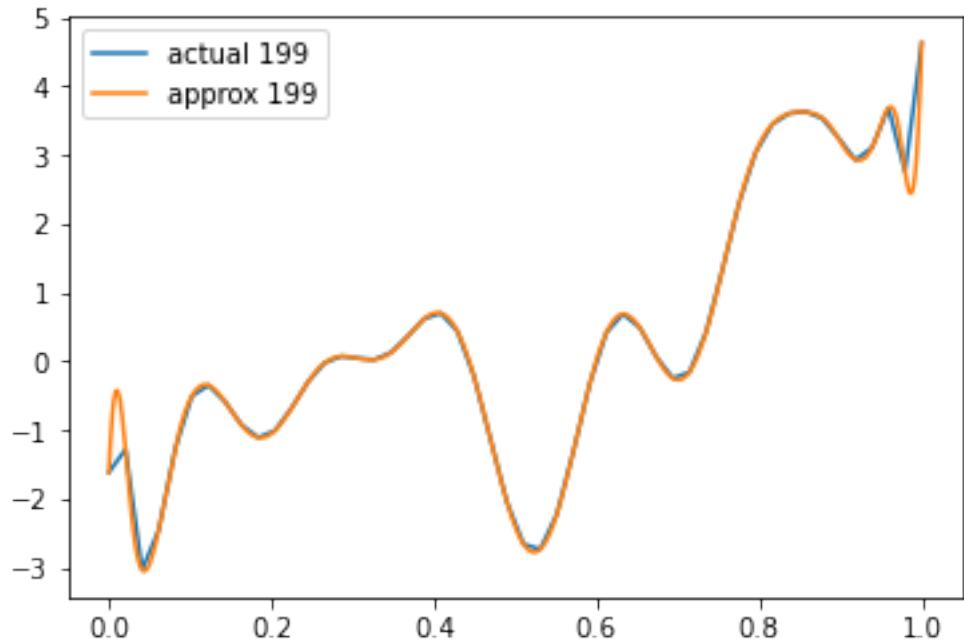


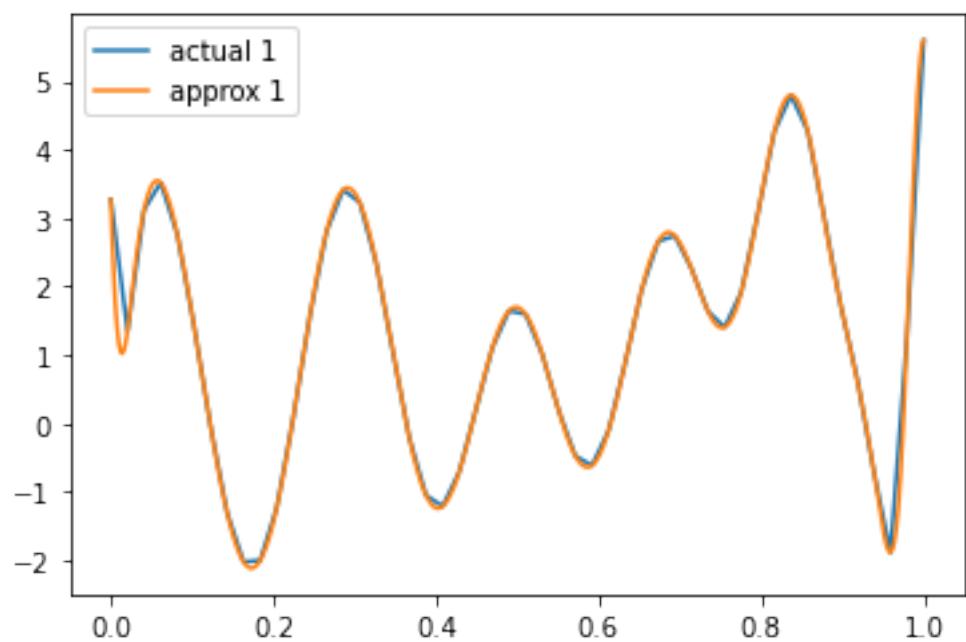
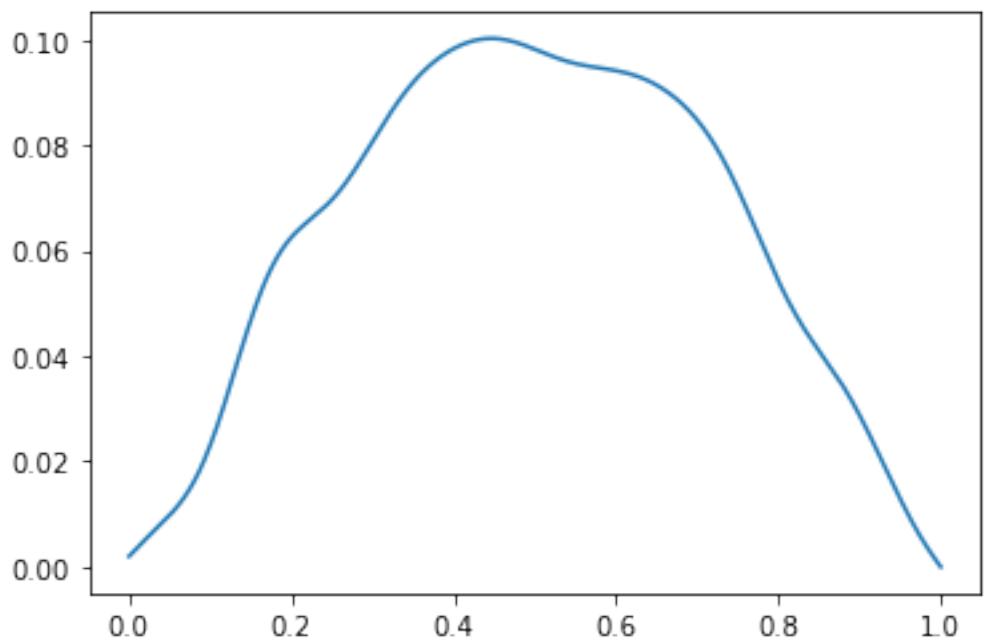


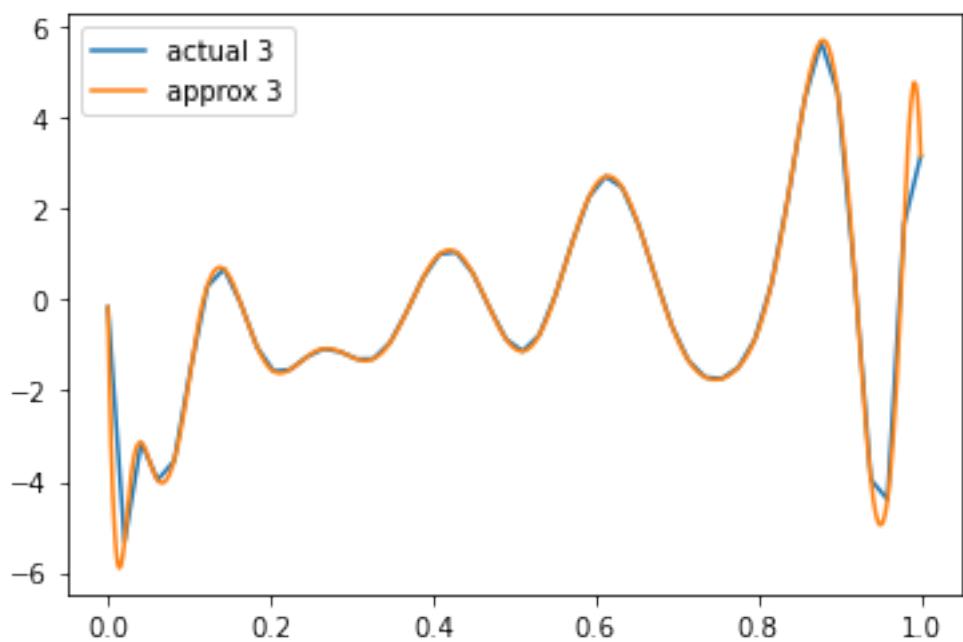
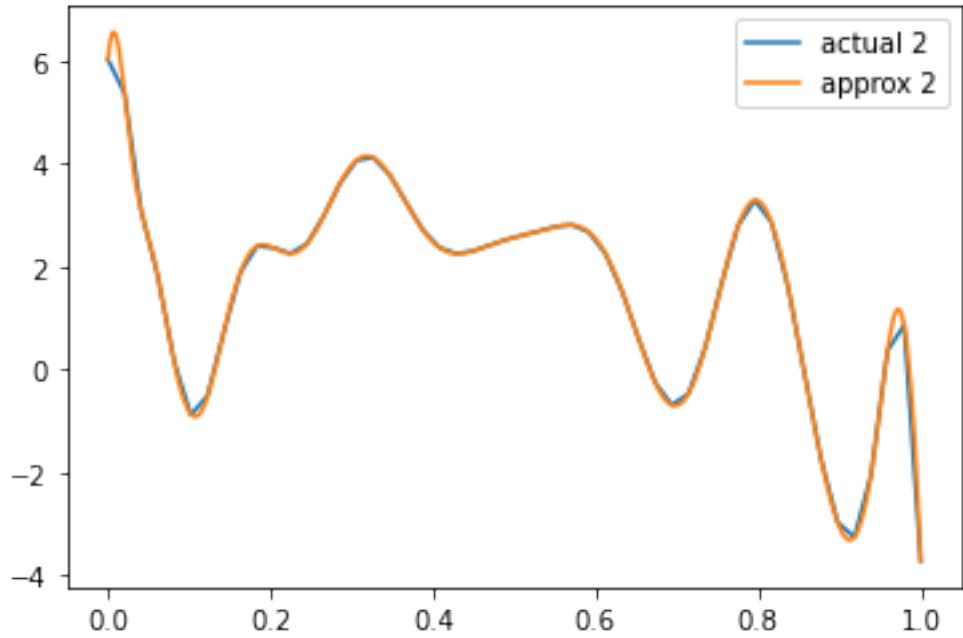


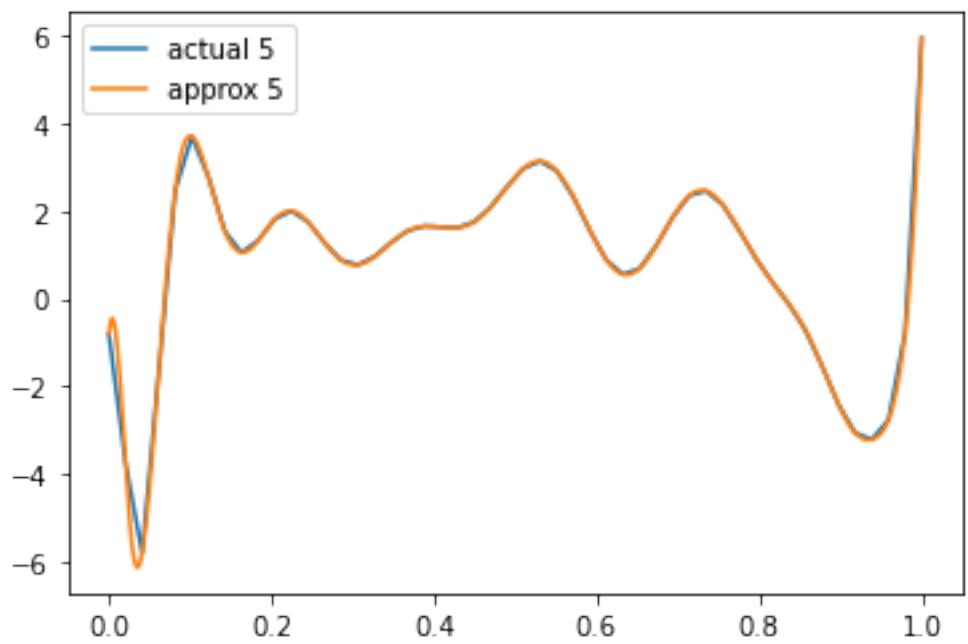
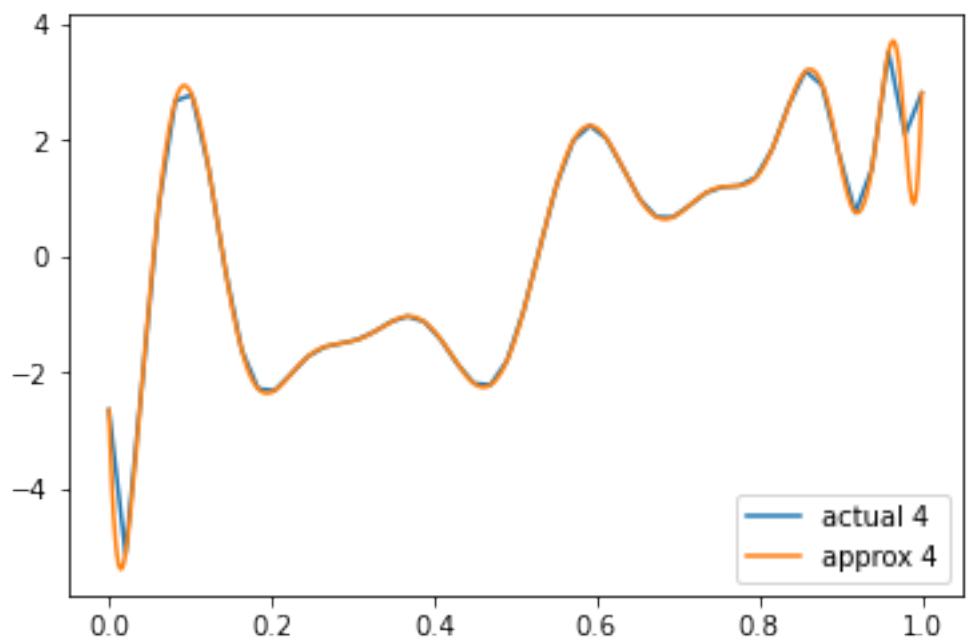


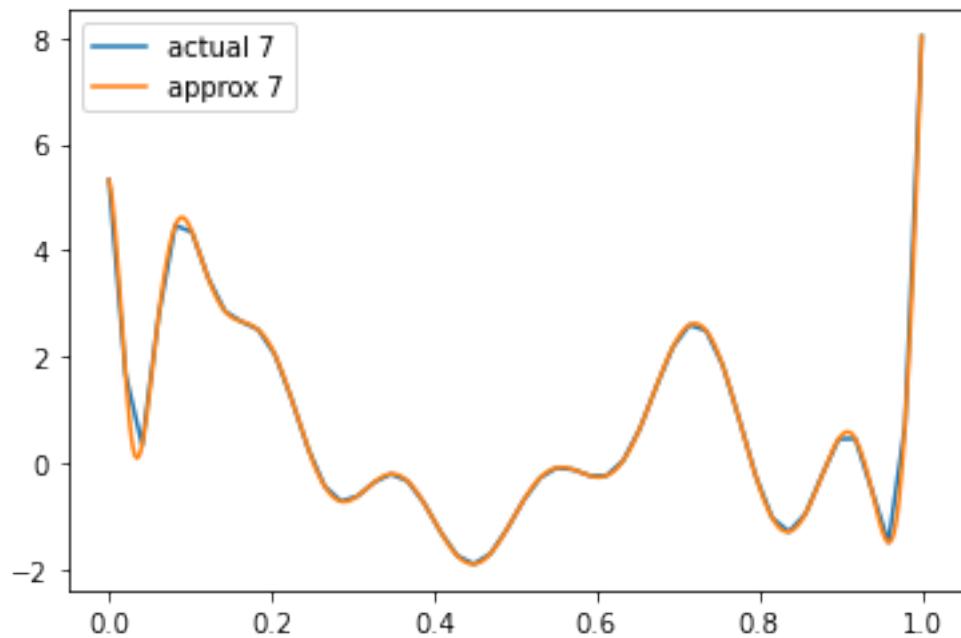
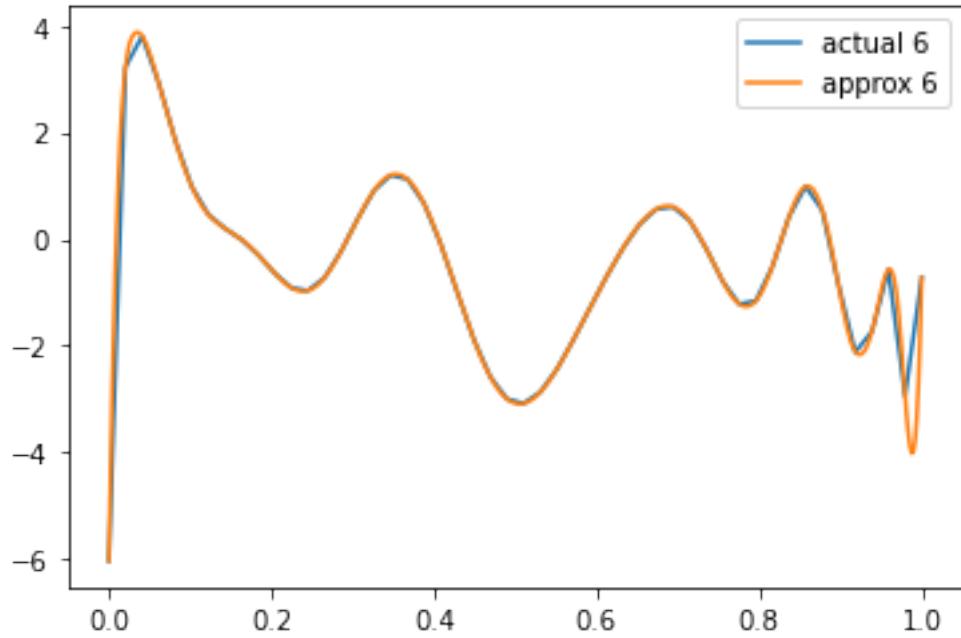


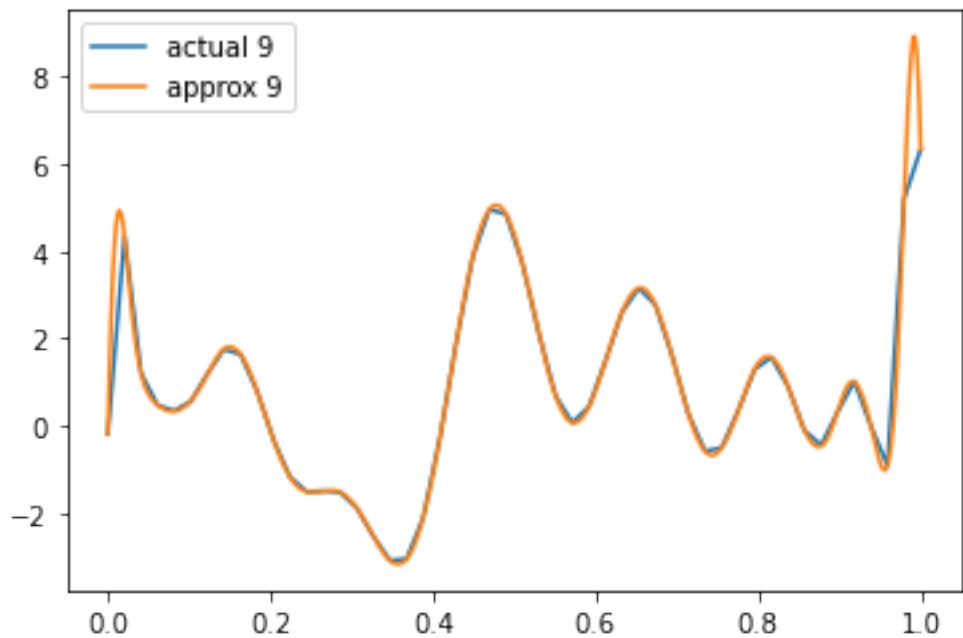
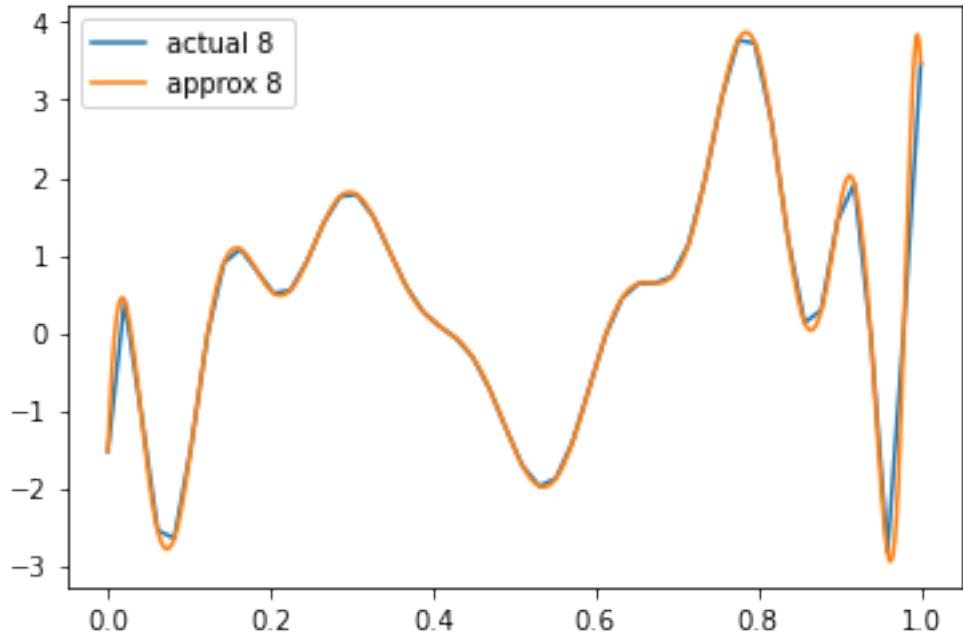


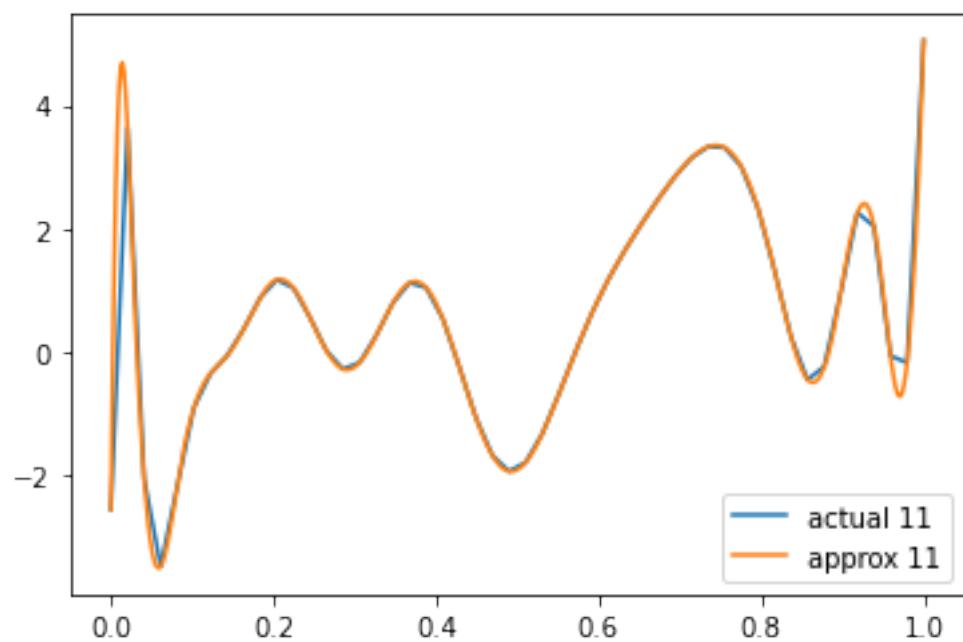
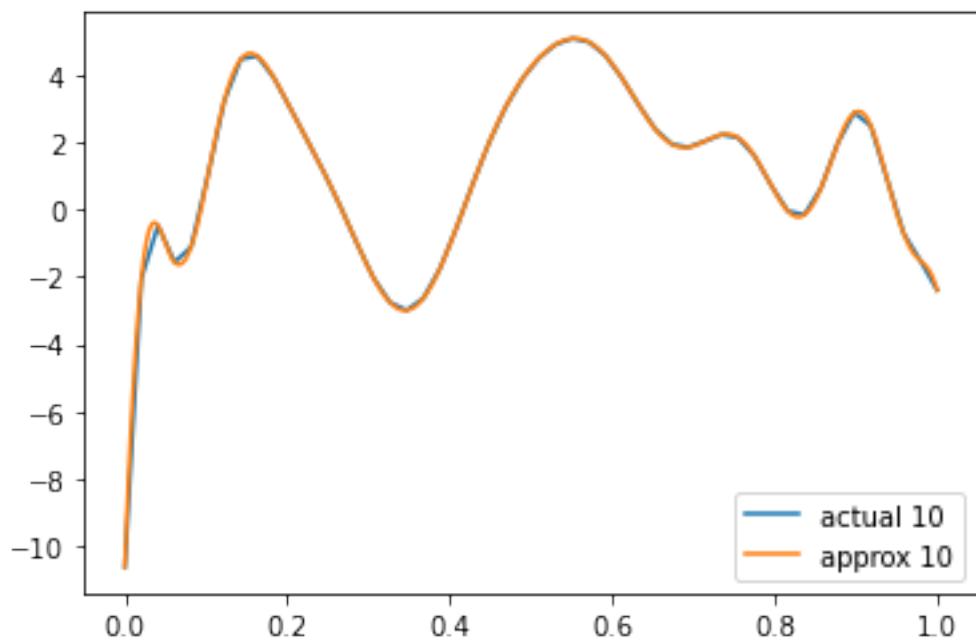


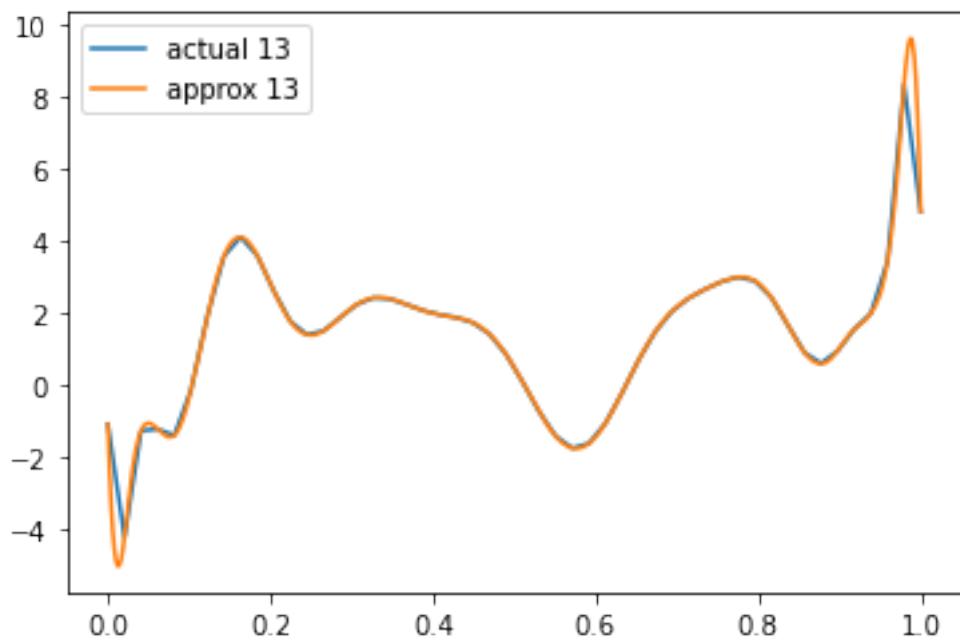
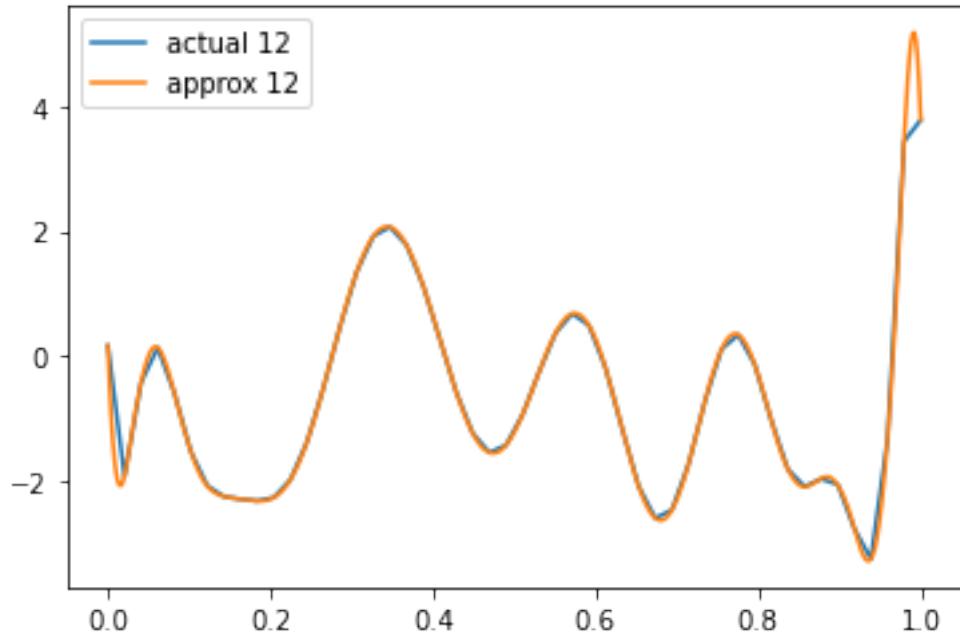


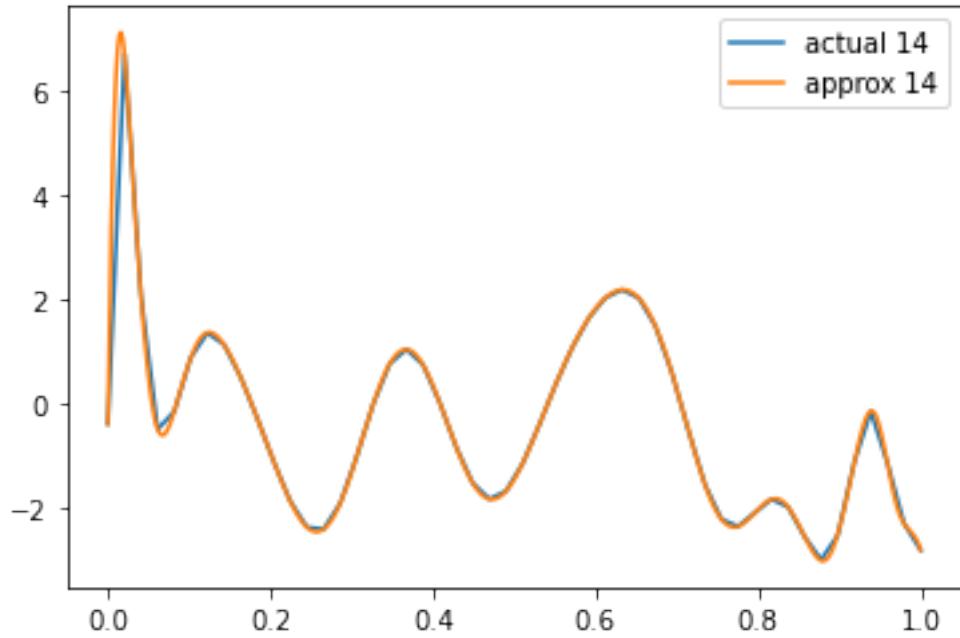




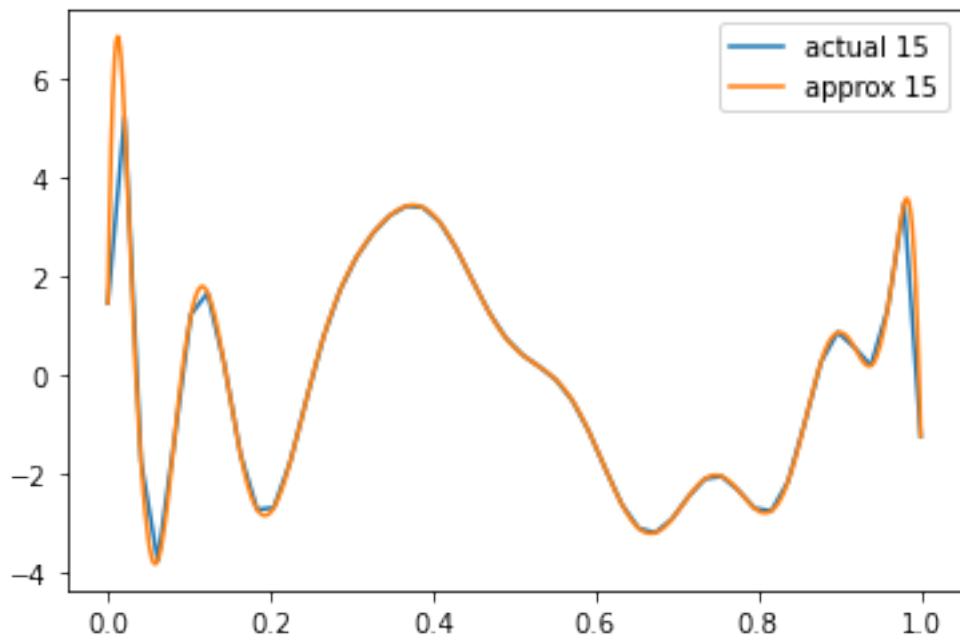


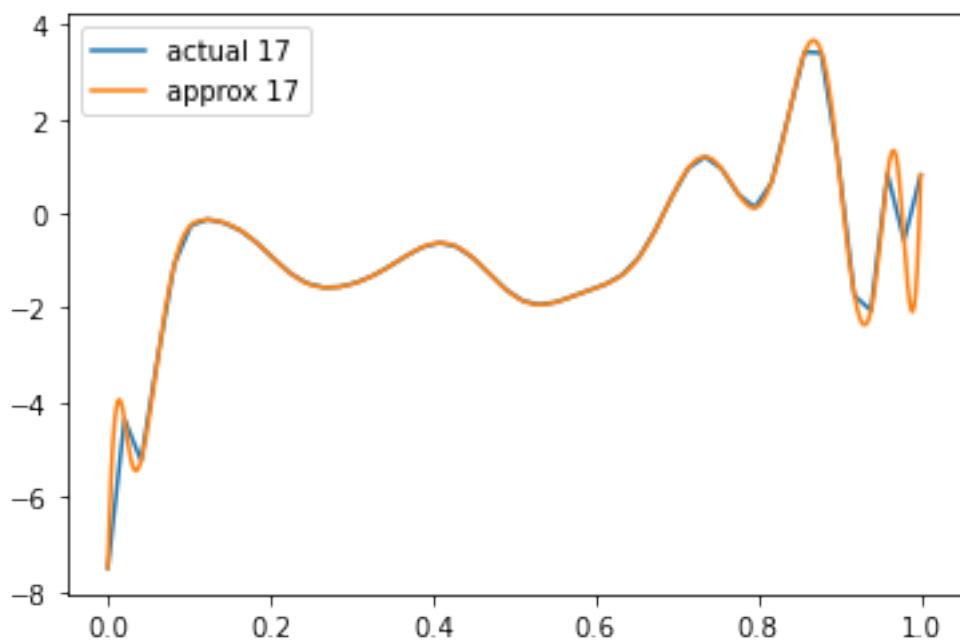
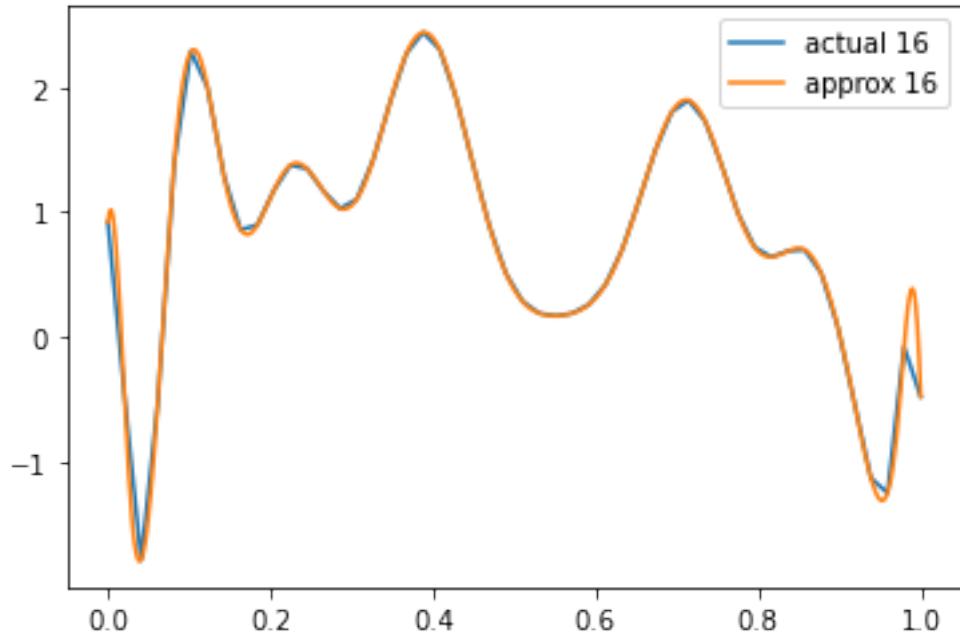


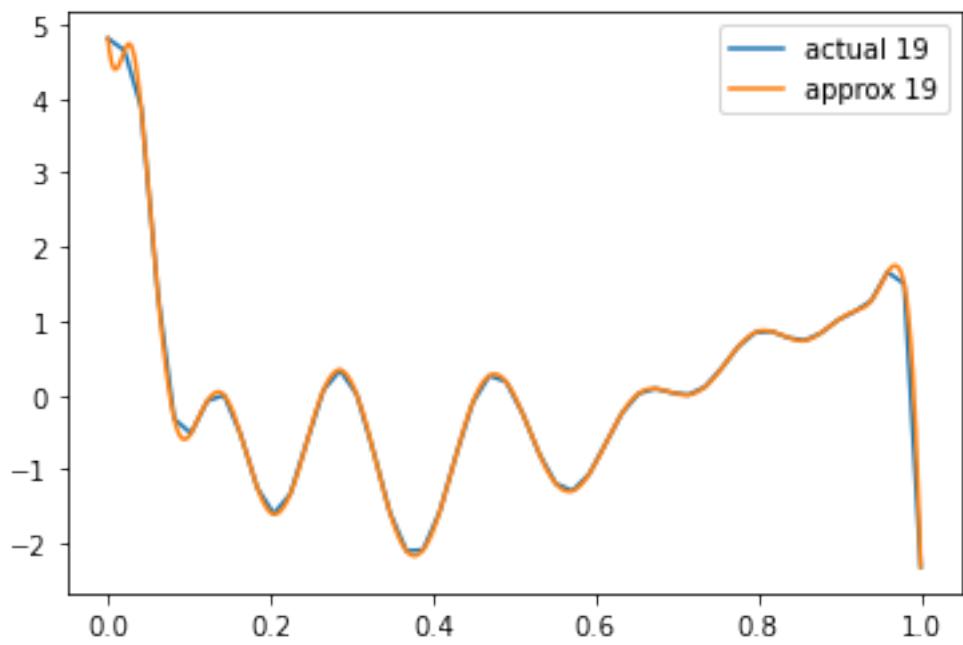
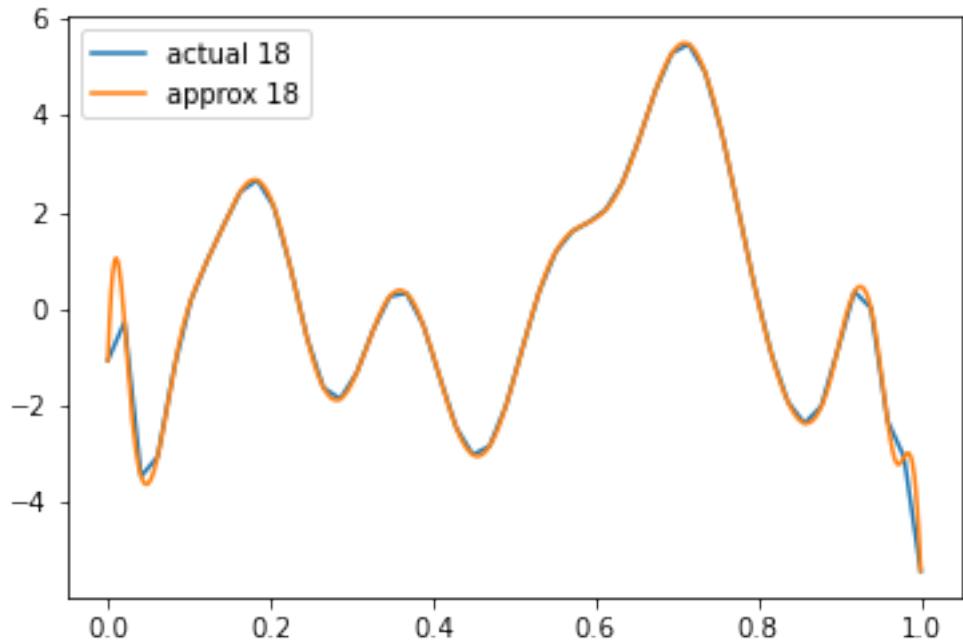


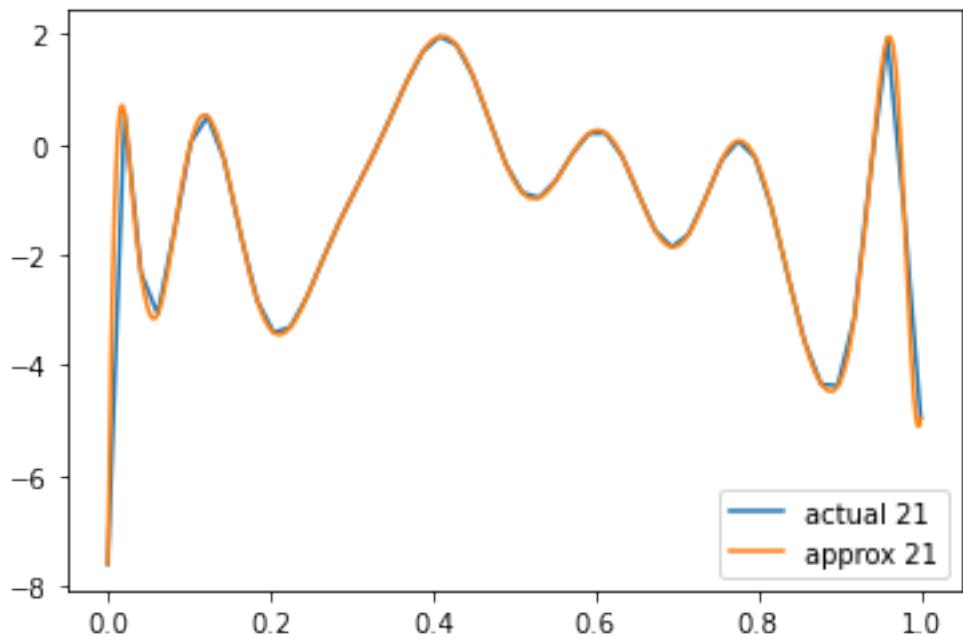
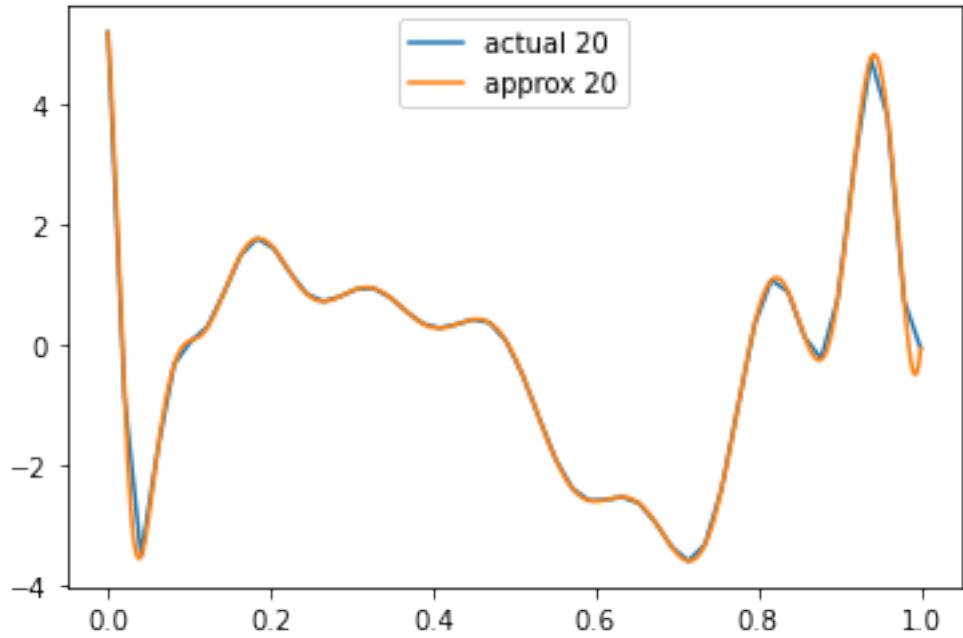


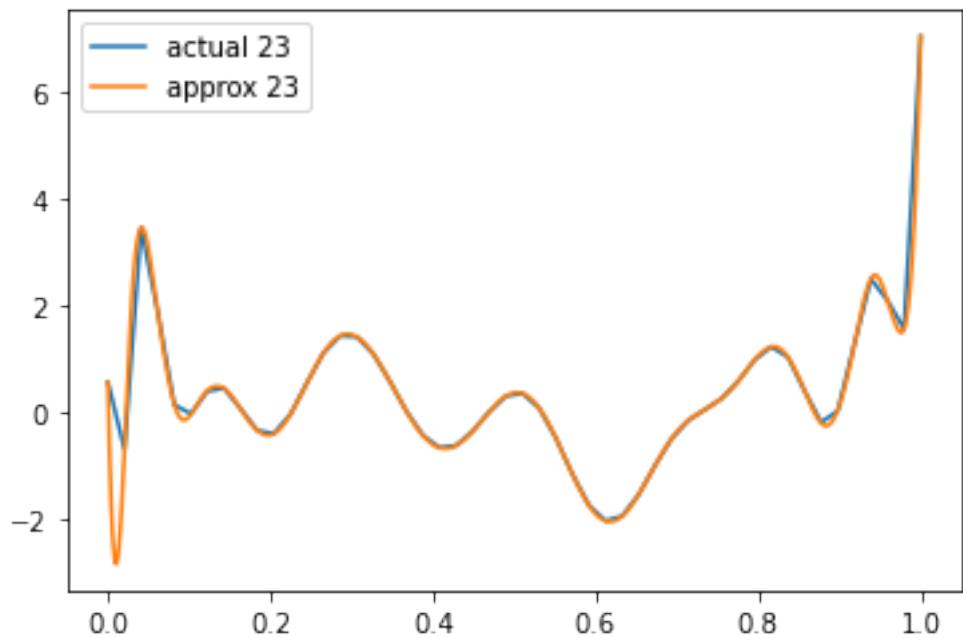
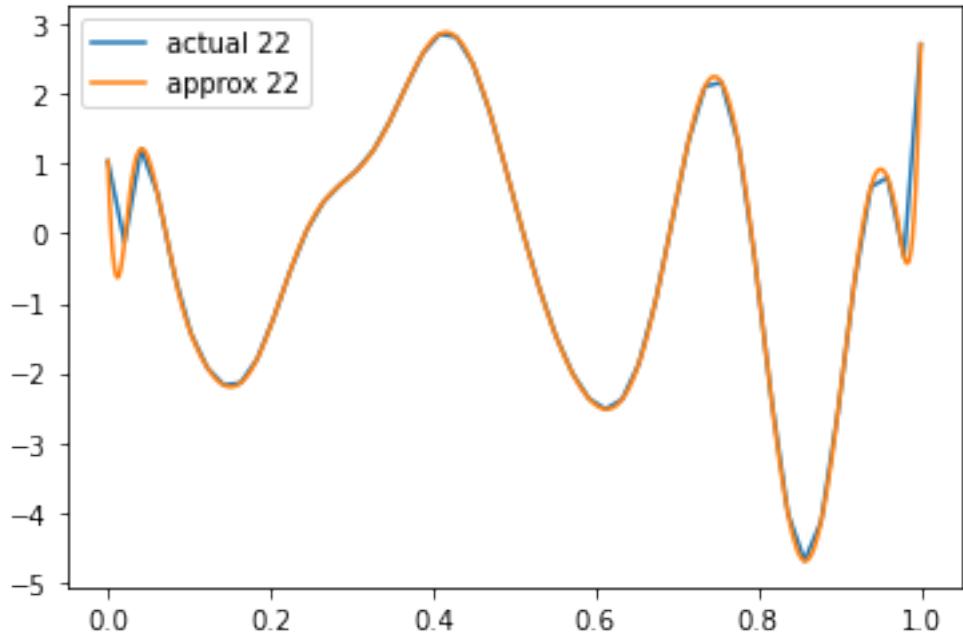
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to bounds  
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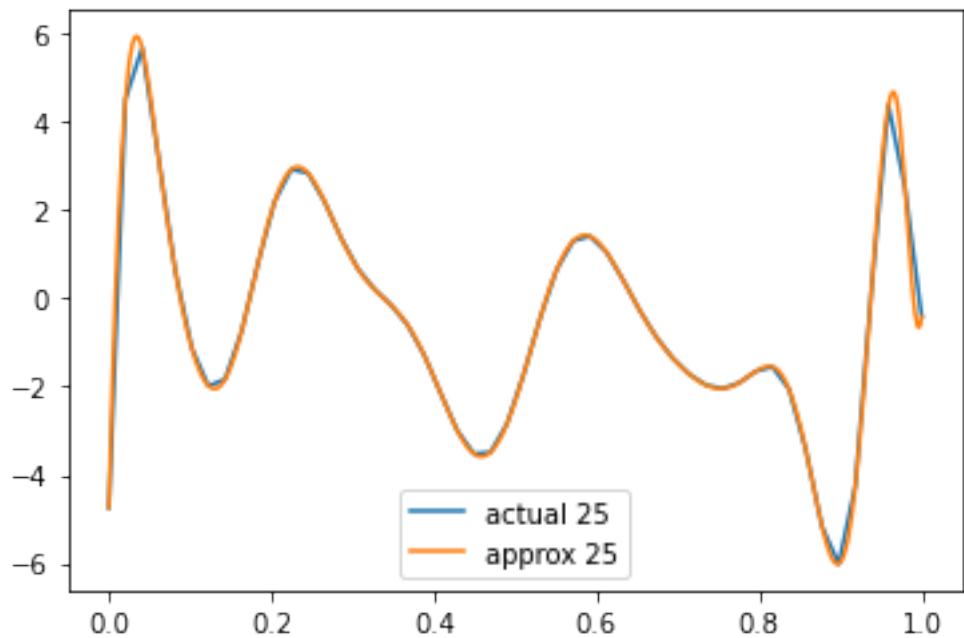
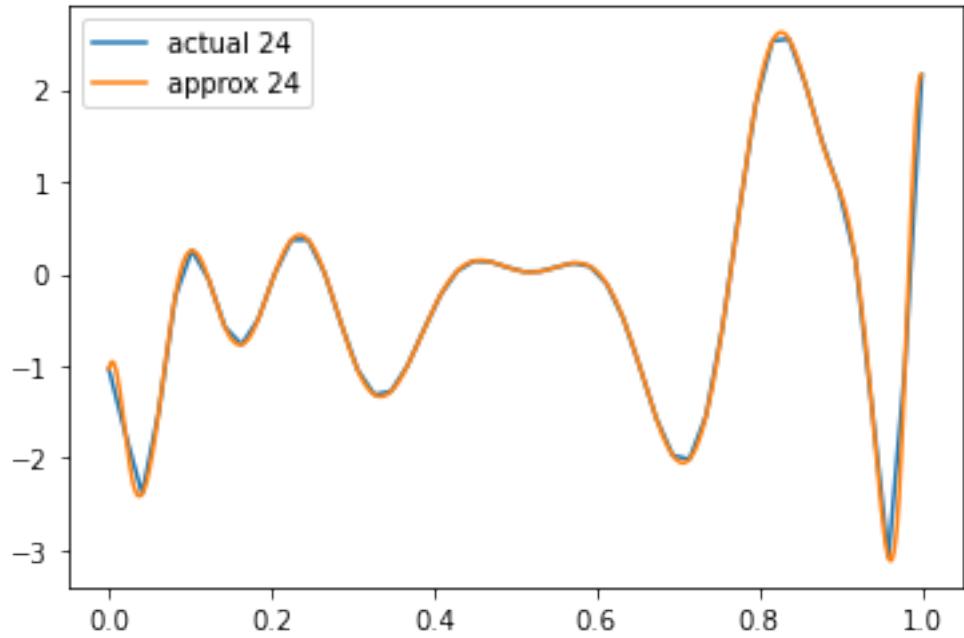


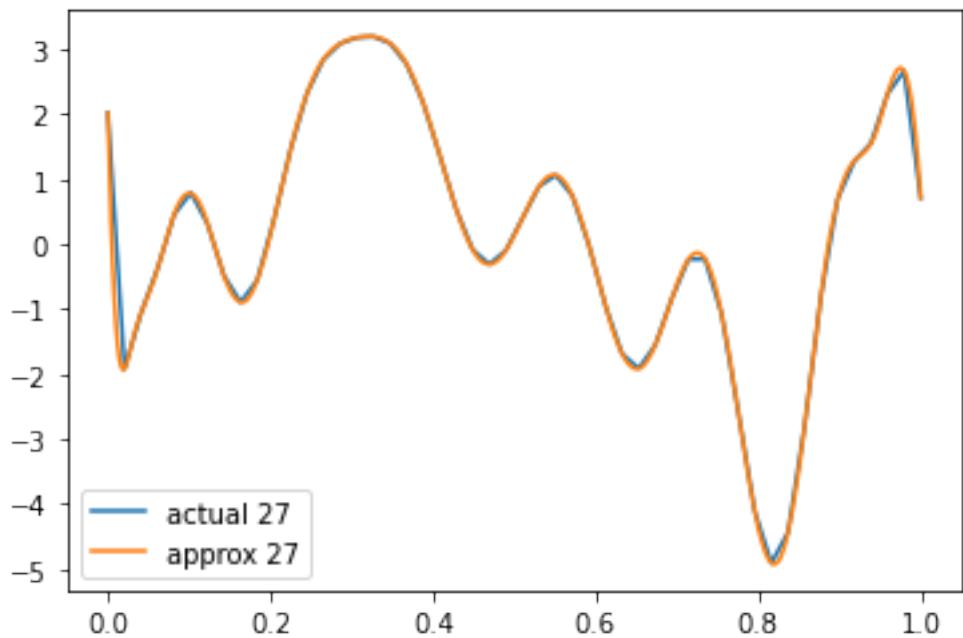
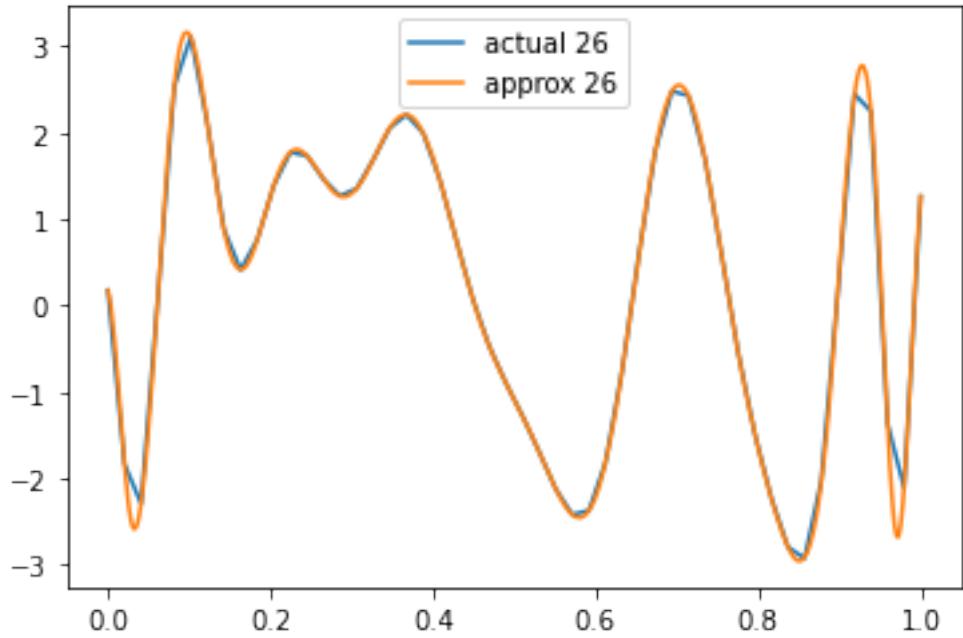


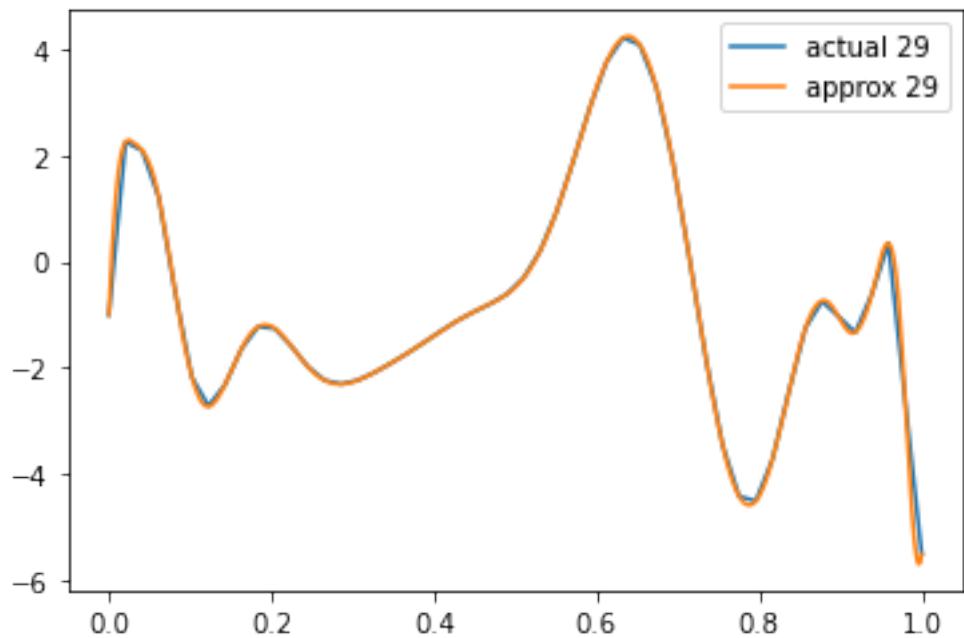
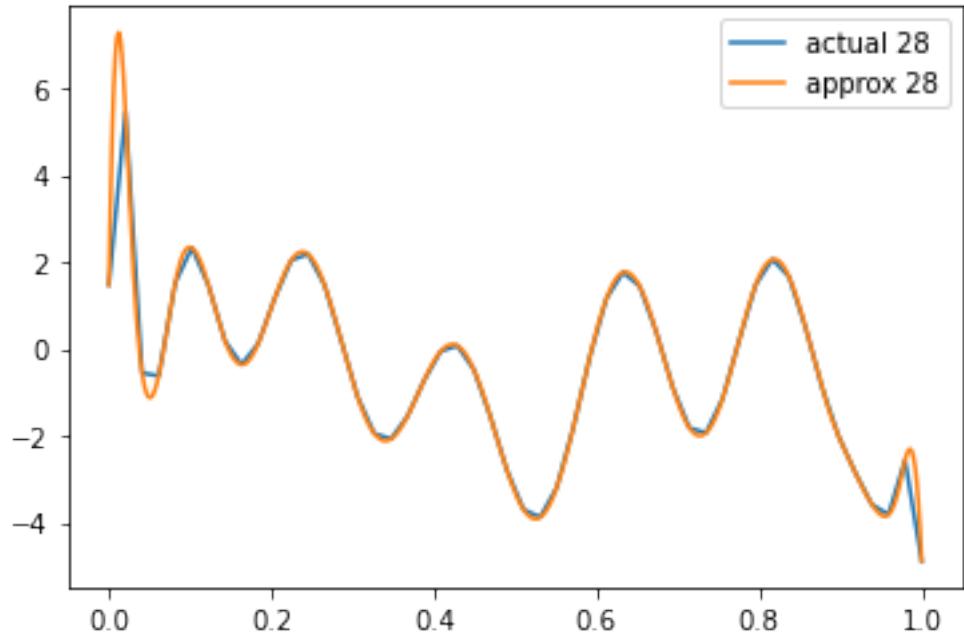


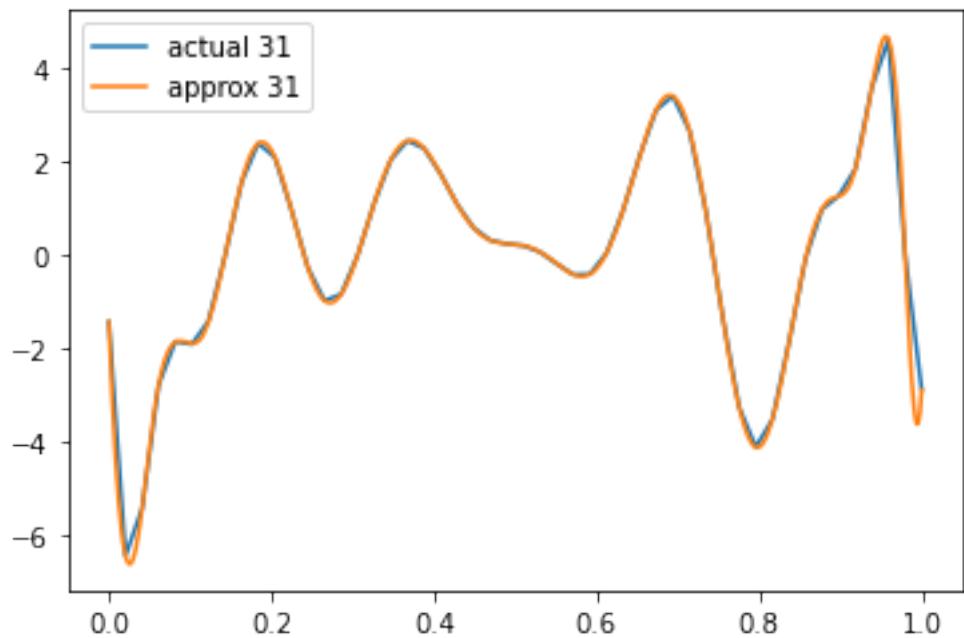
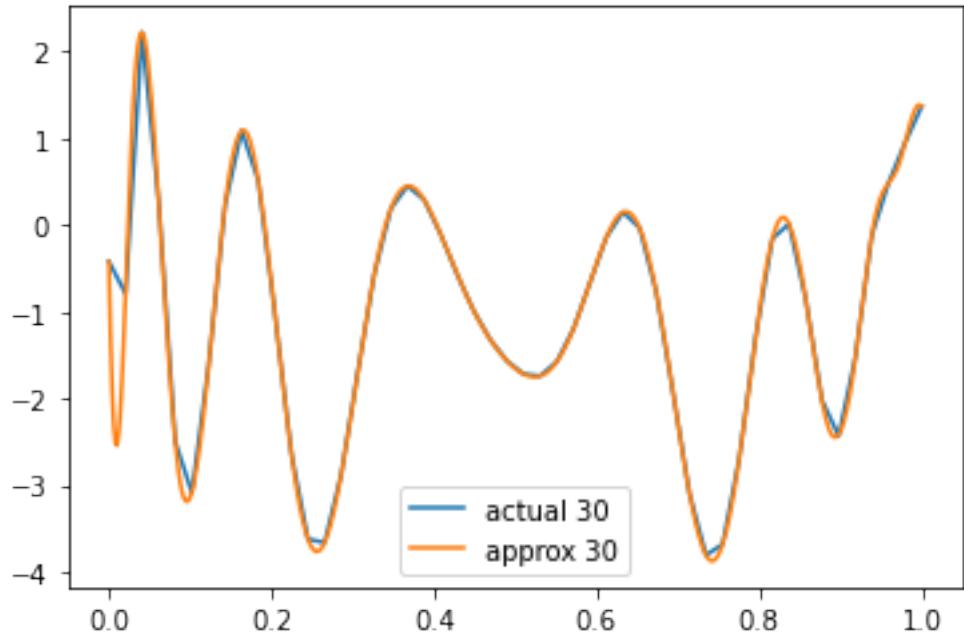


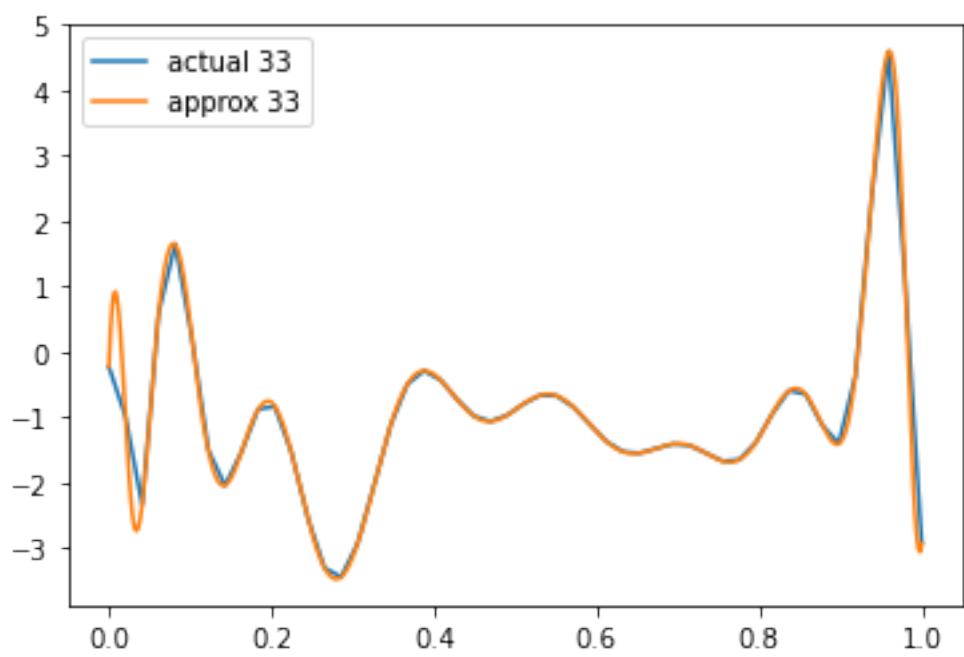
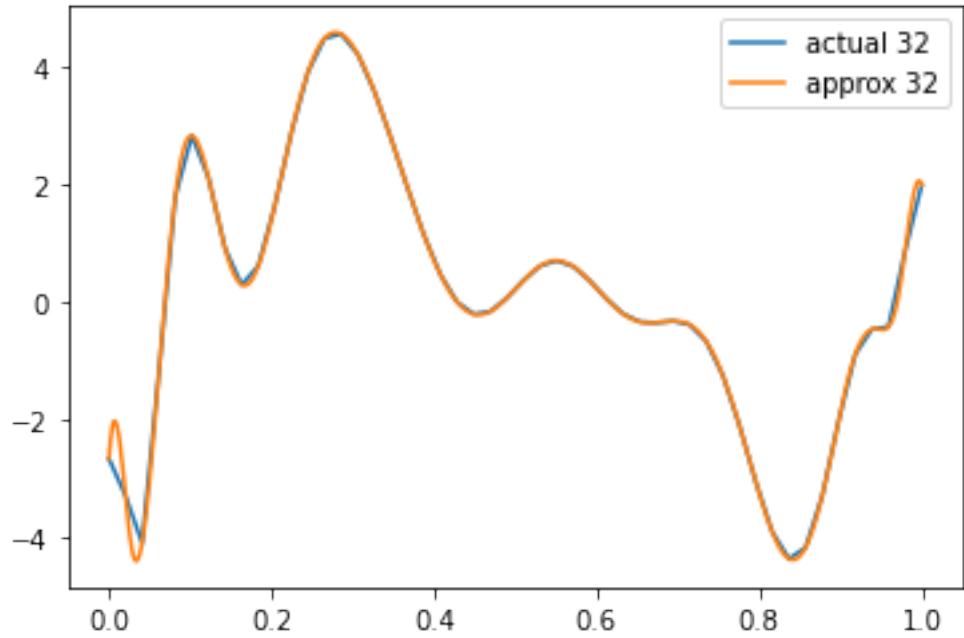


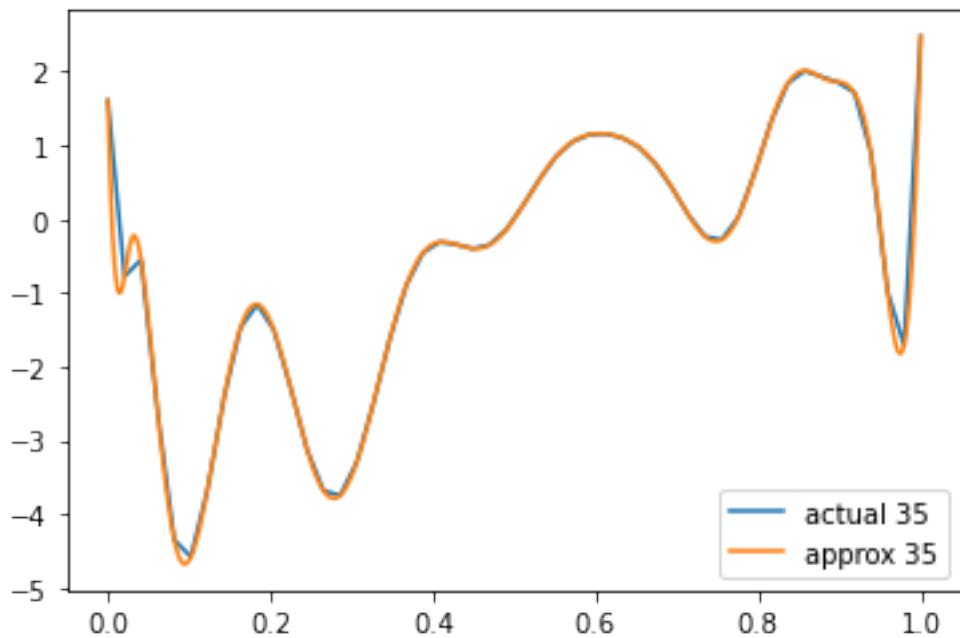
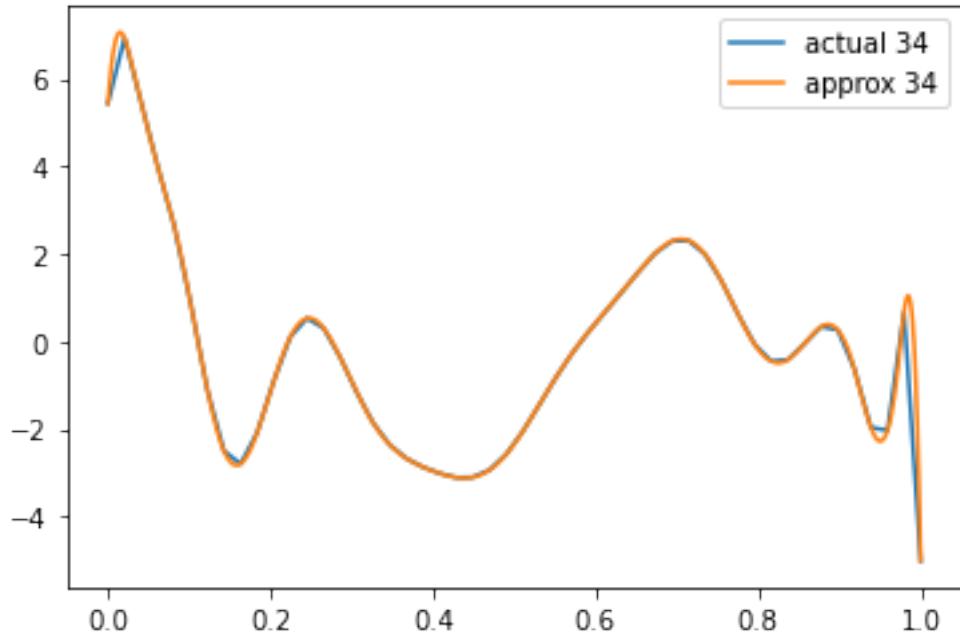


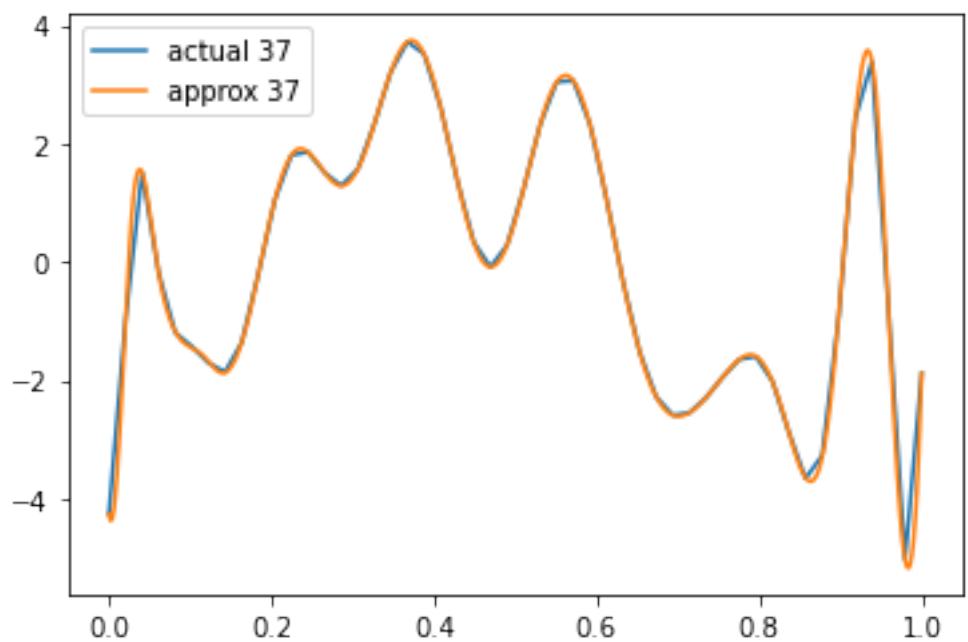
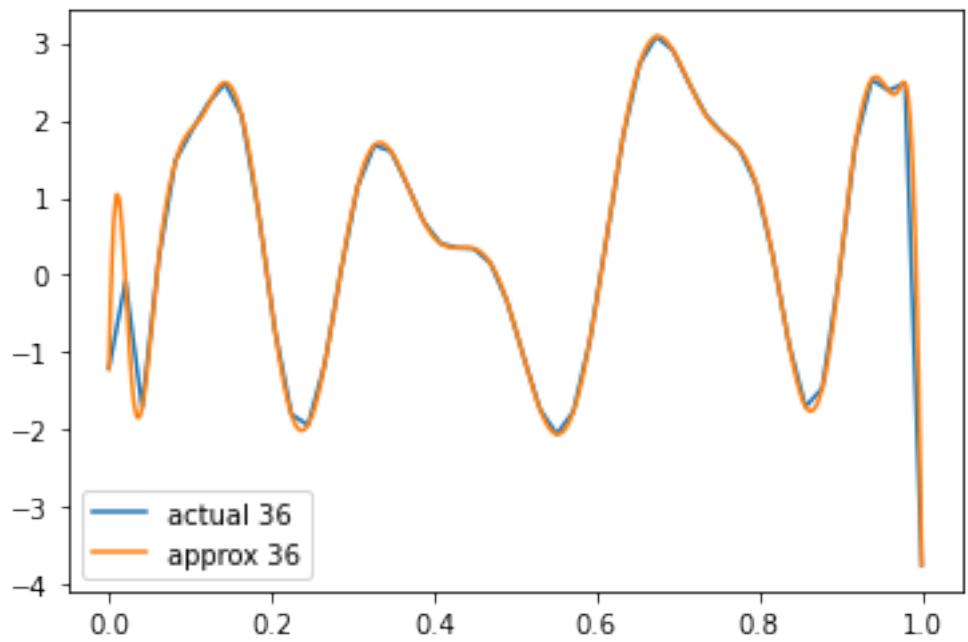


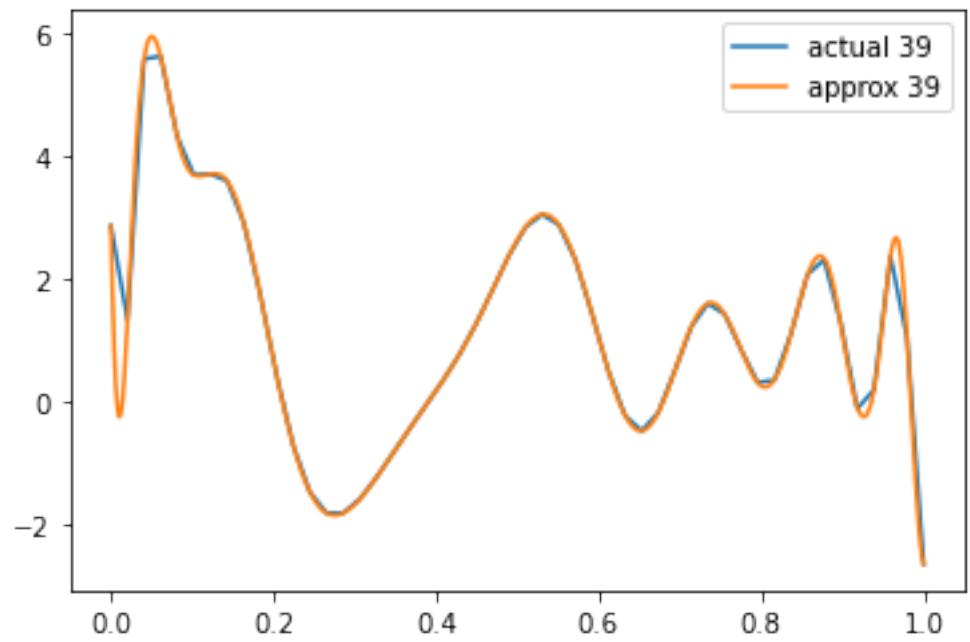
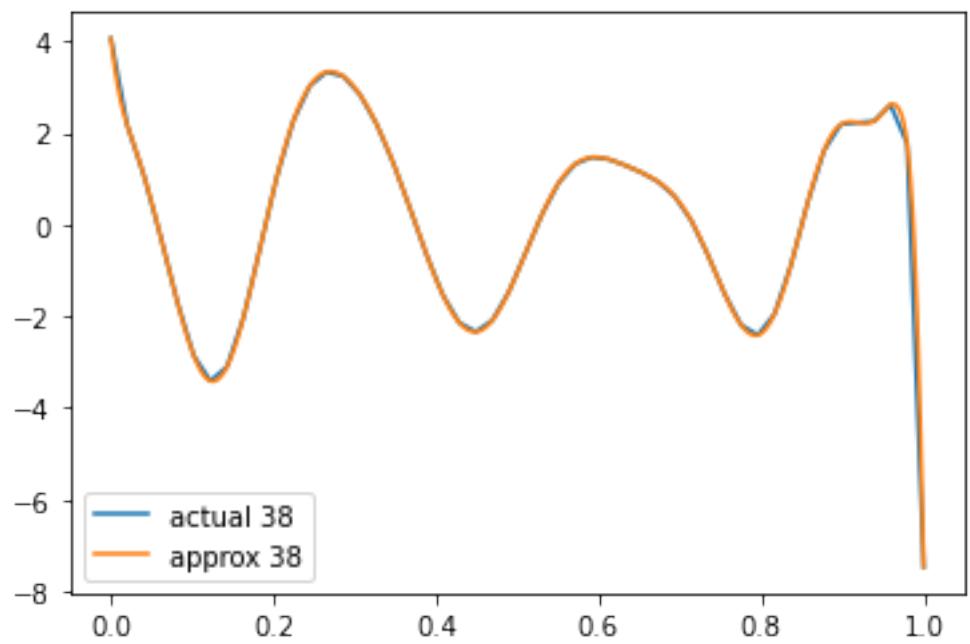


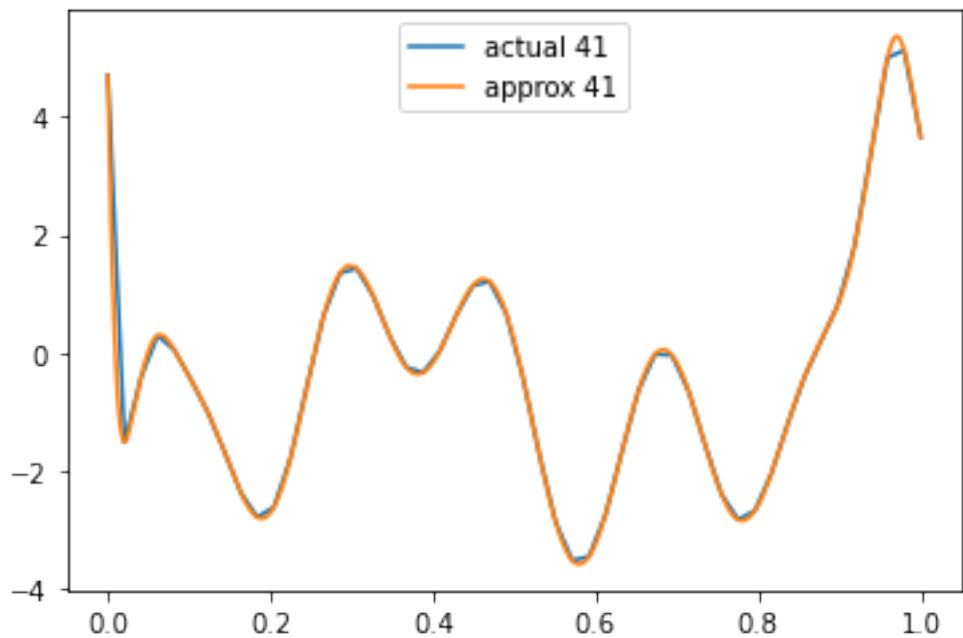
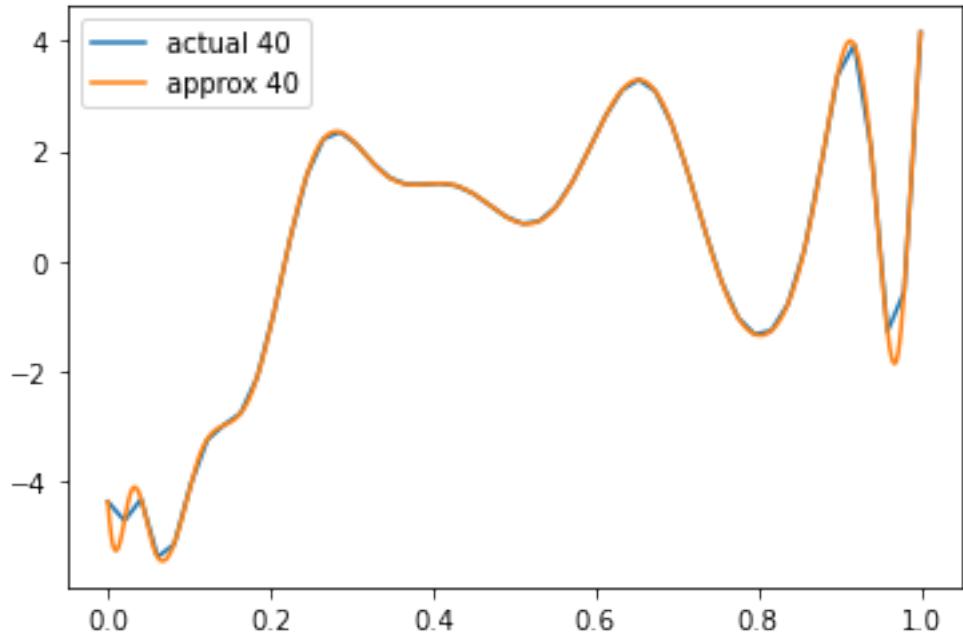


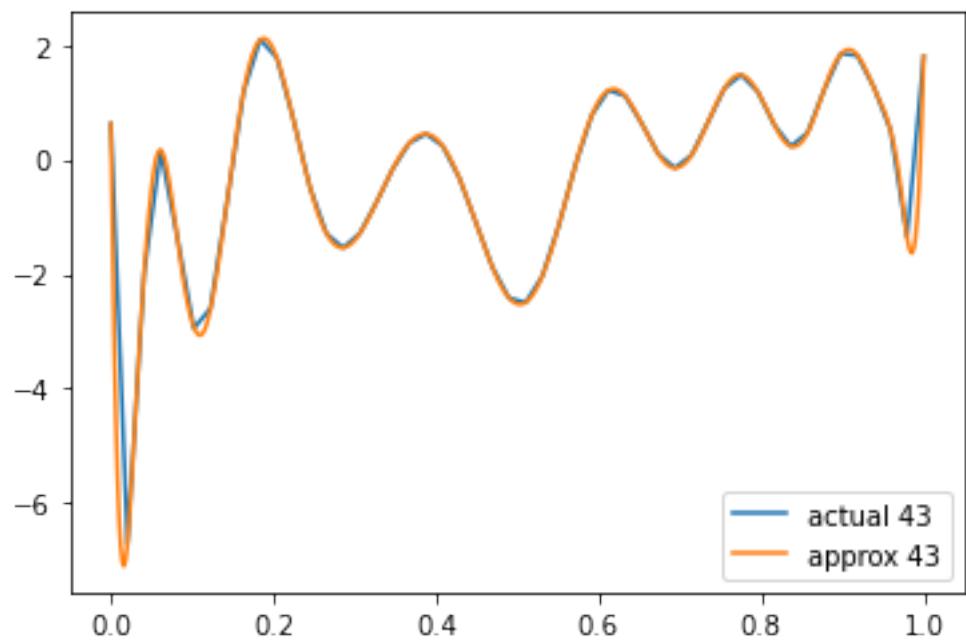
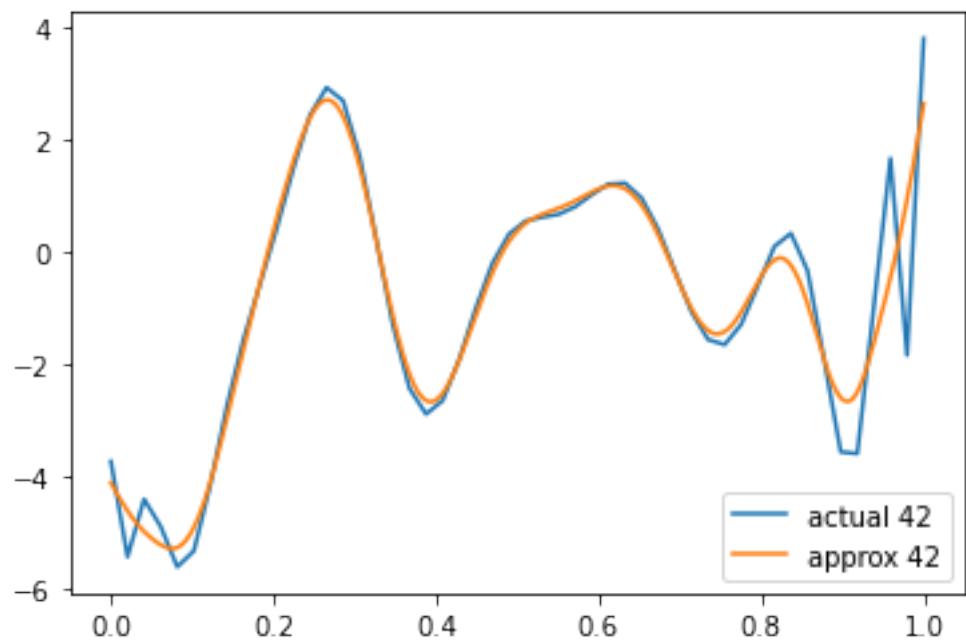


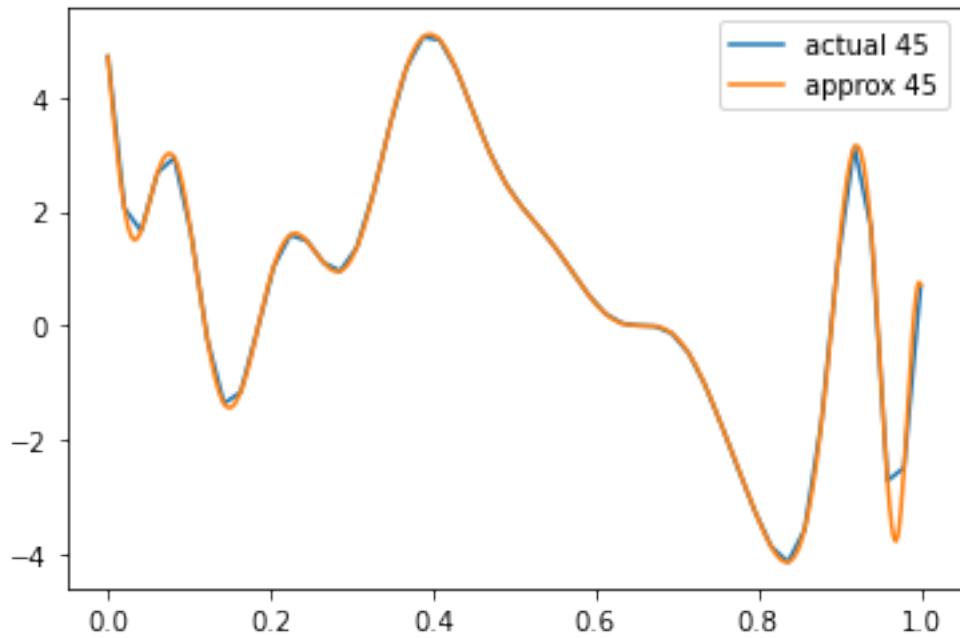
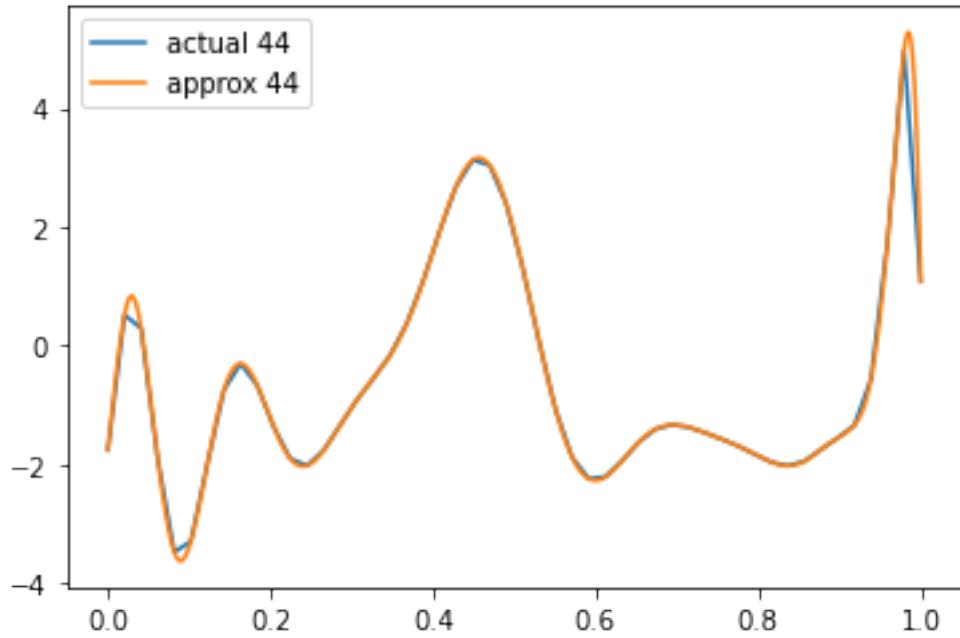


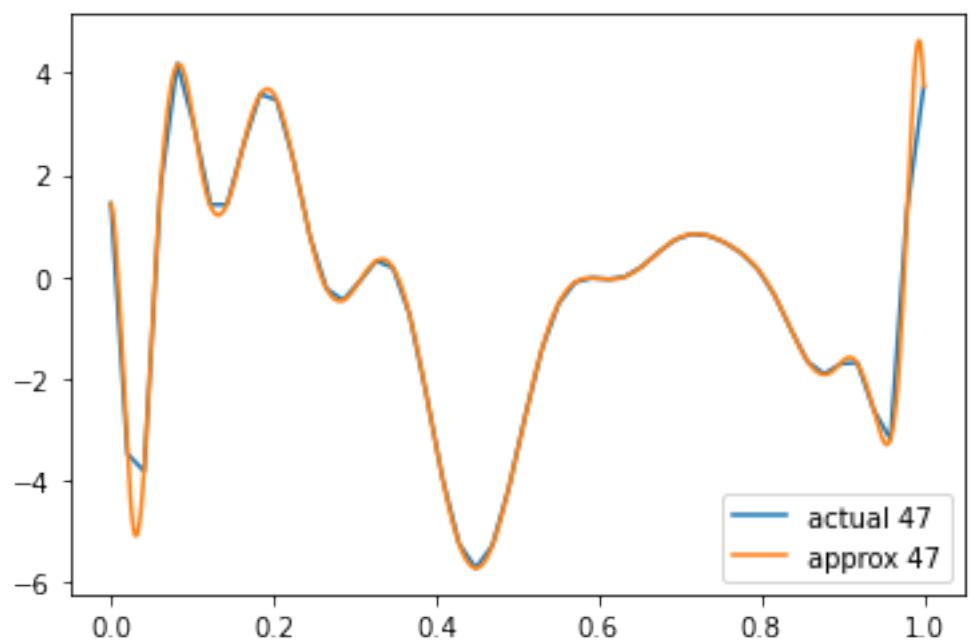
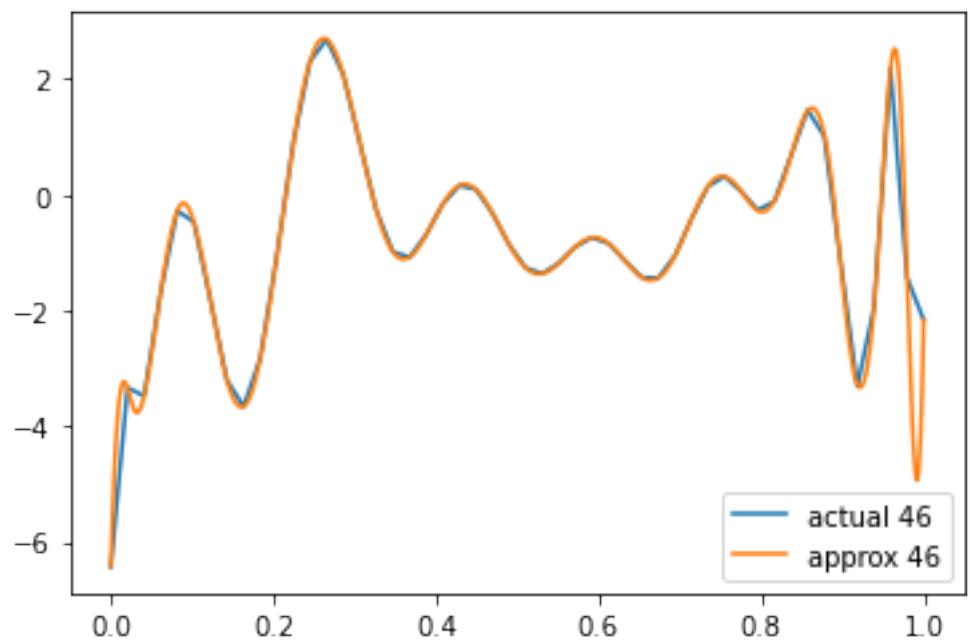


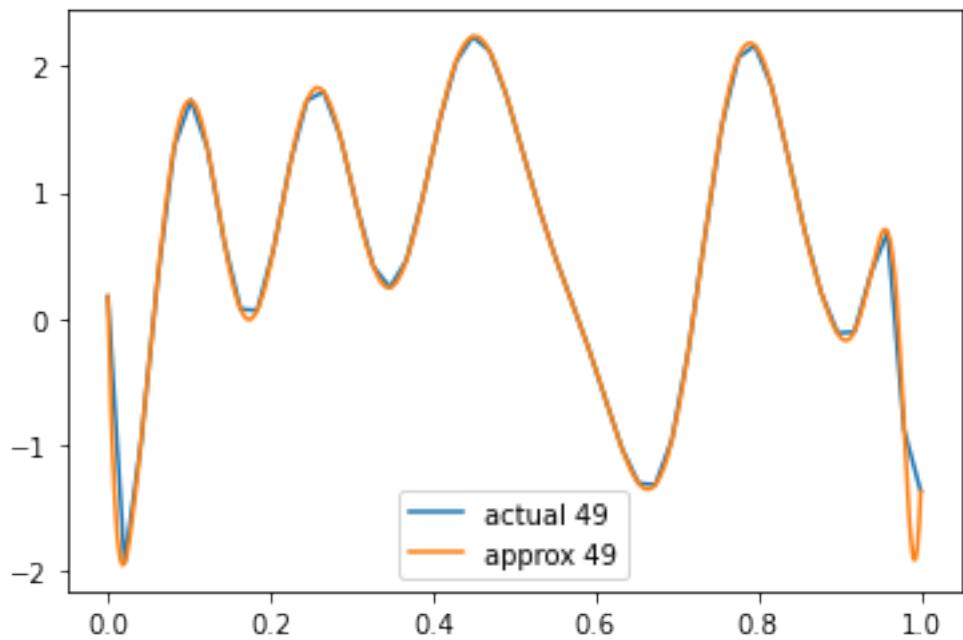
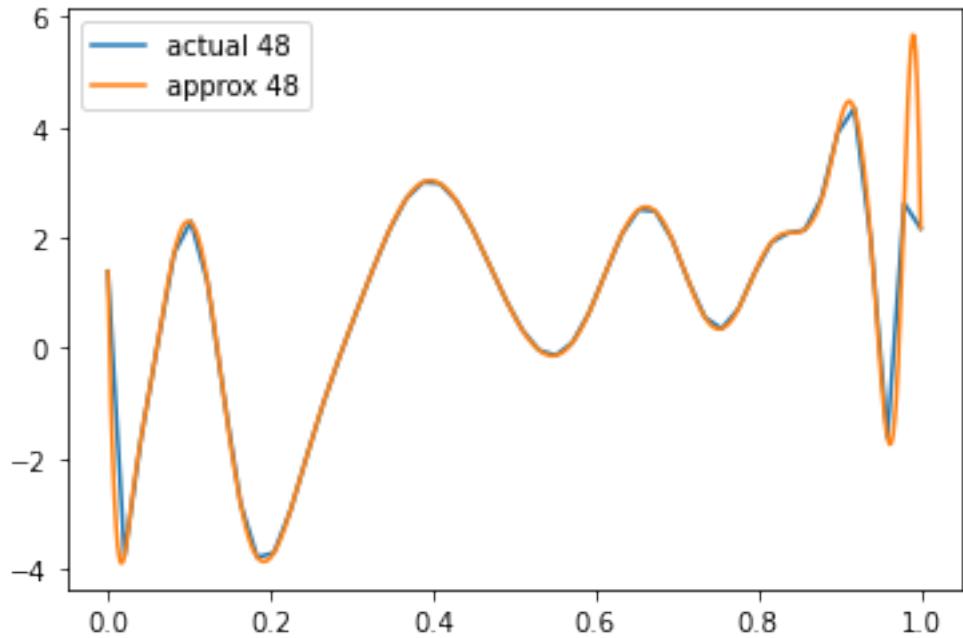


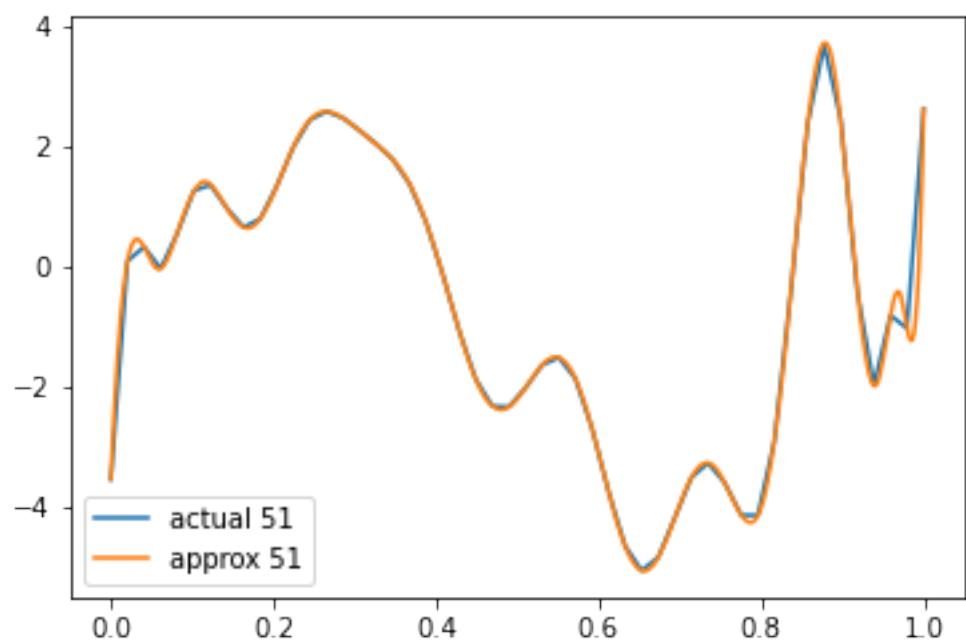
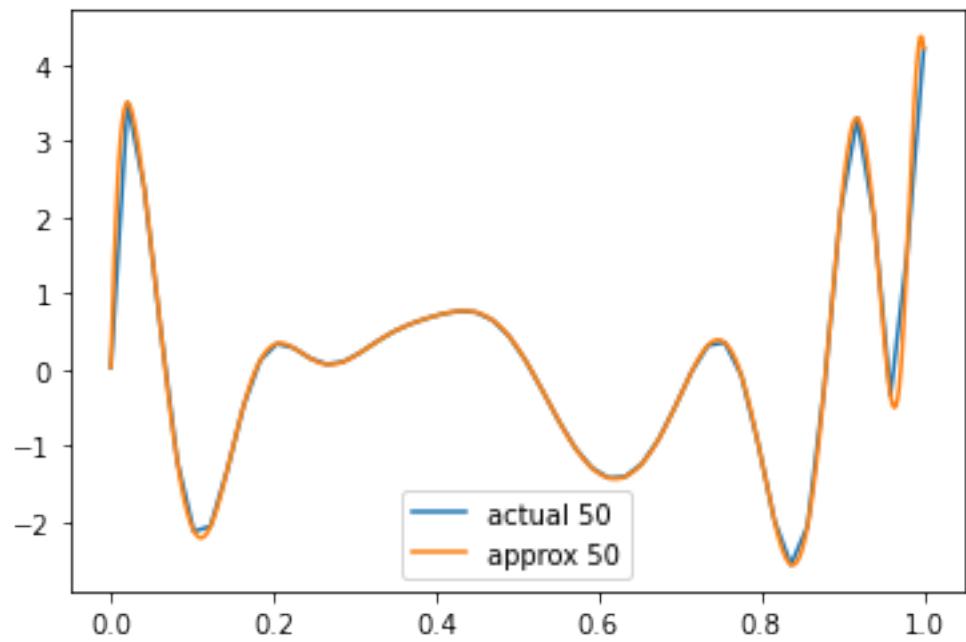


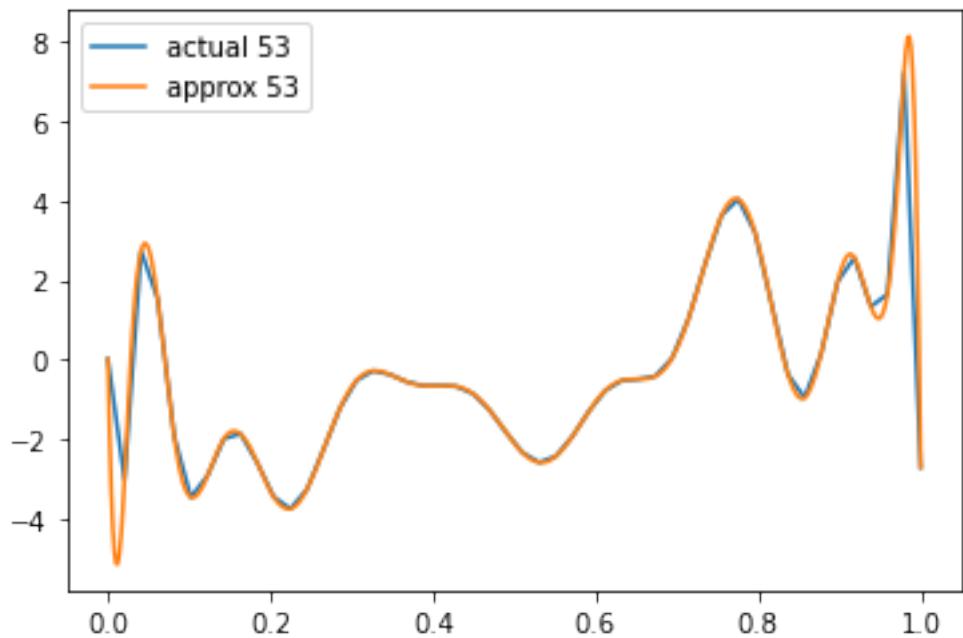
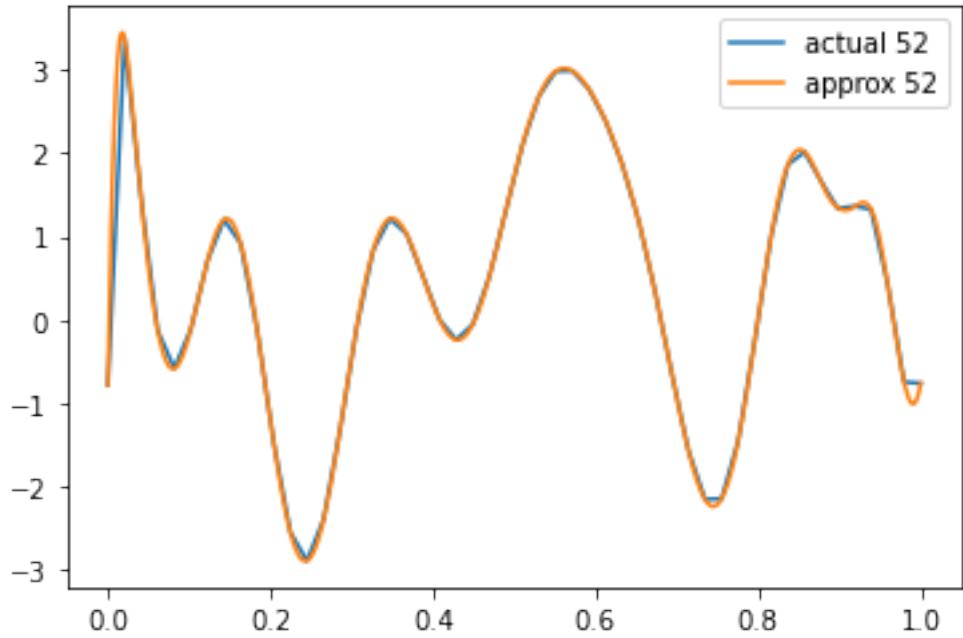


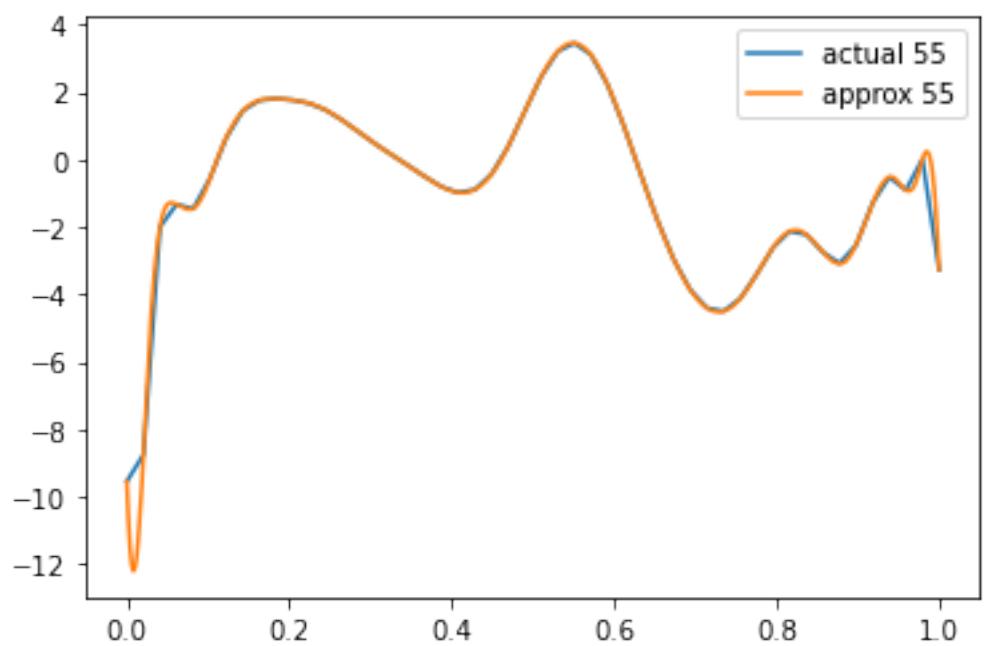
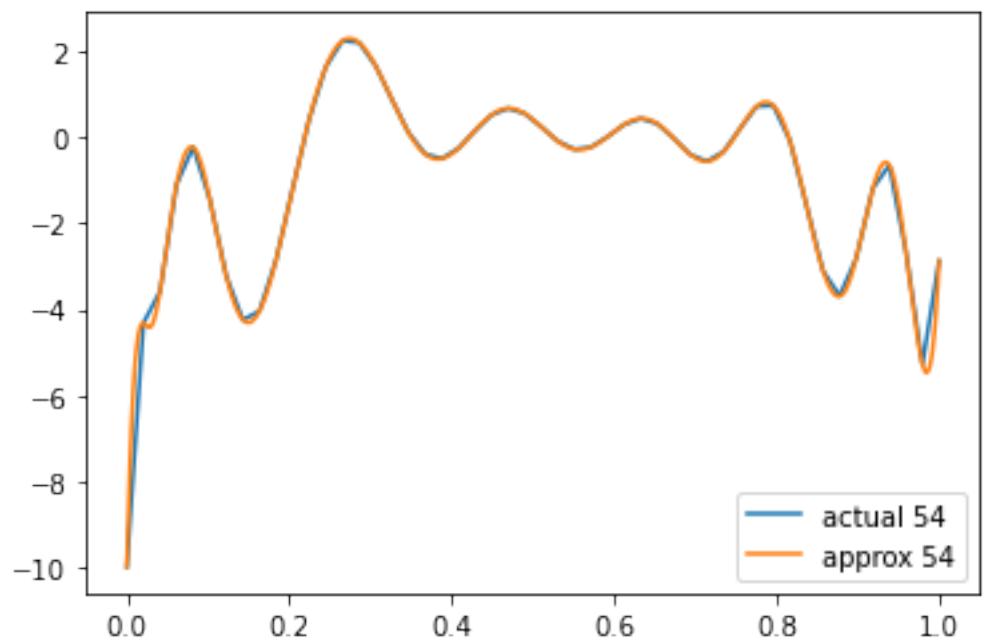


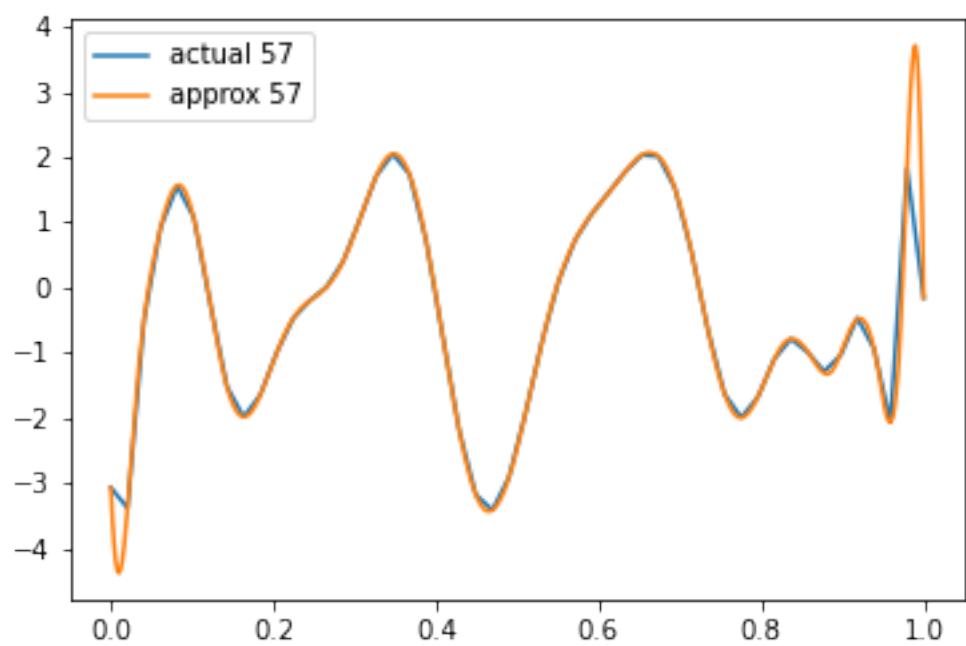
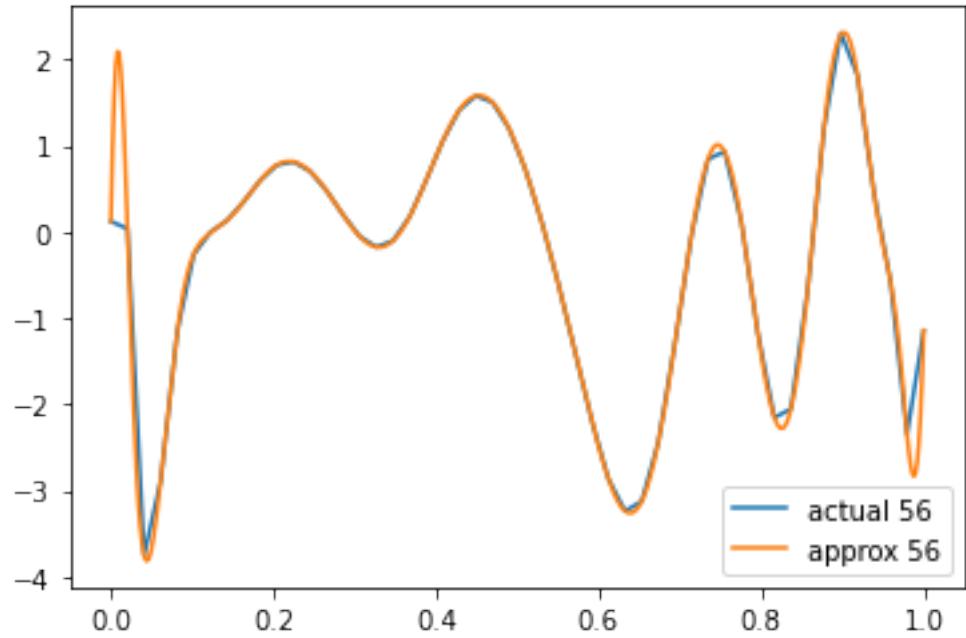


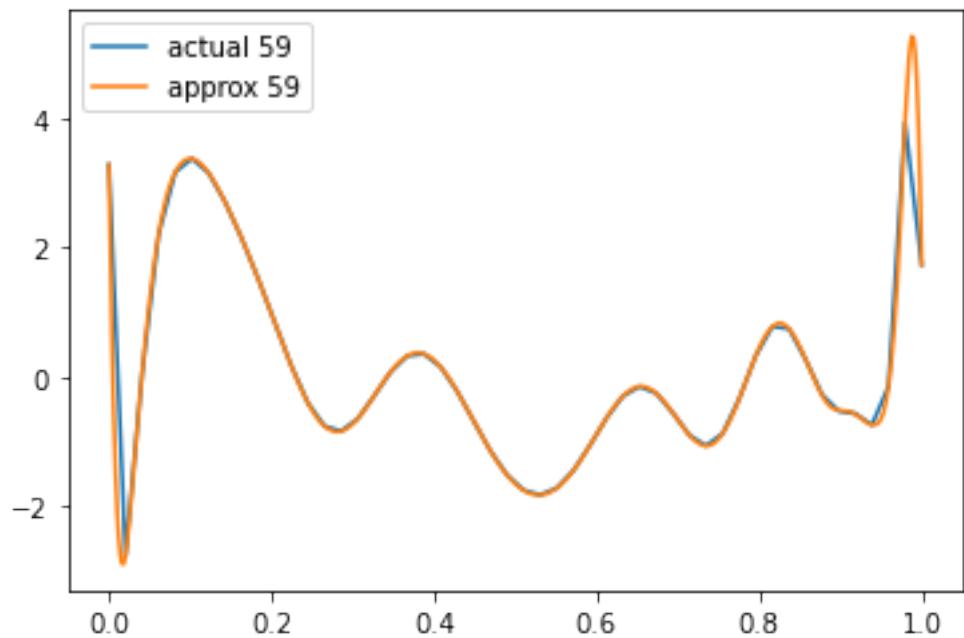
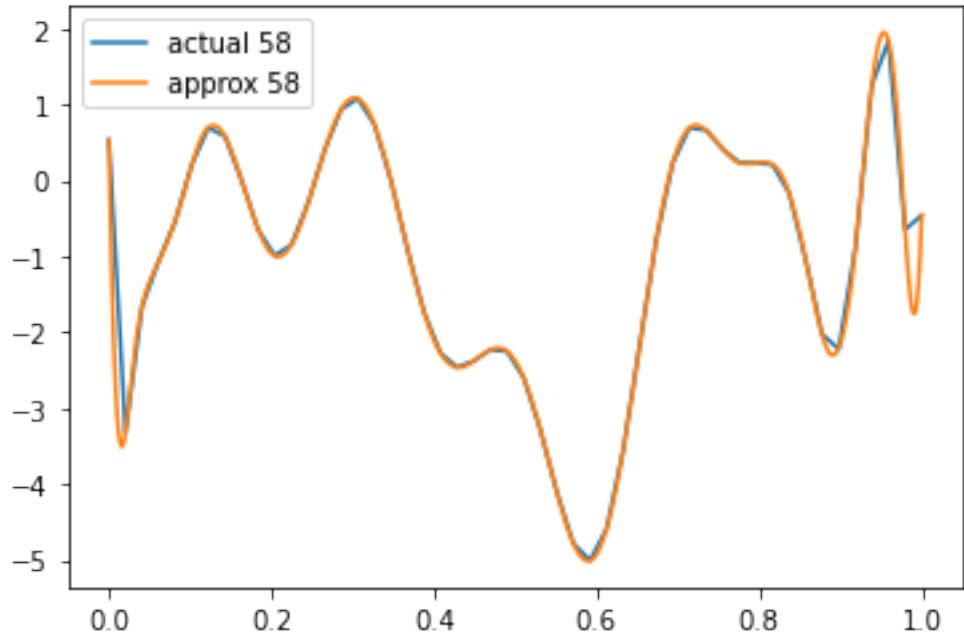


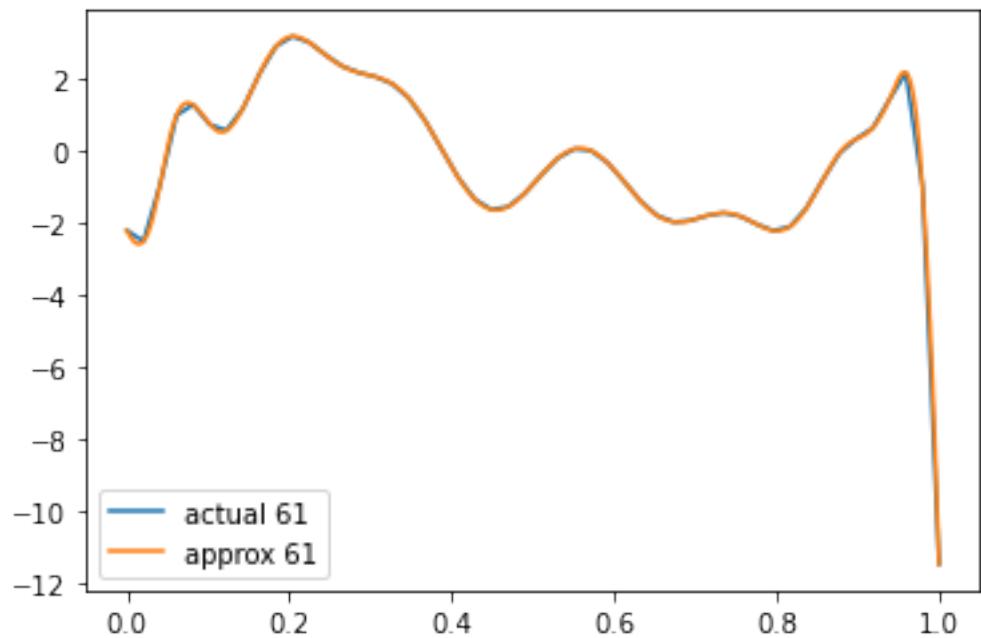
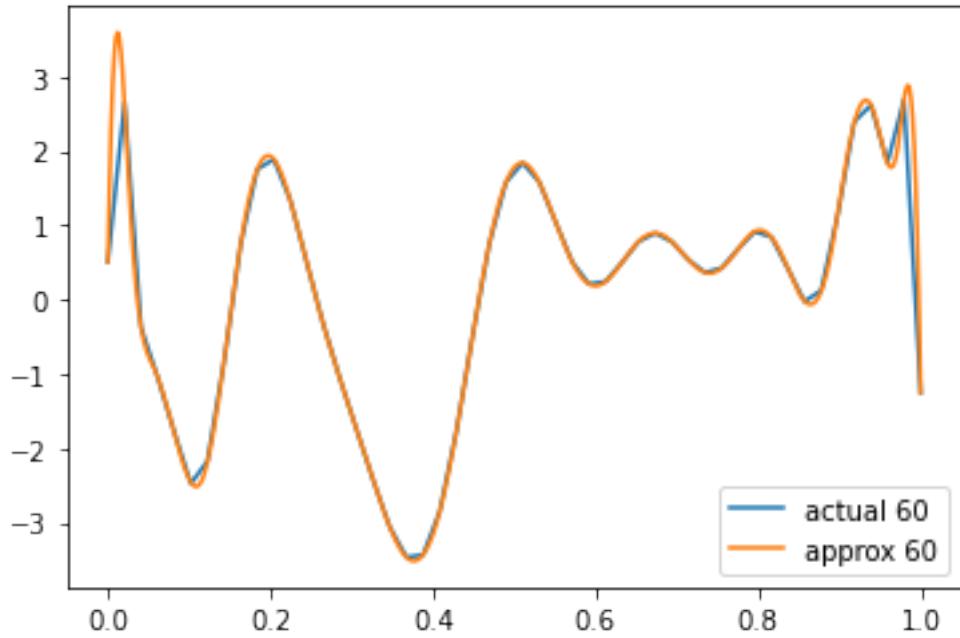


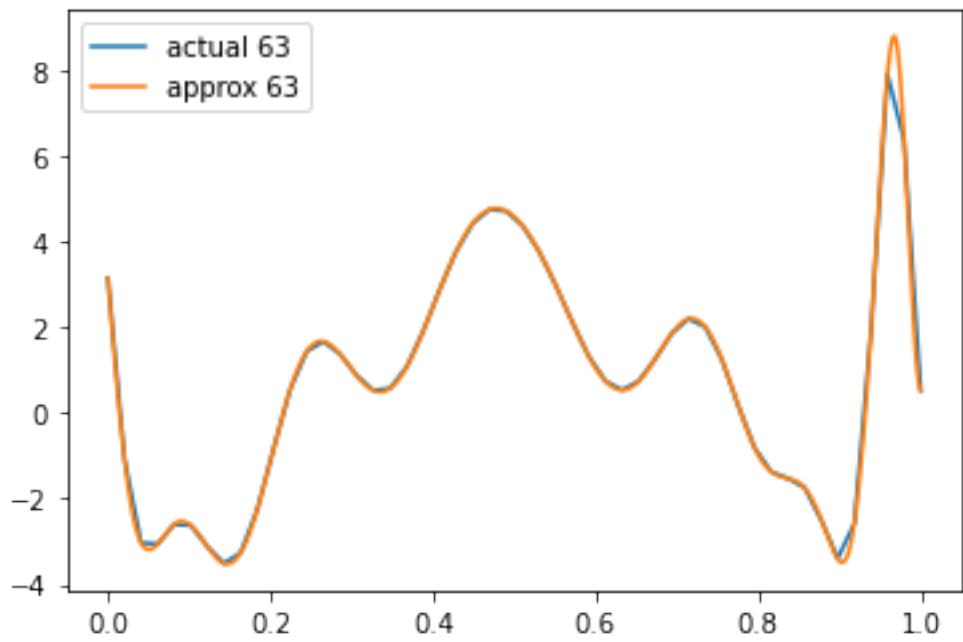
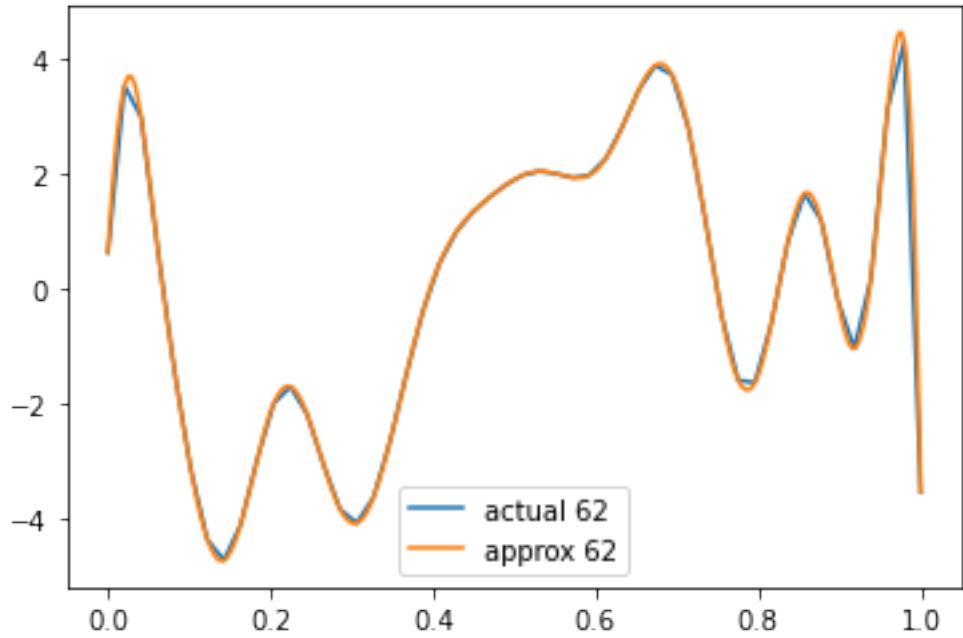


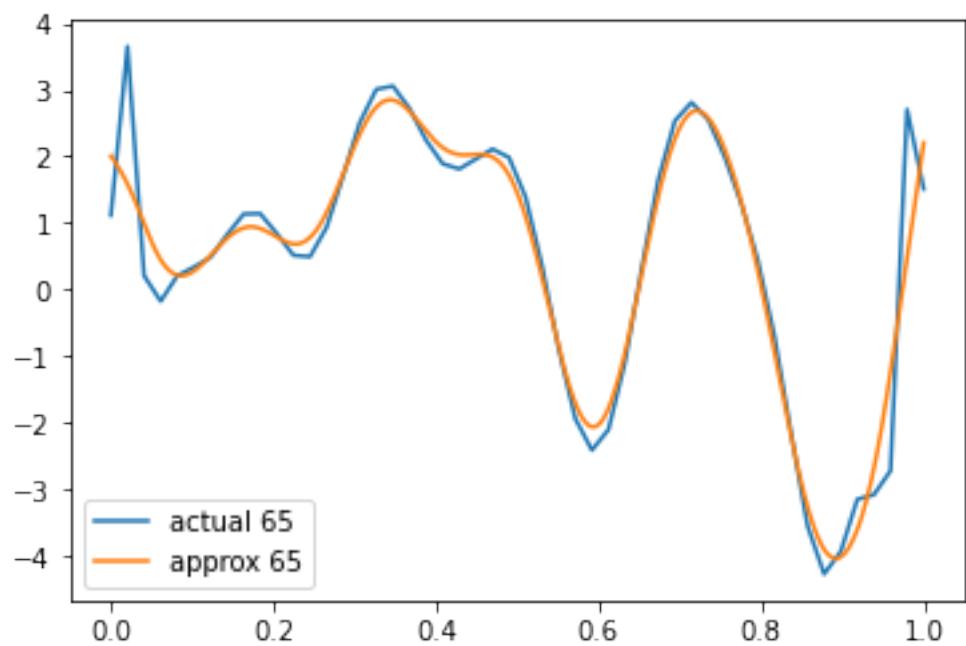
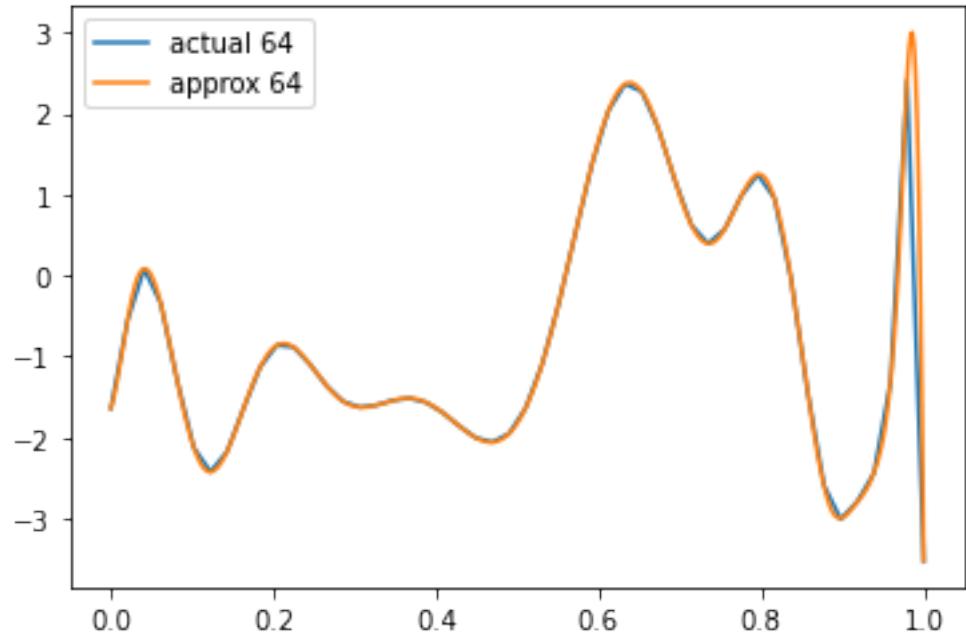


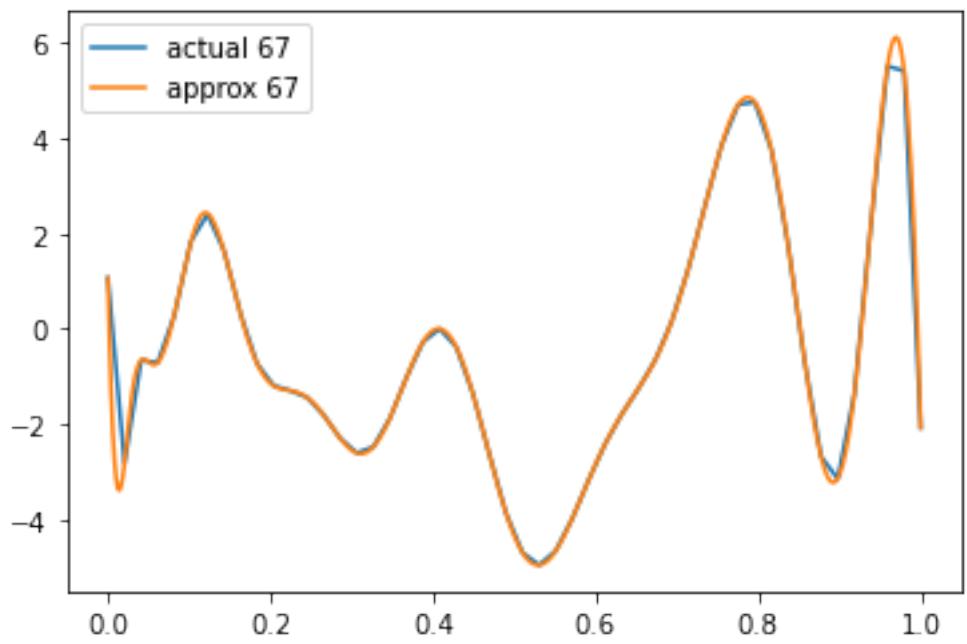
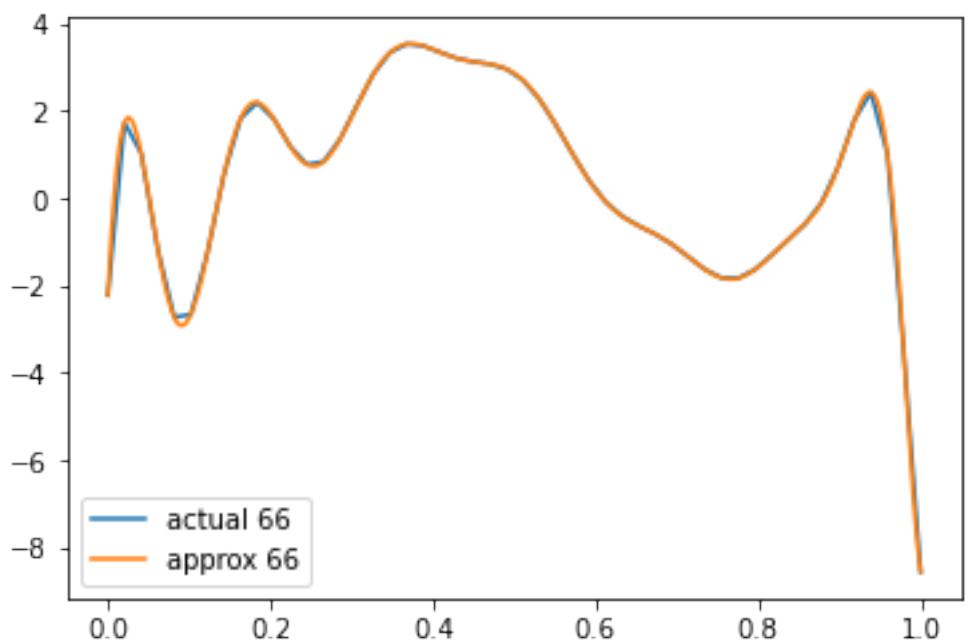


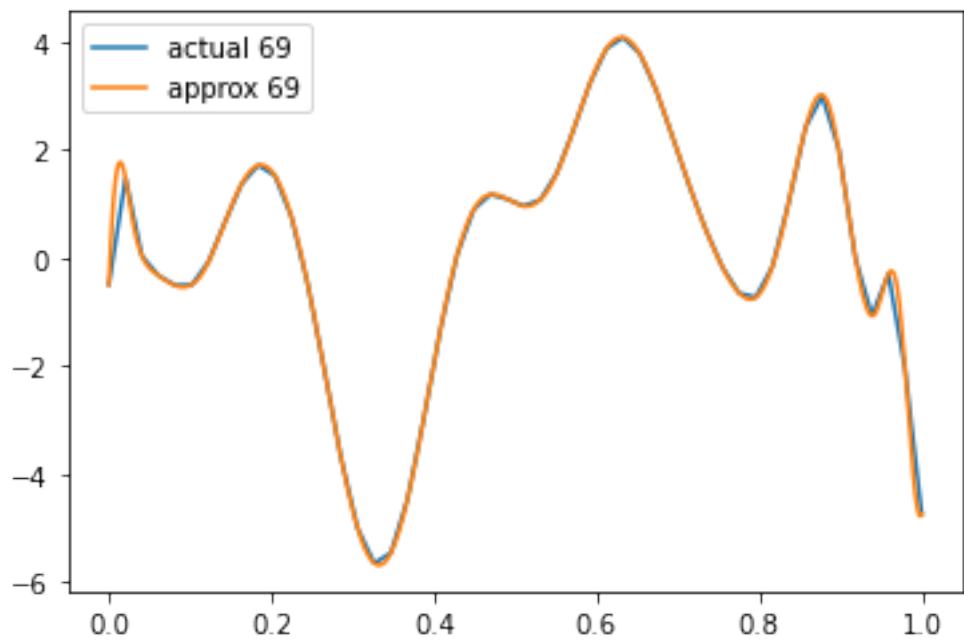
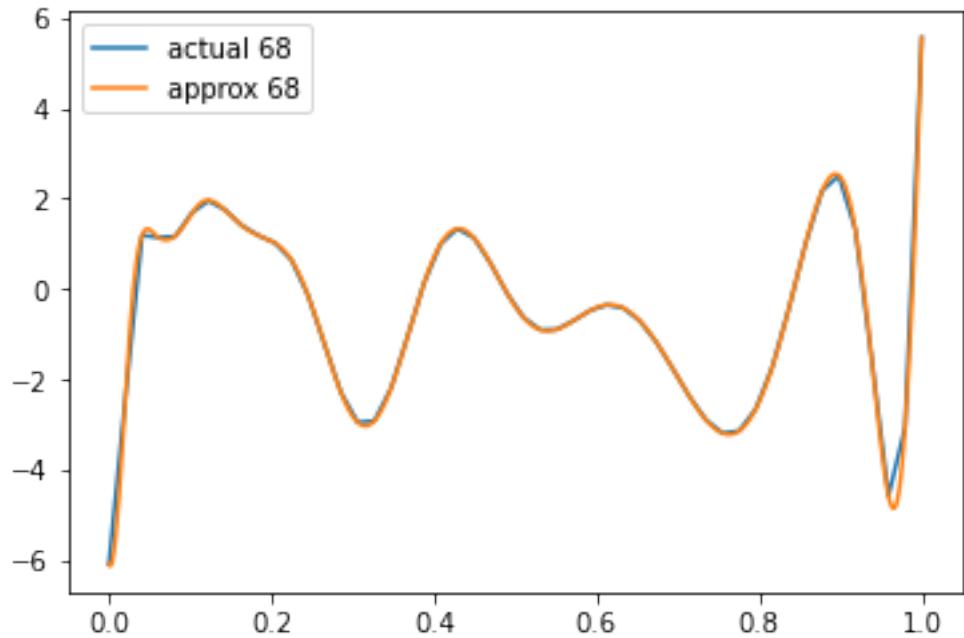


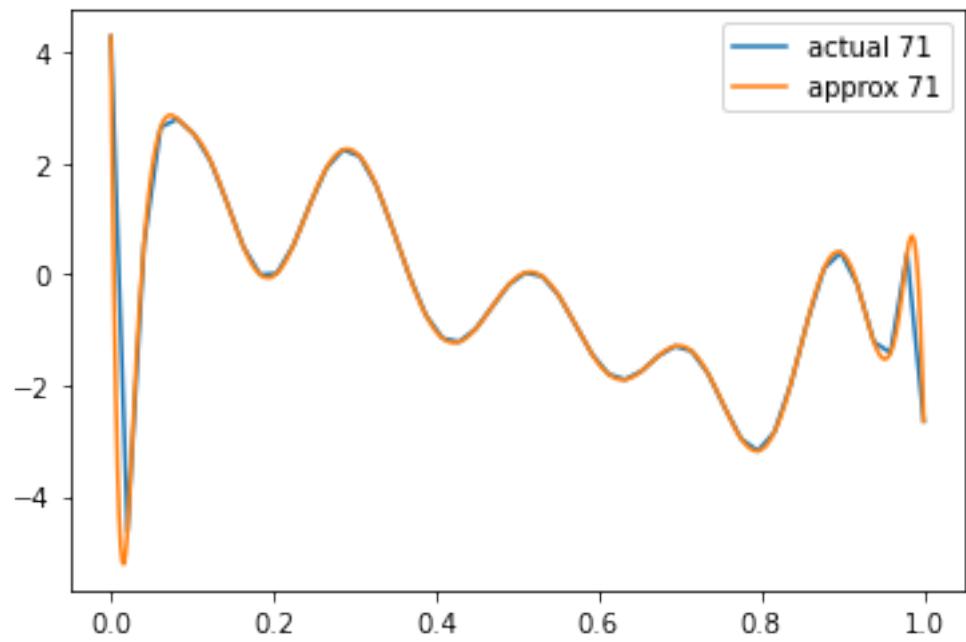
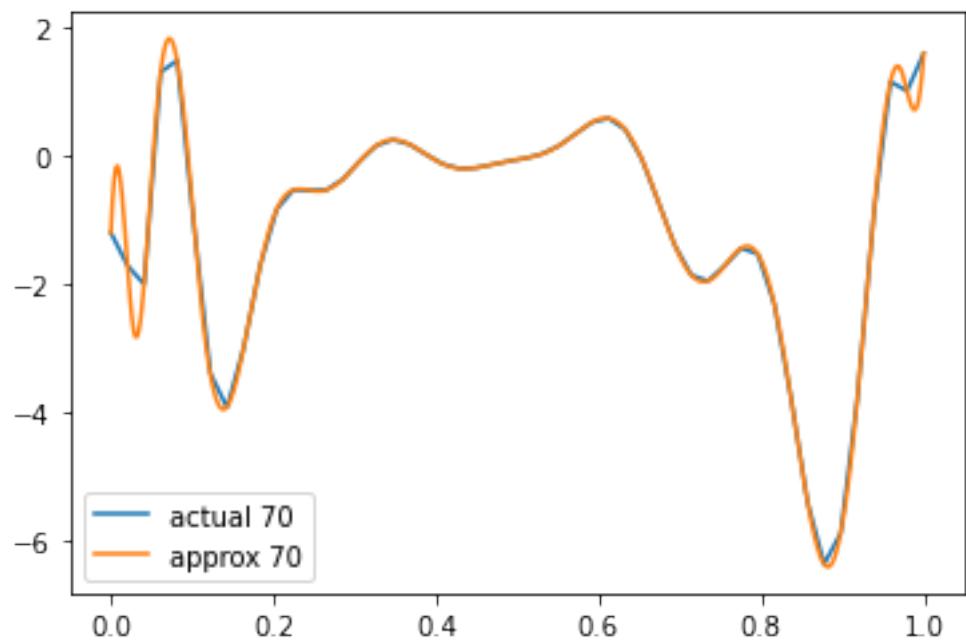


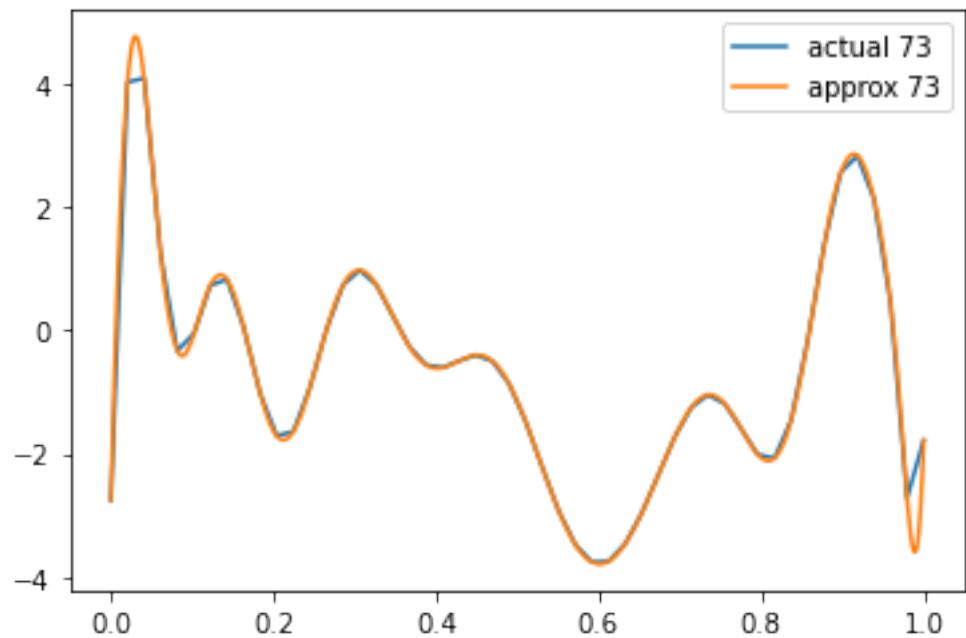
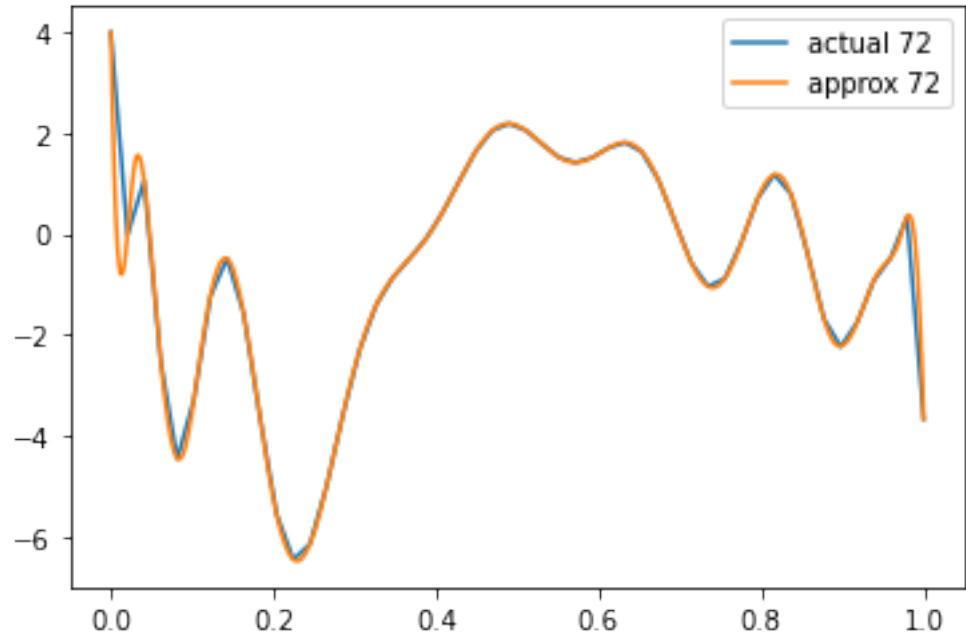


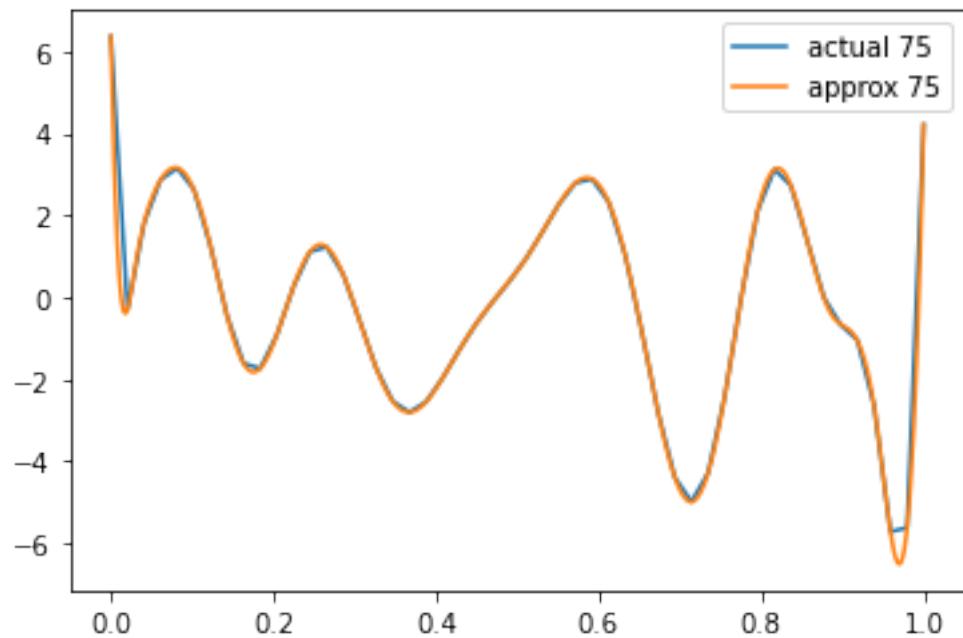
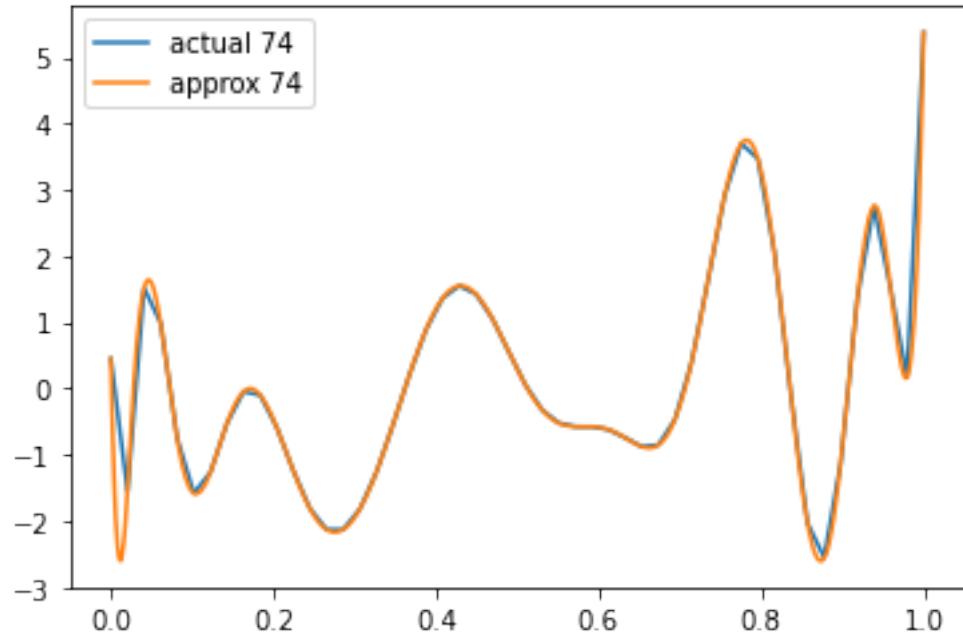


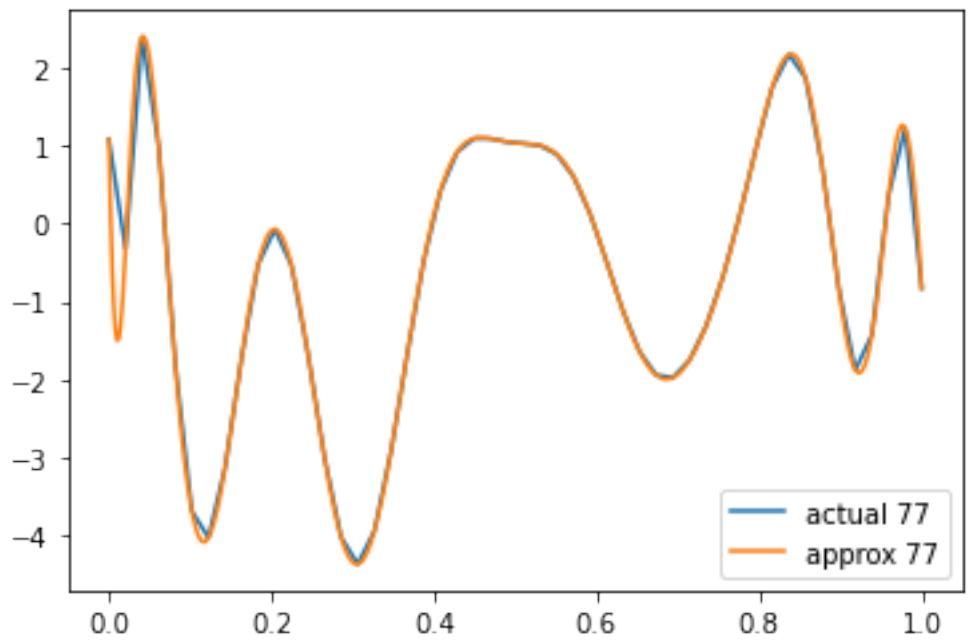
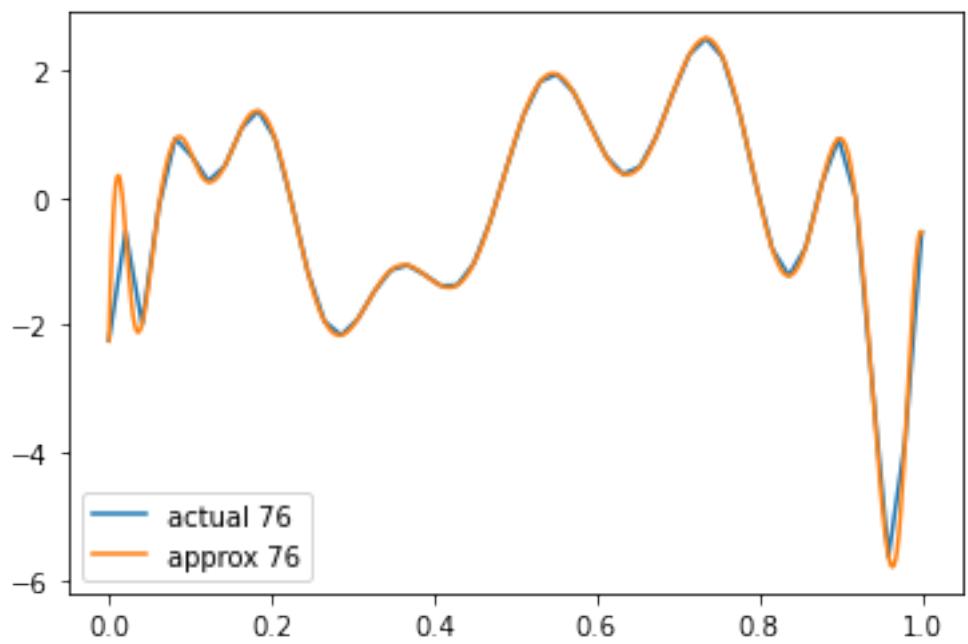


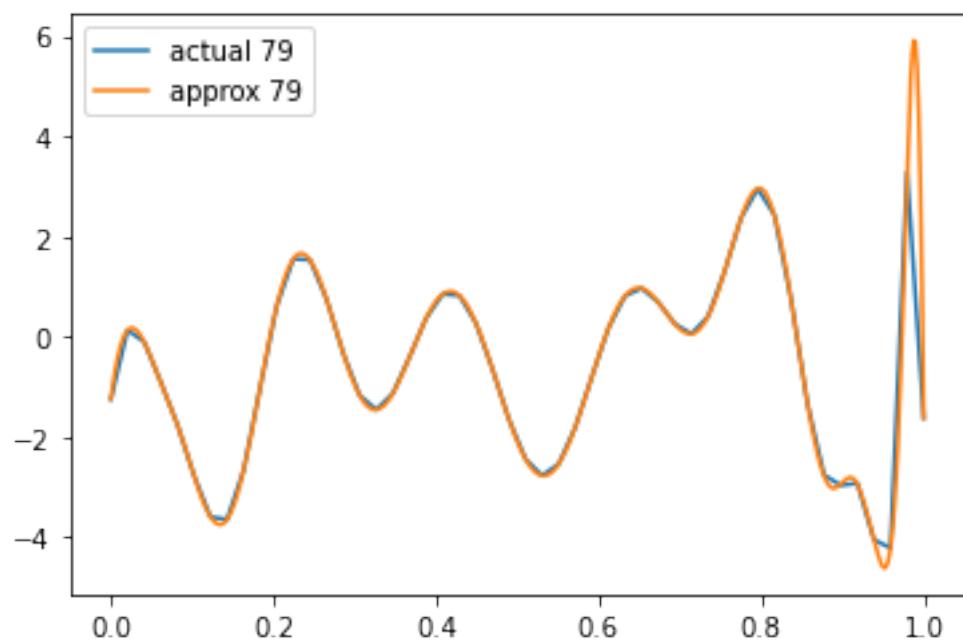
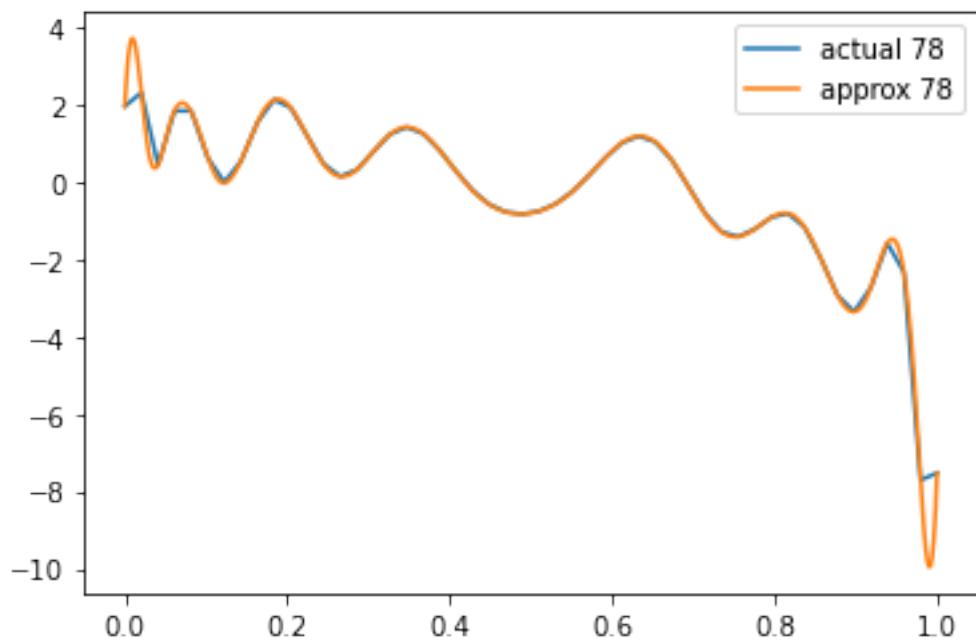


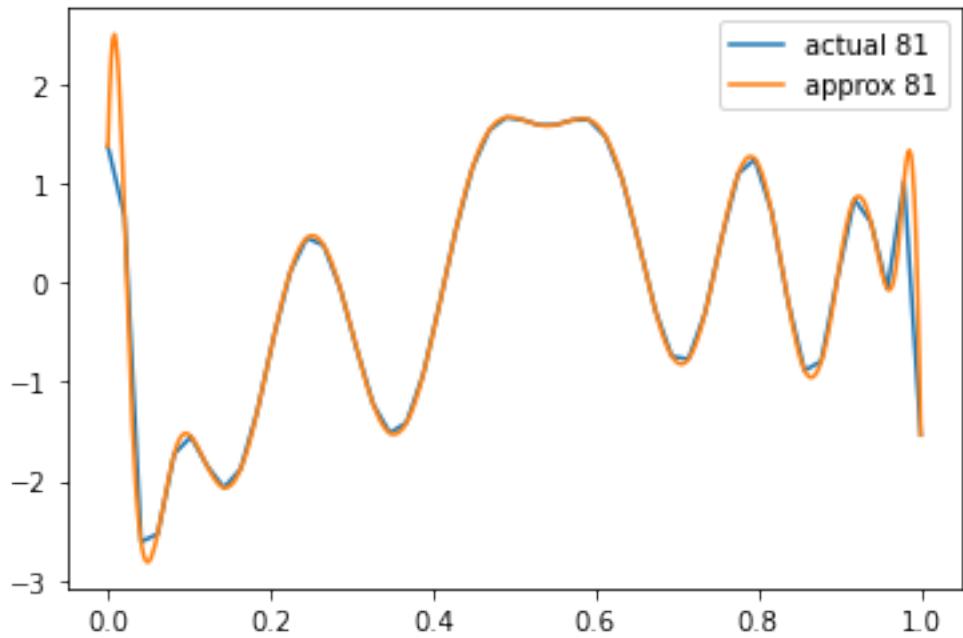
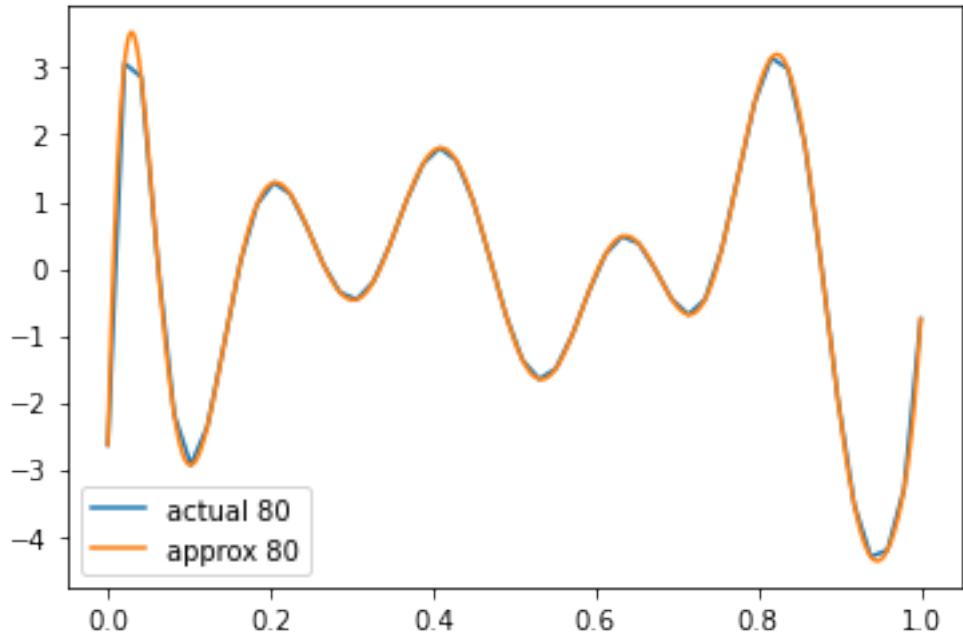


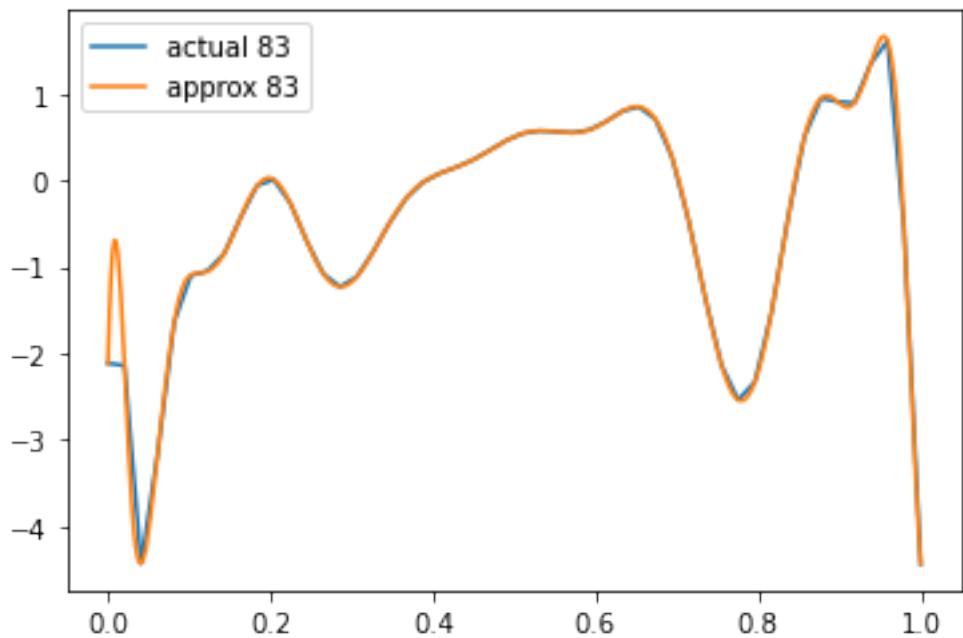
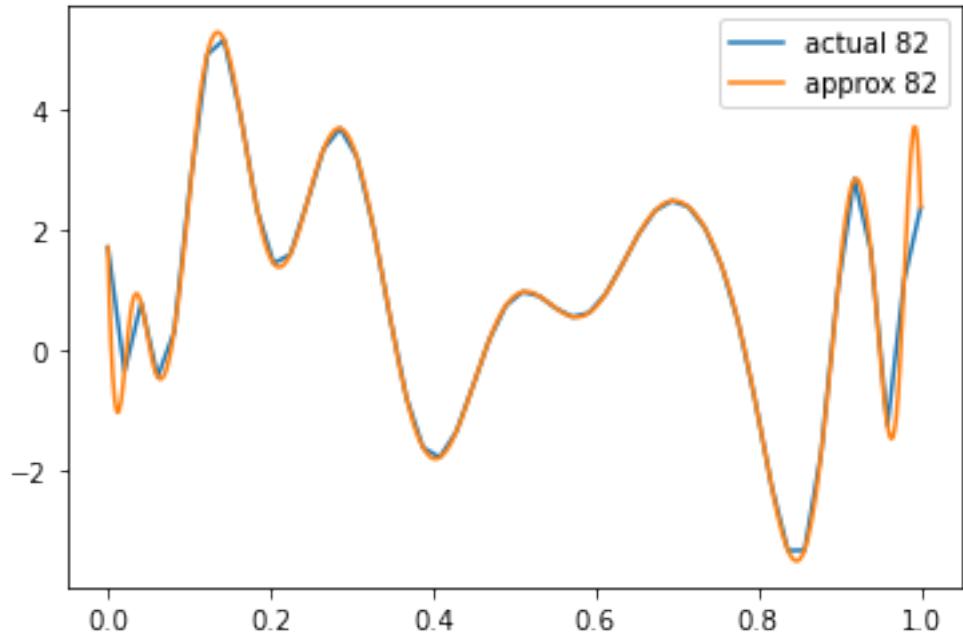


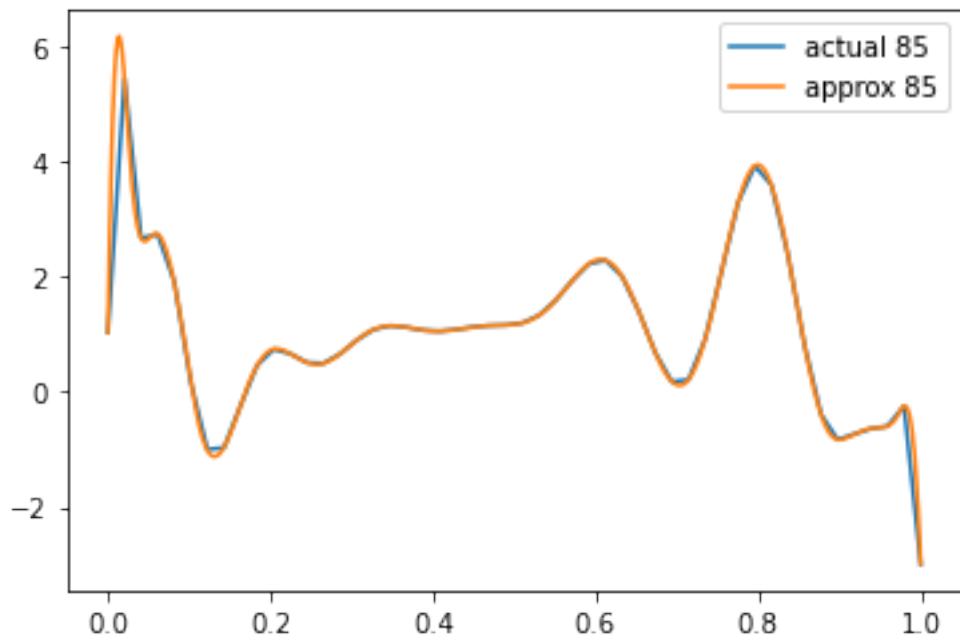
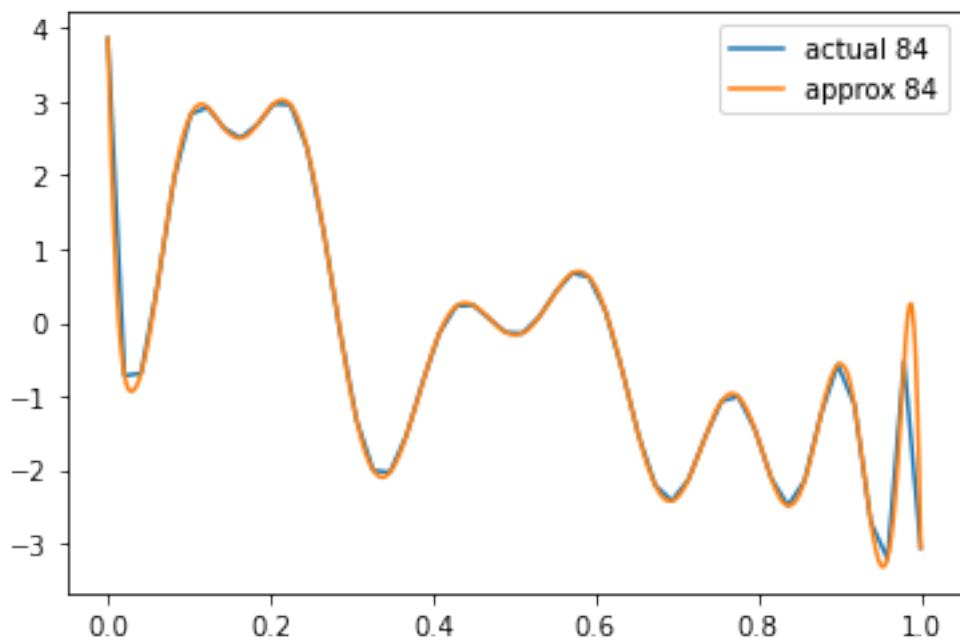


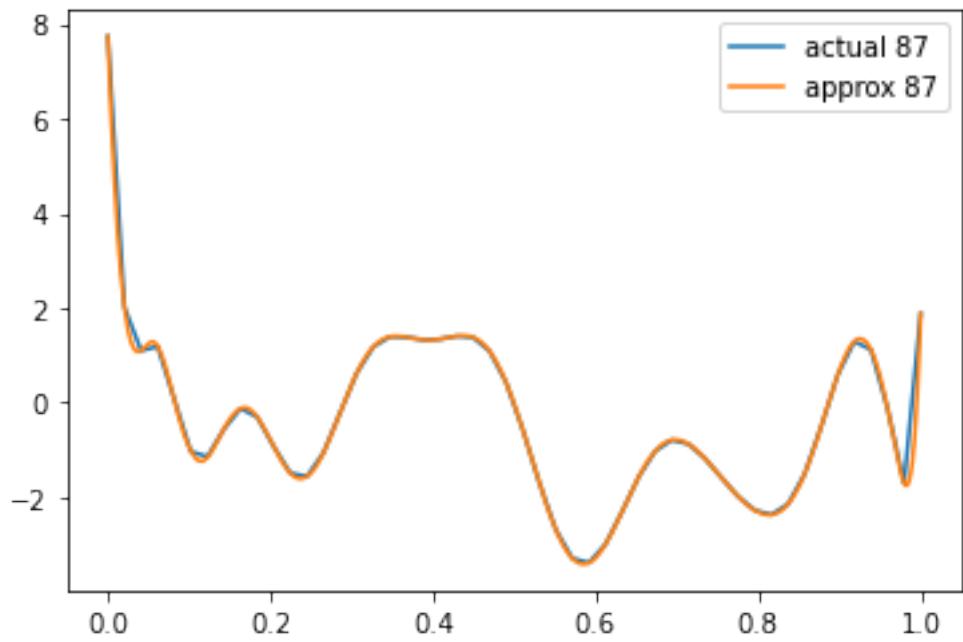
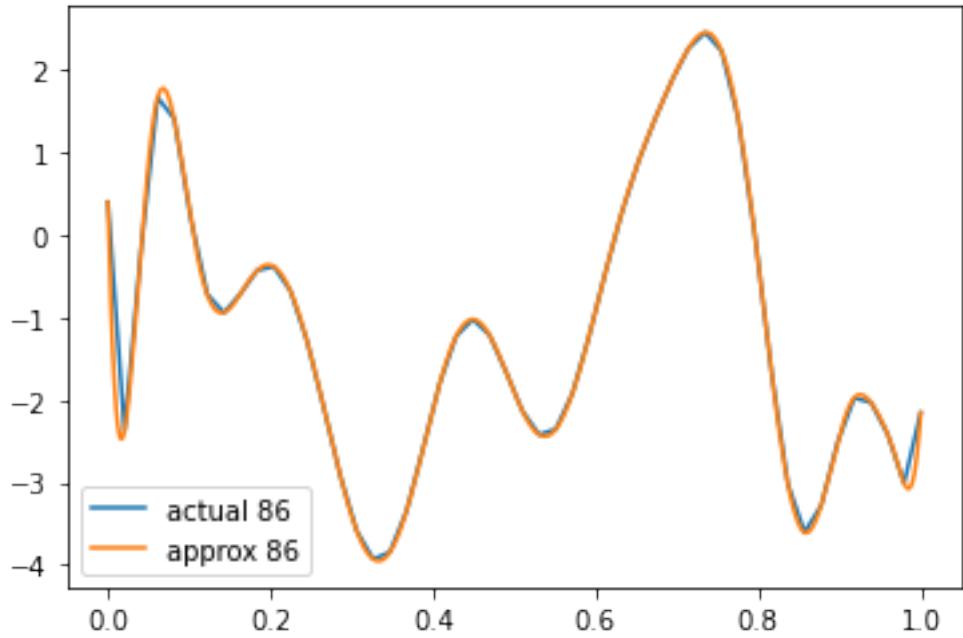


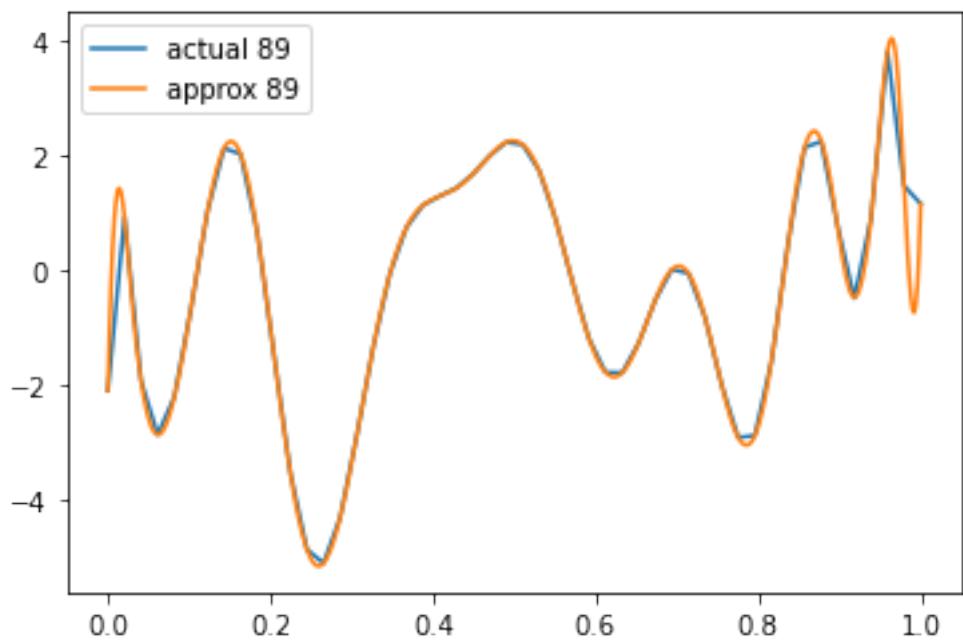
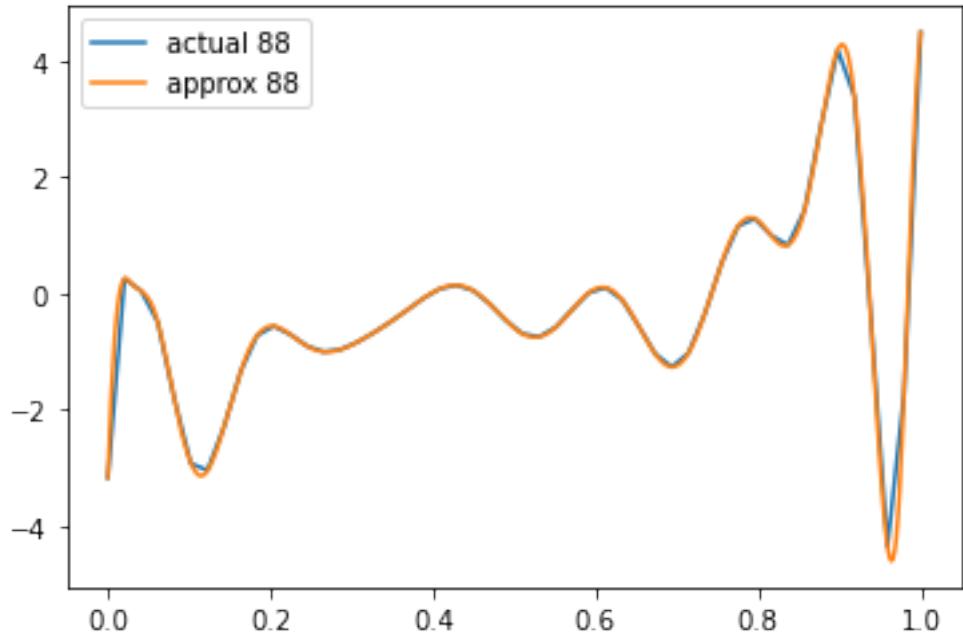


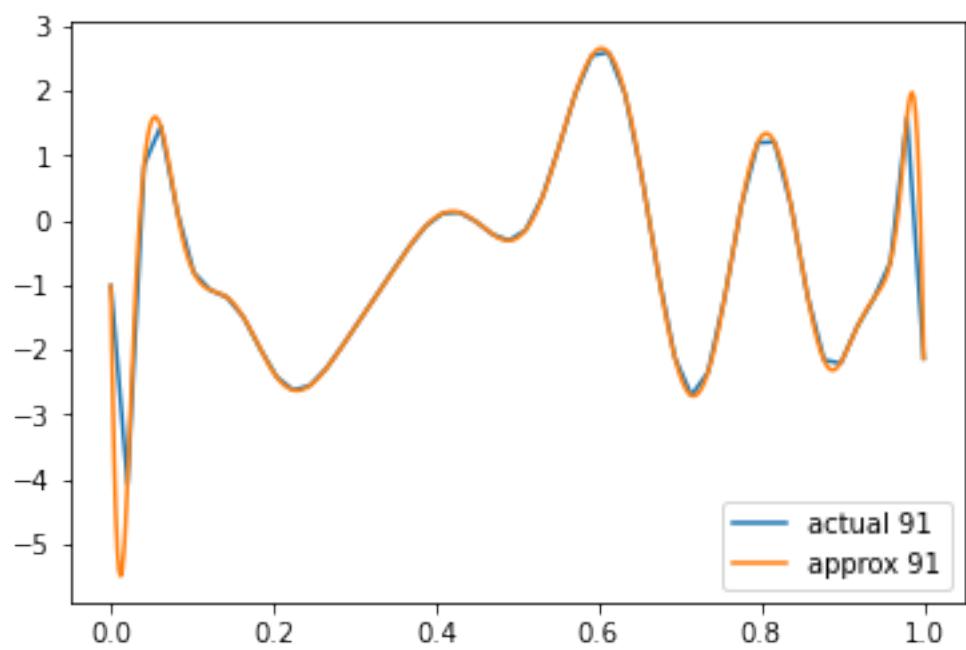
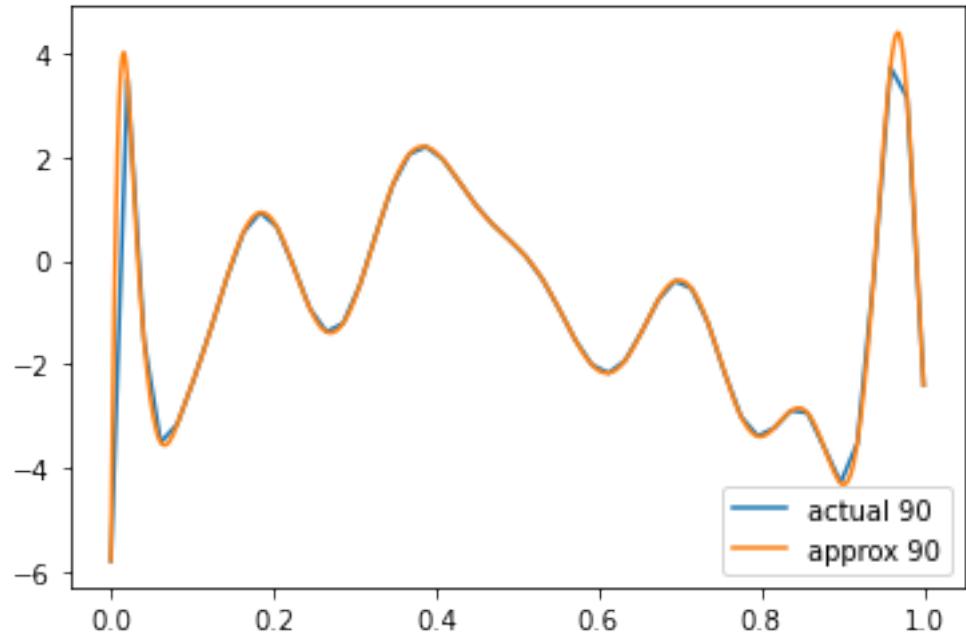


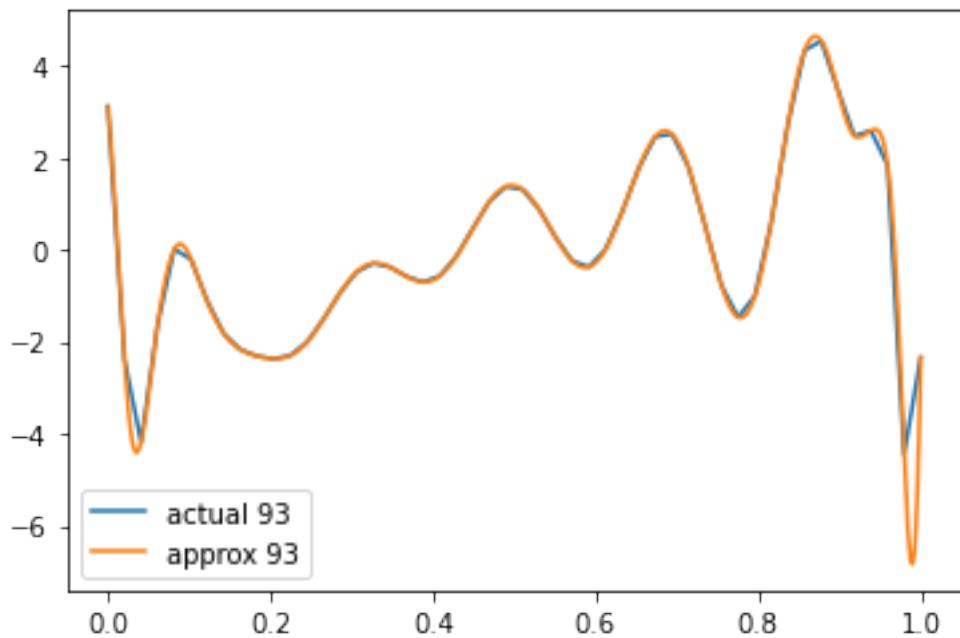
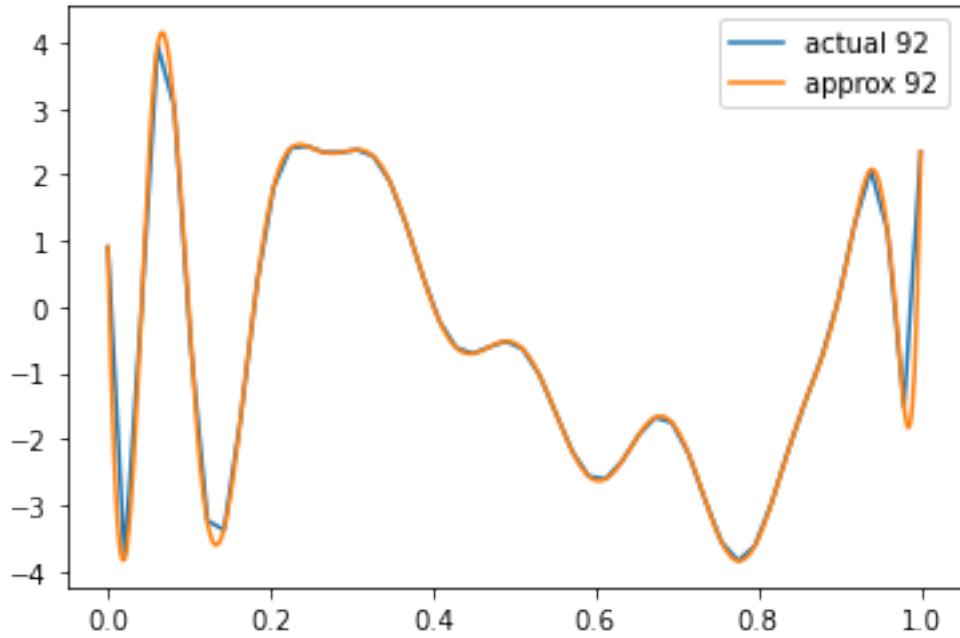


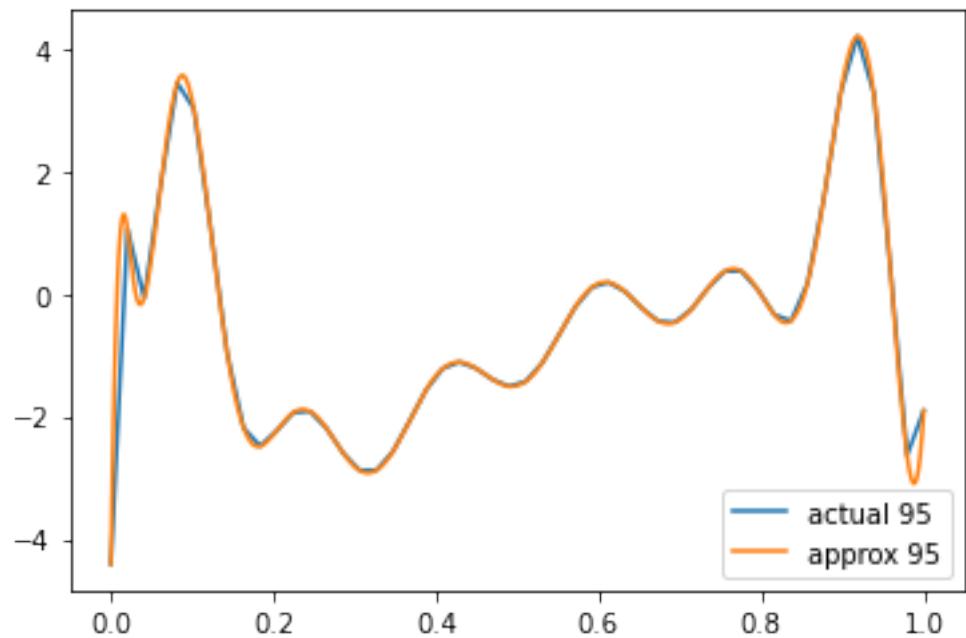
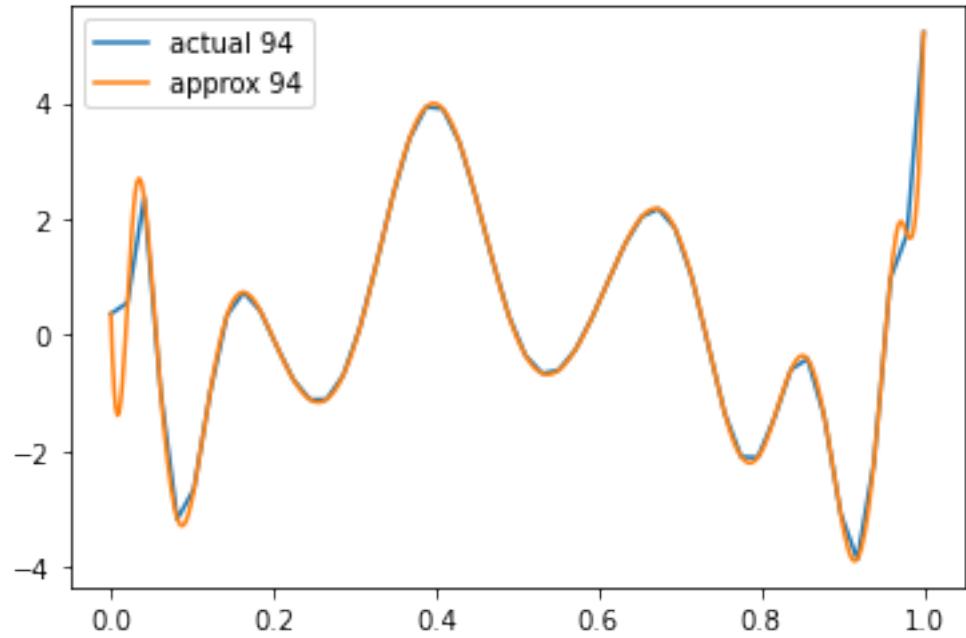


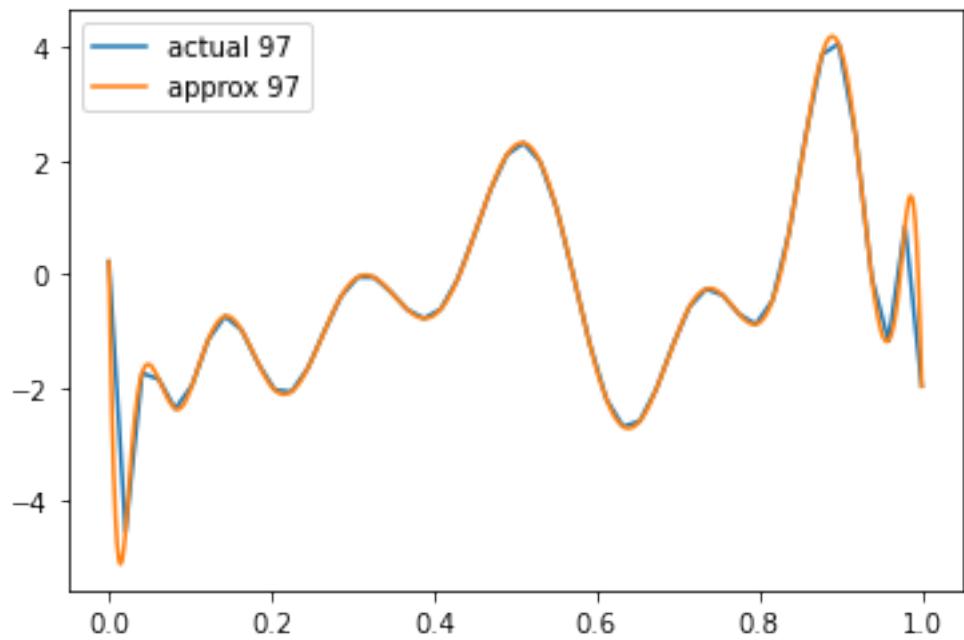
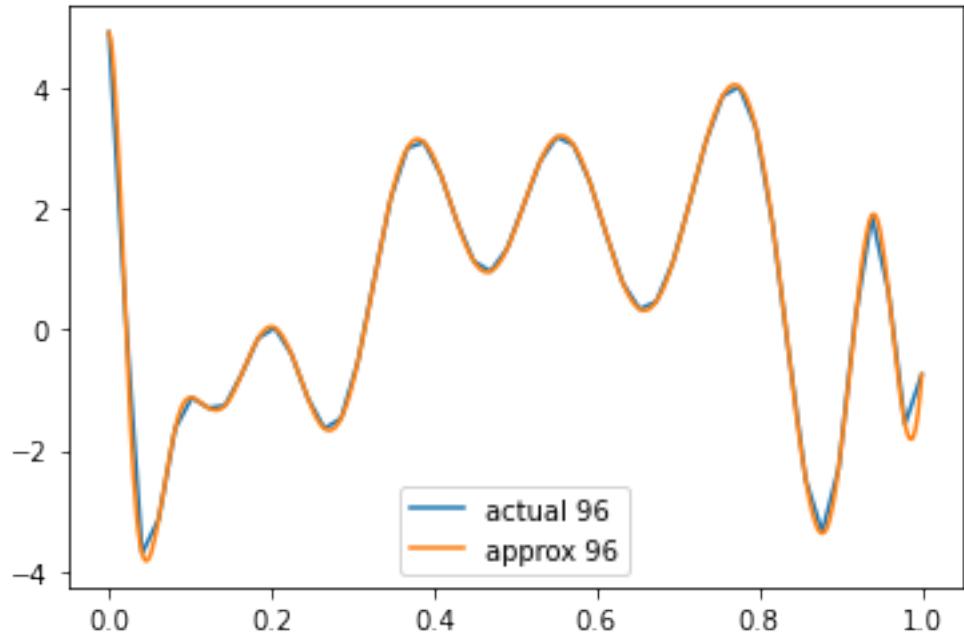


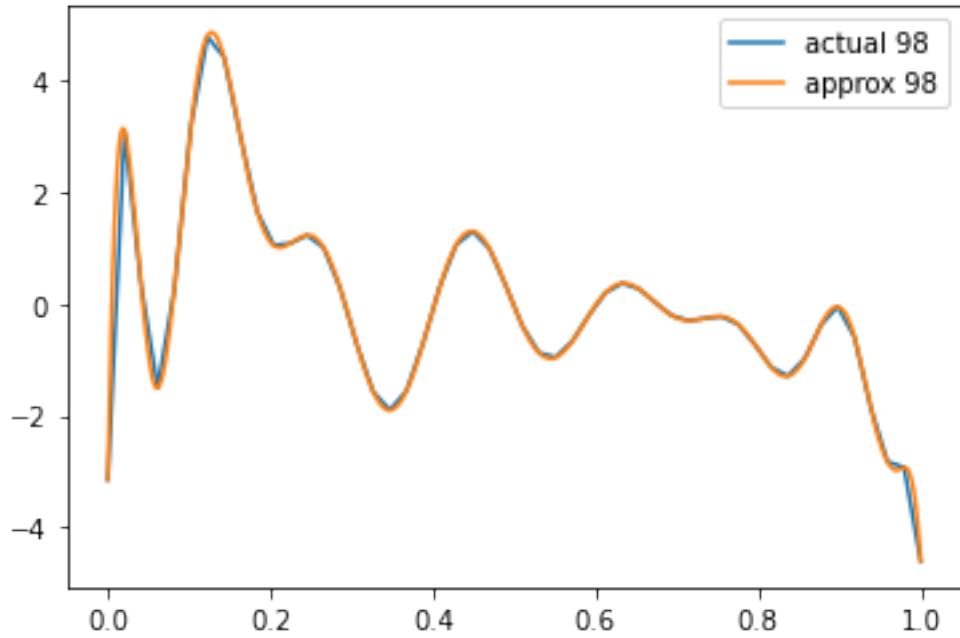




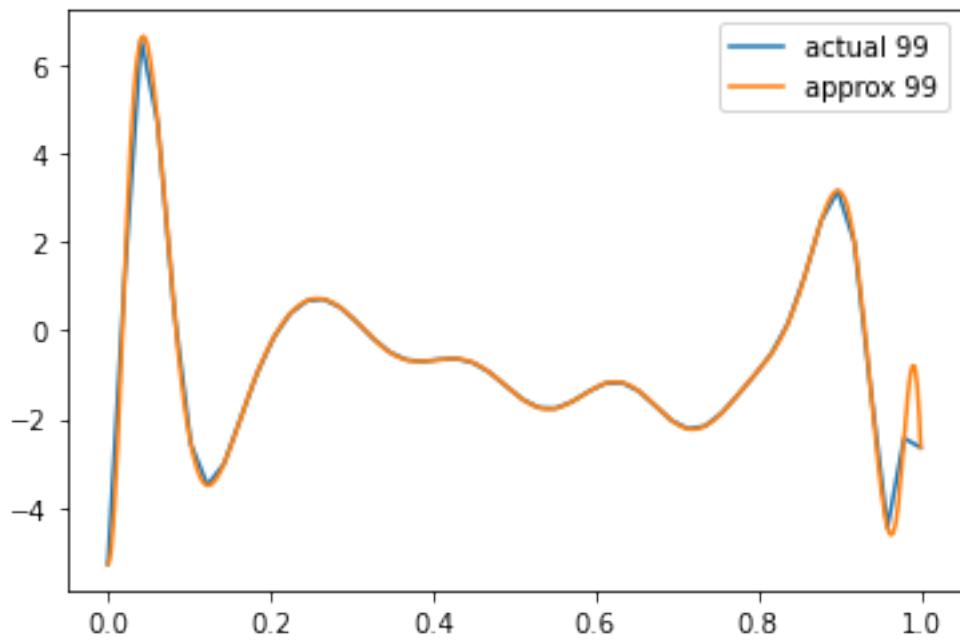


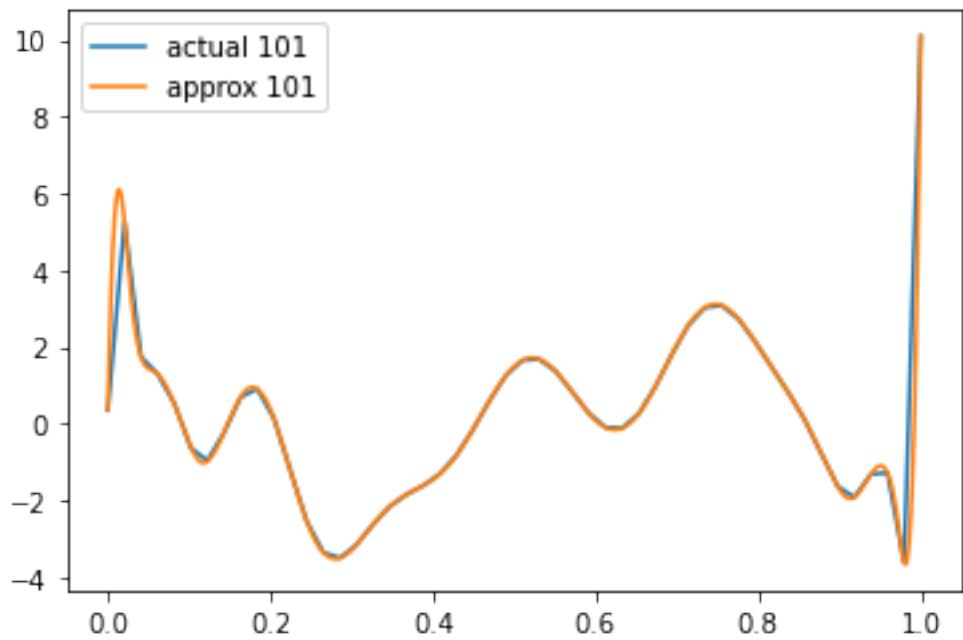
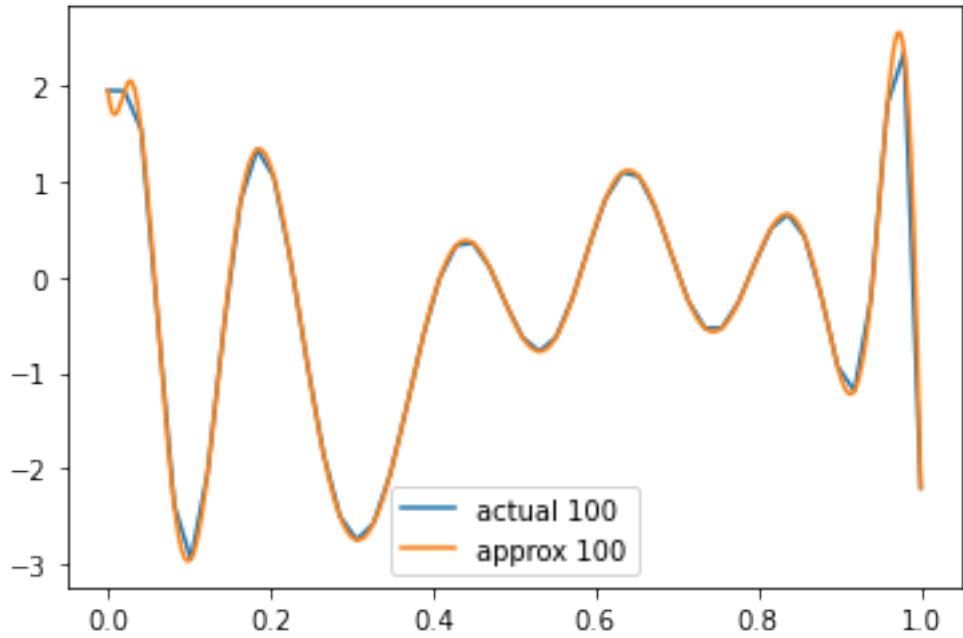


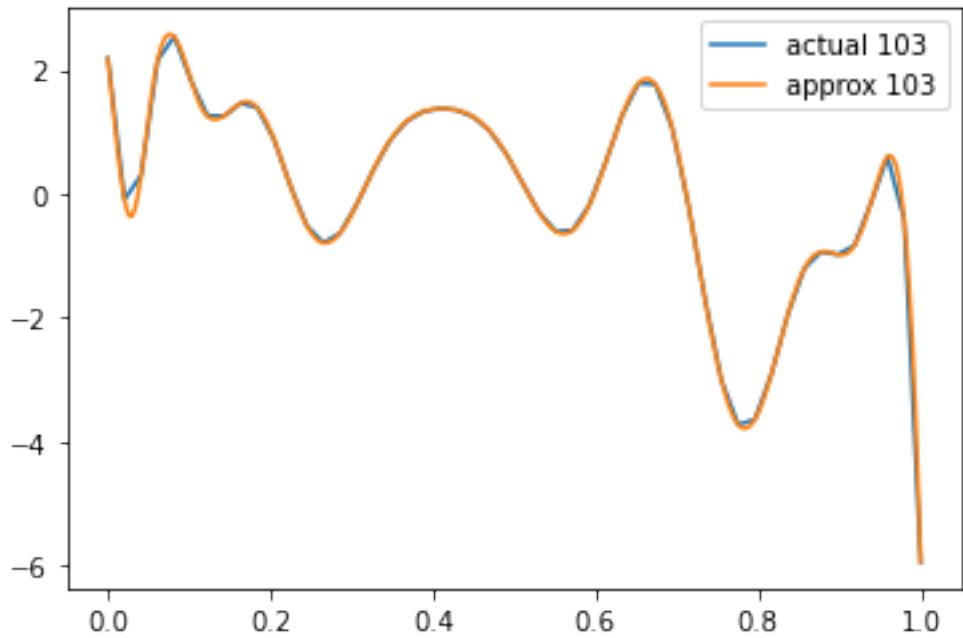
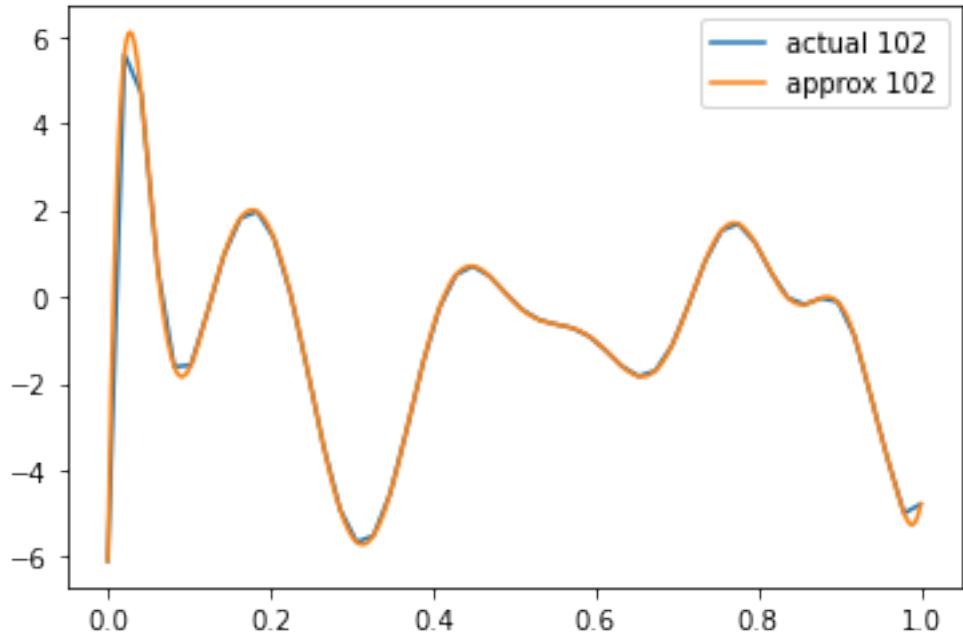


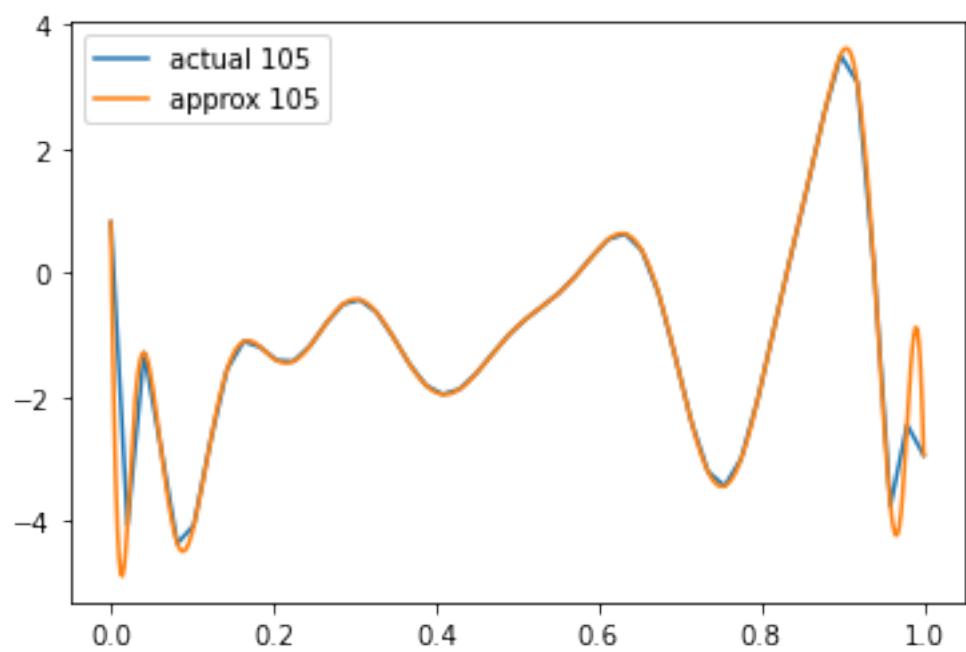
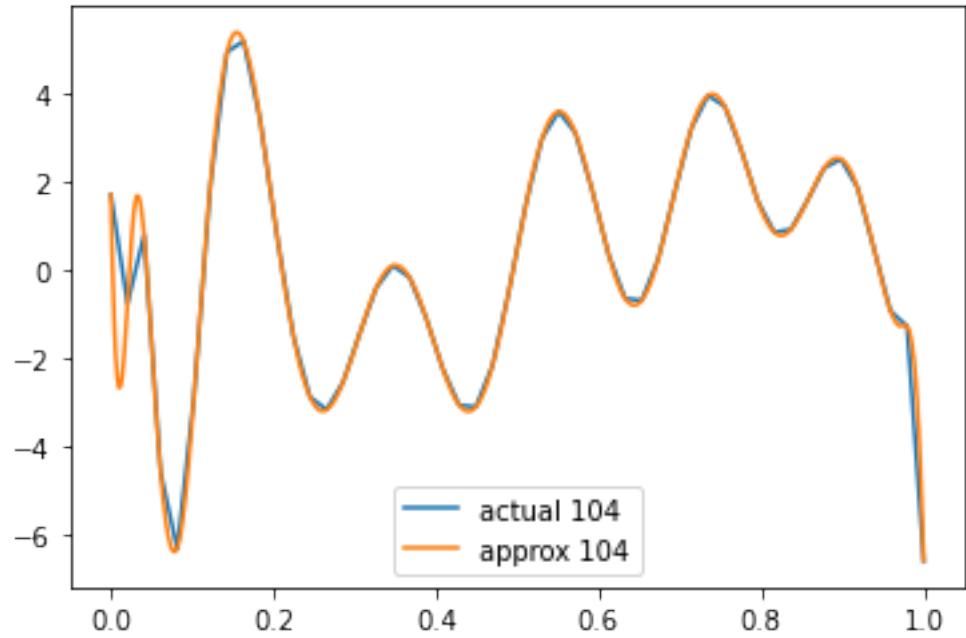


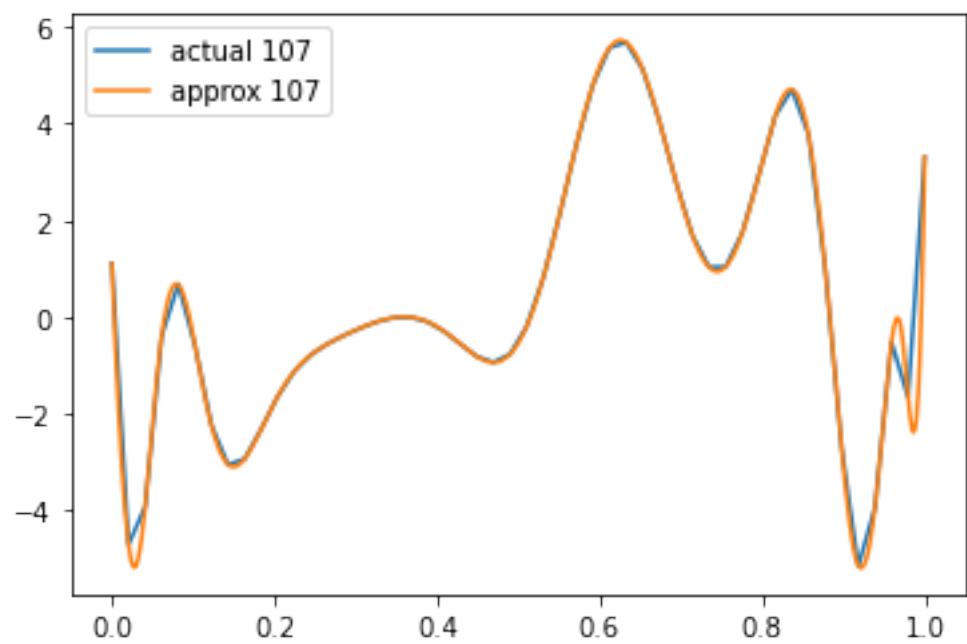
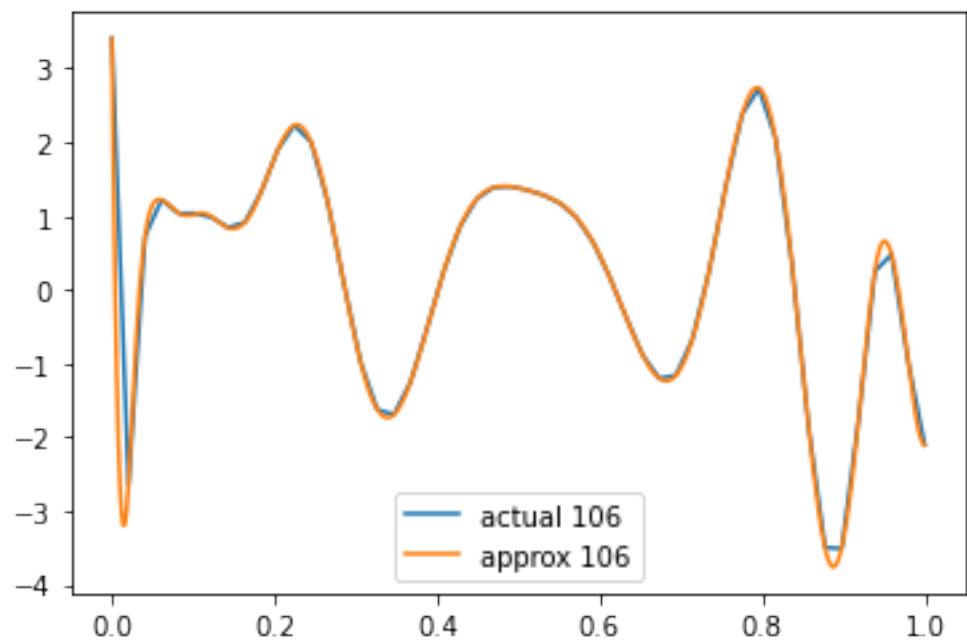
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RuntimeWarning: Values in x were outside bounds during a minimize step, clipping  
to bounds  
    warnings.warn("Values in x were outside bounds during a "
```

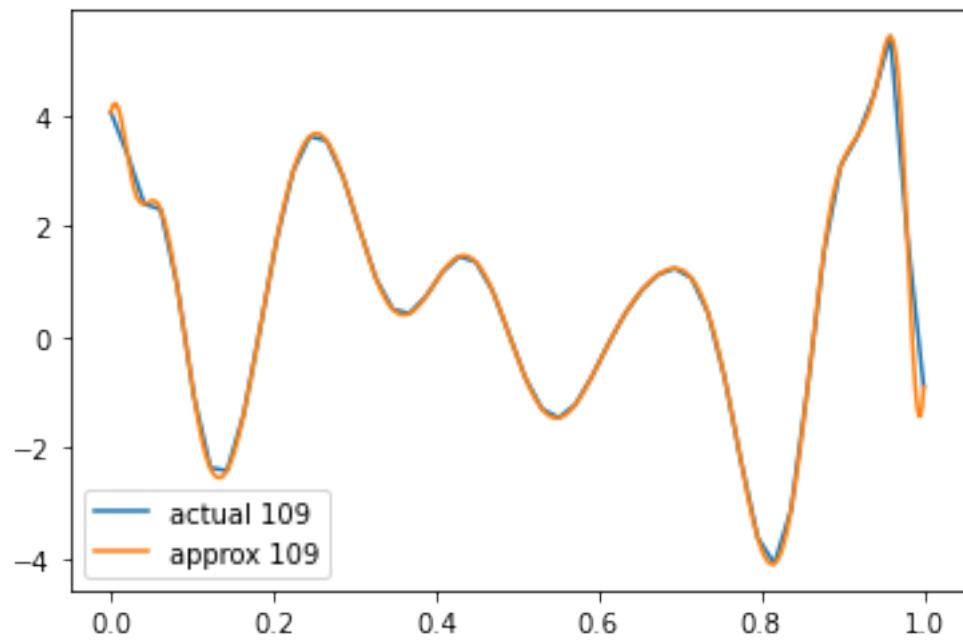
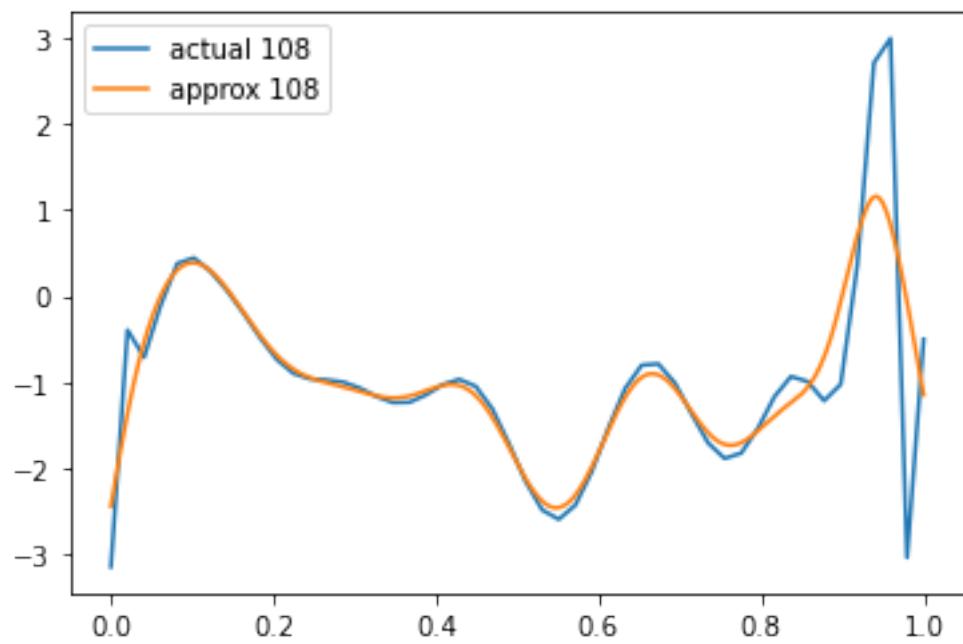


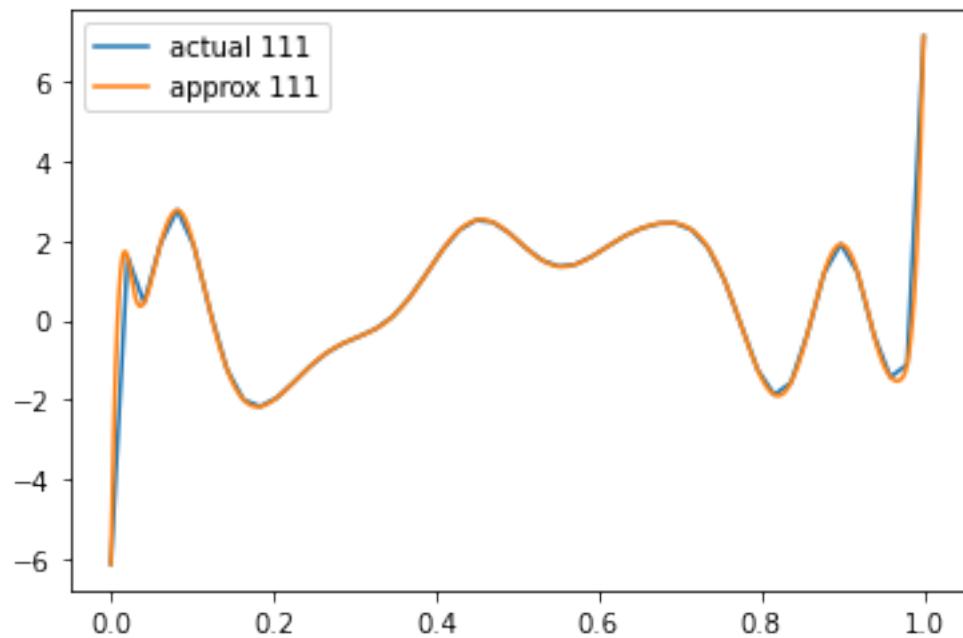
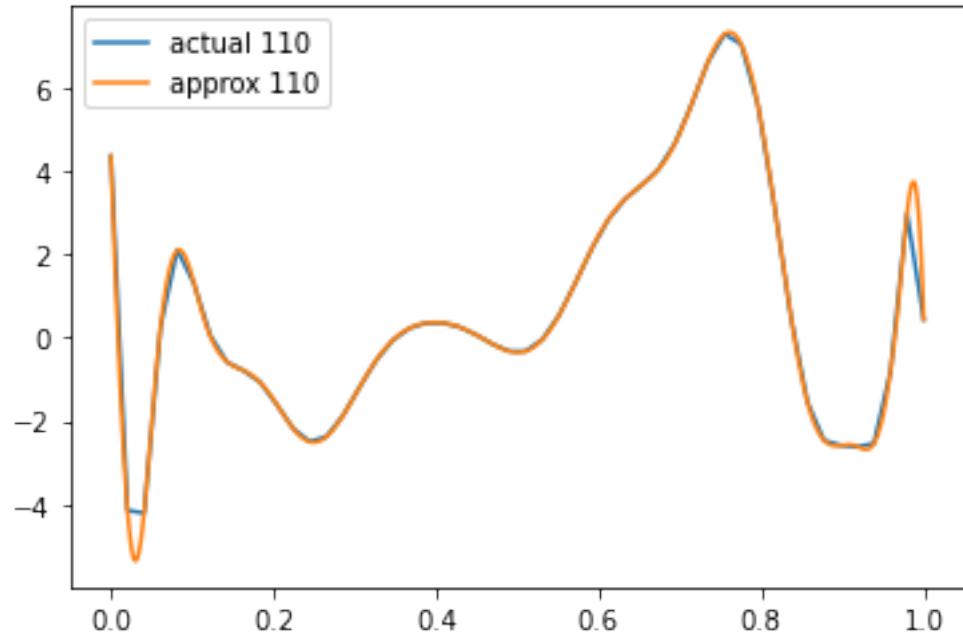


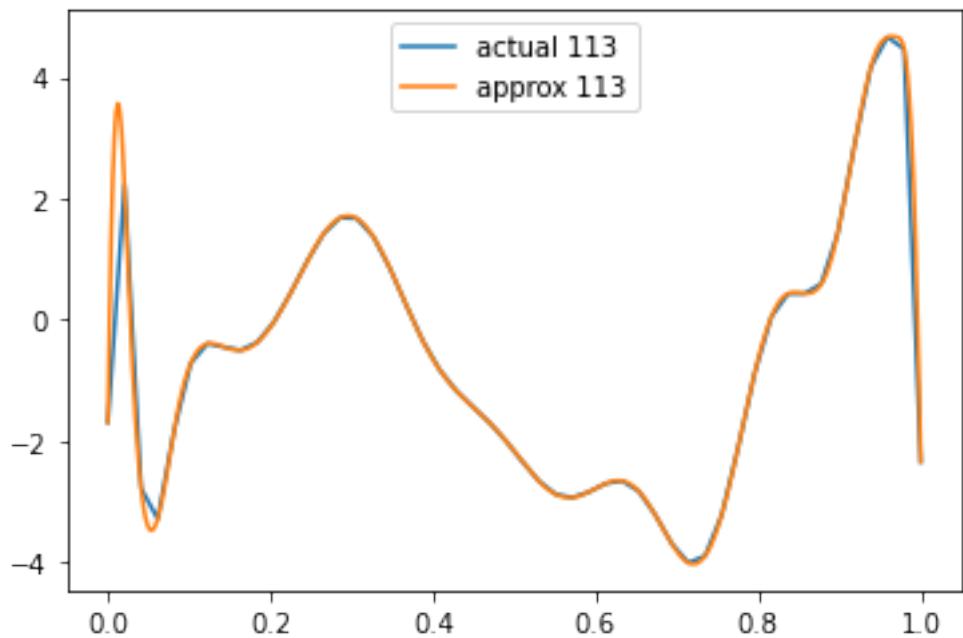
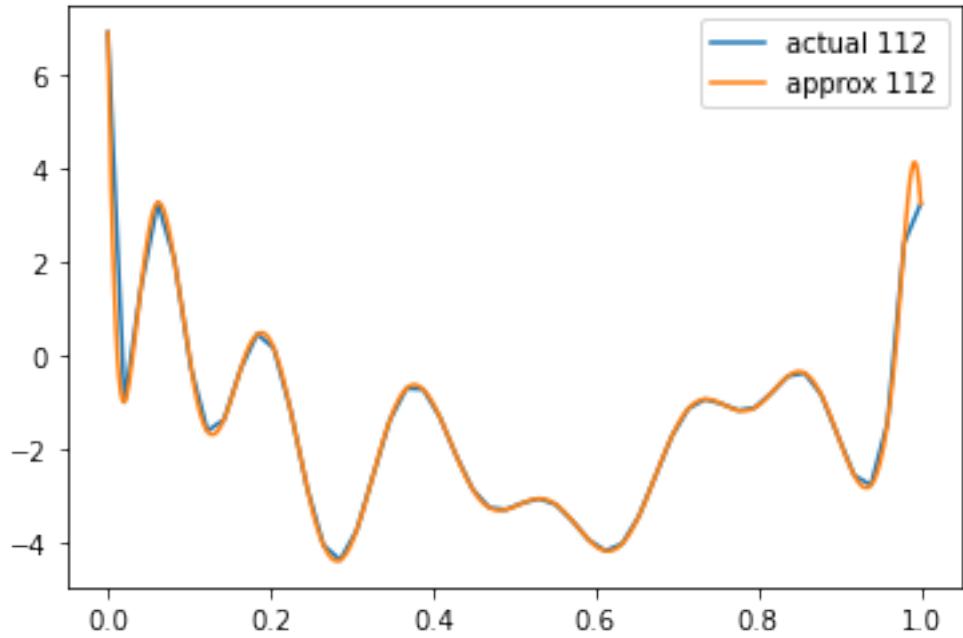


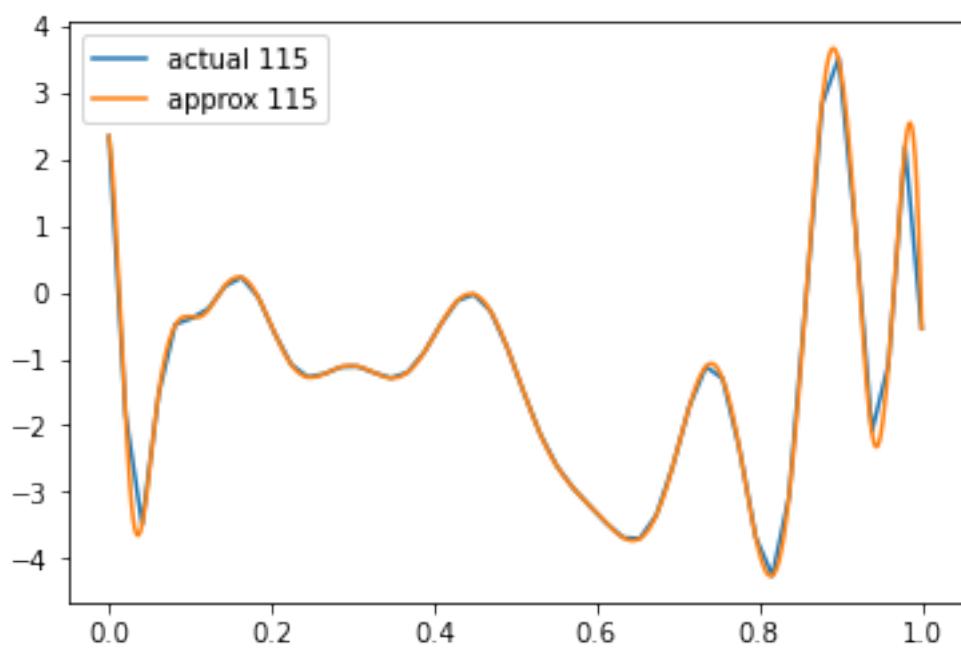
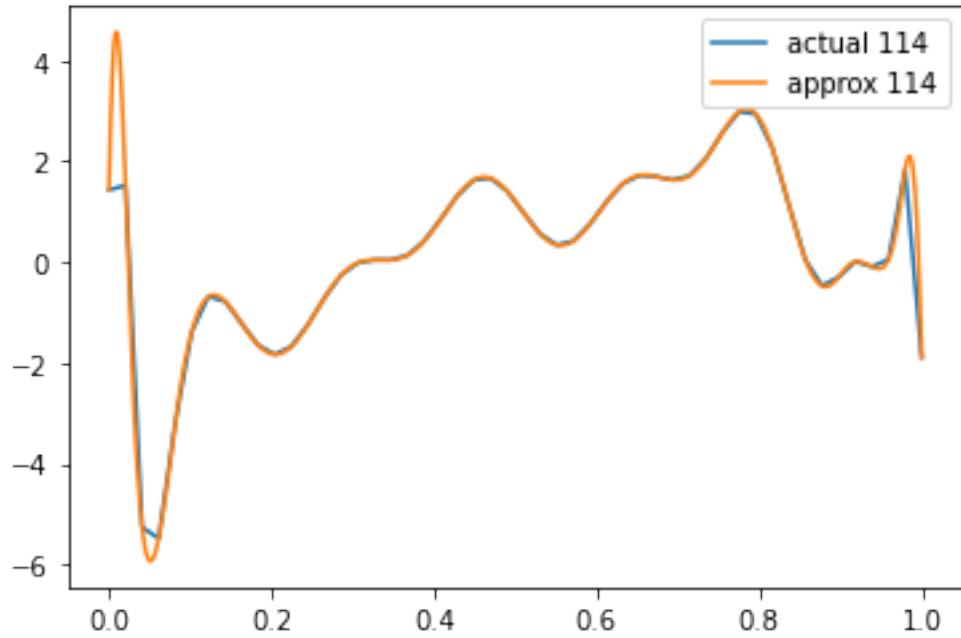


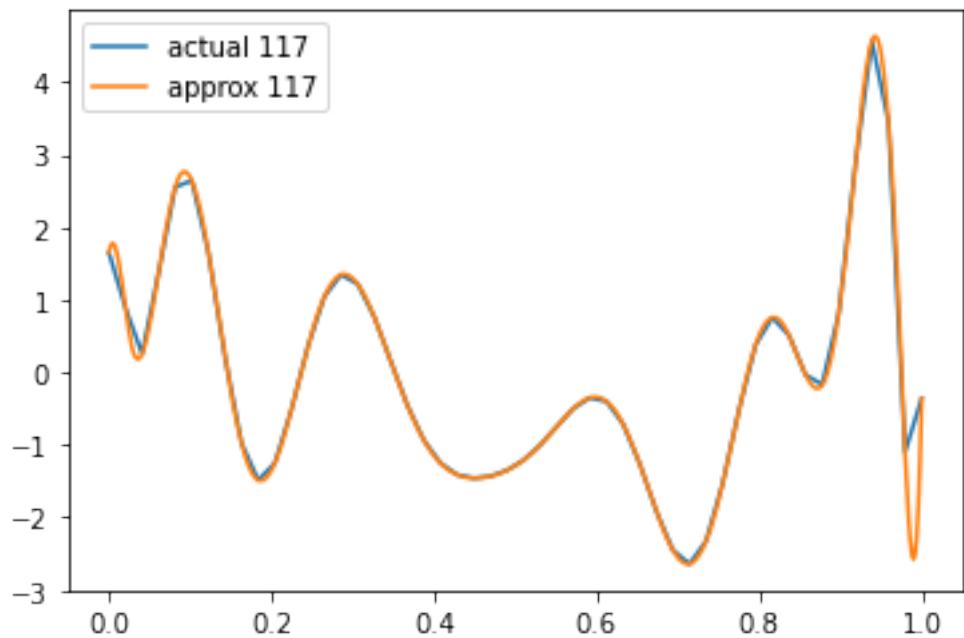
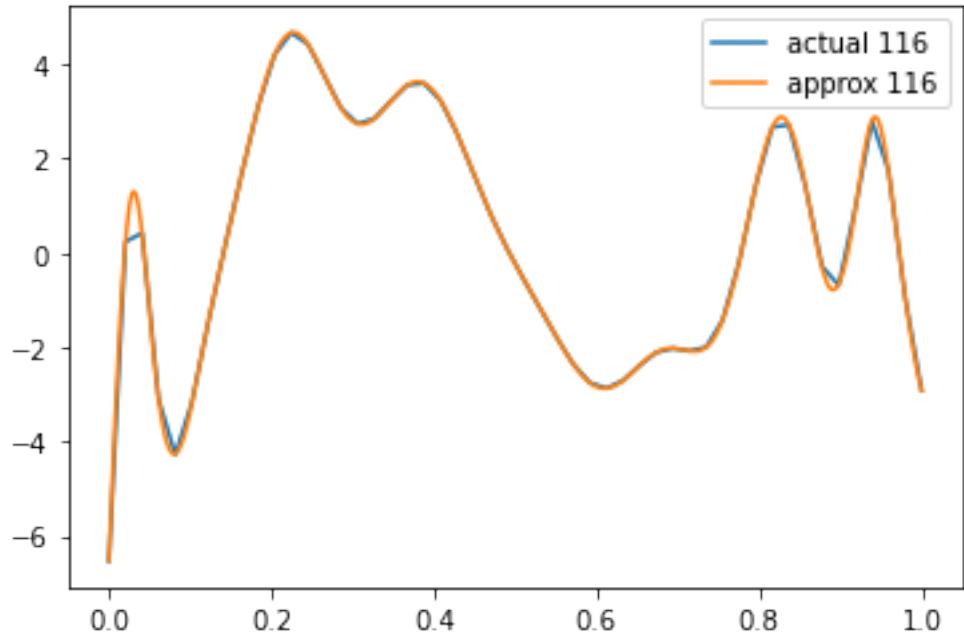


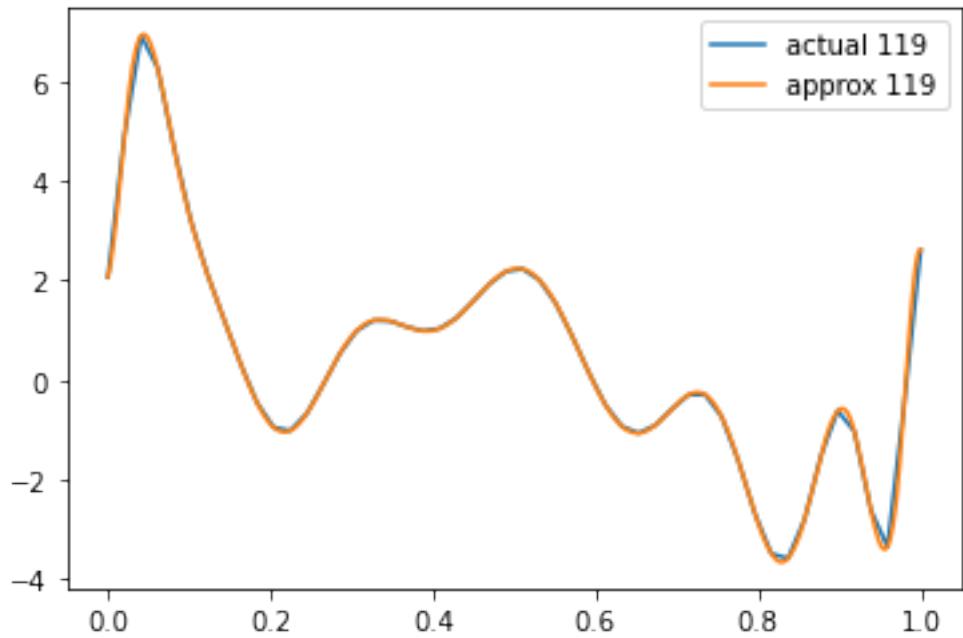
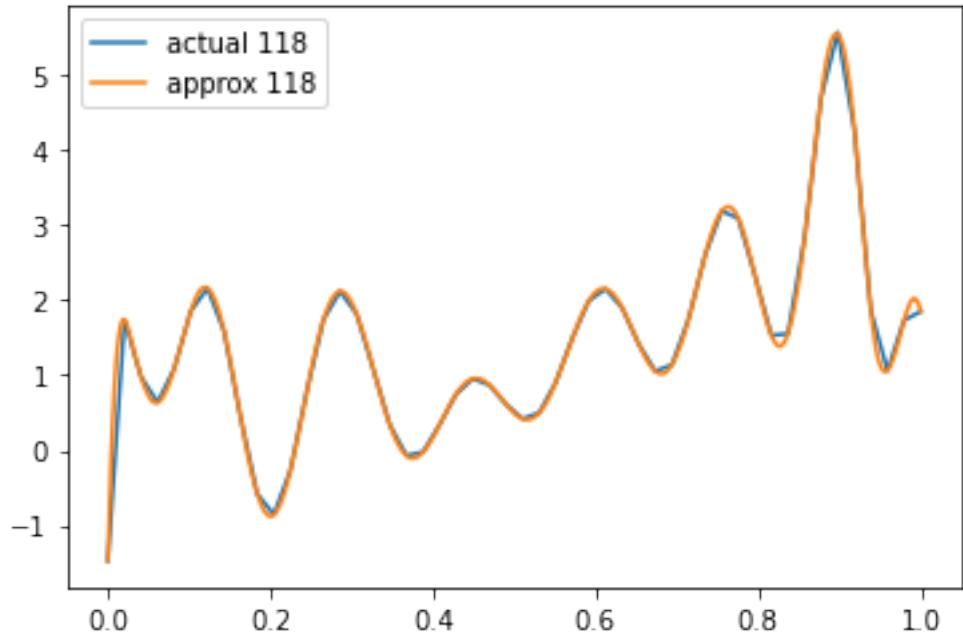


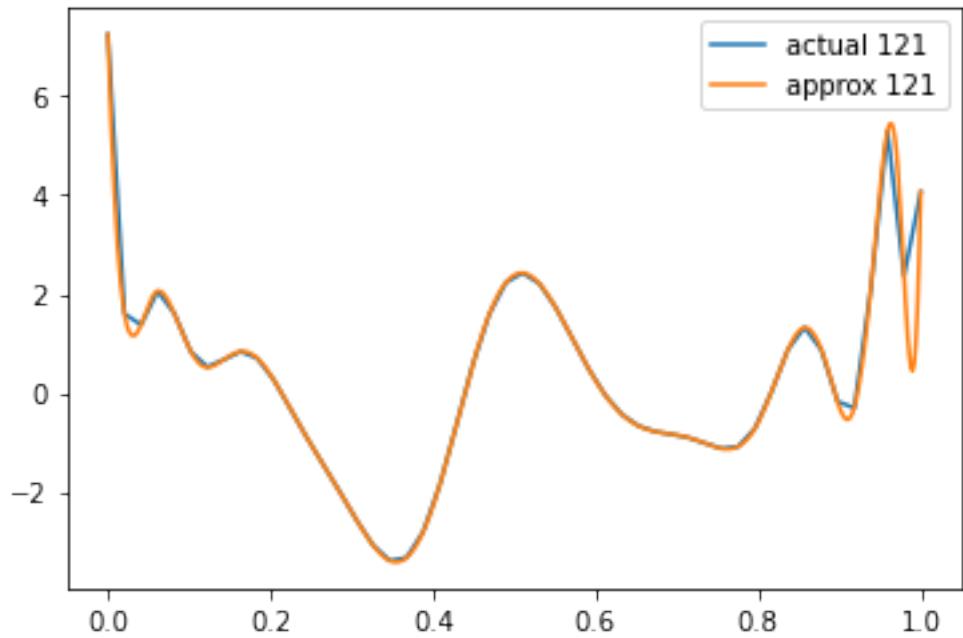
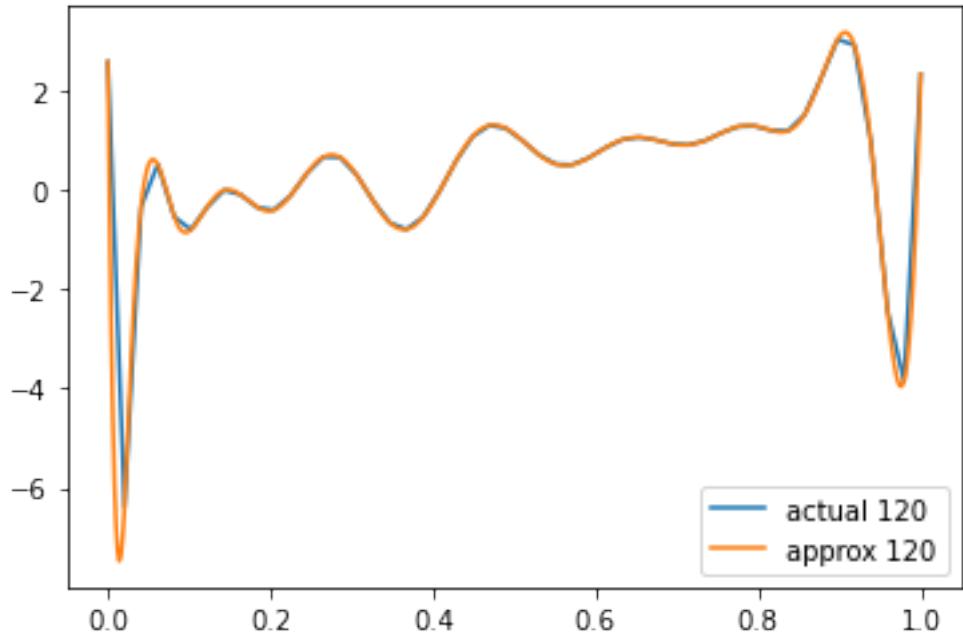


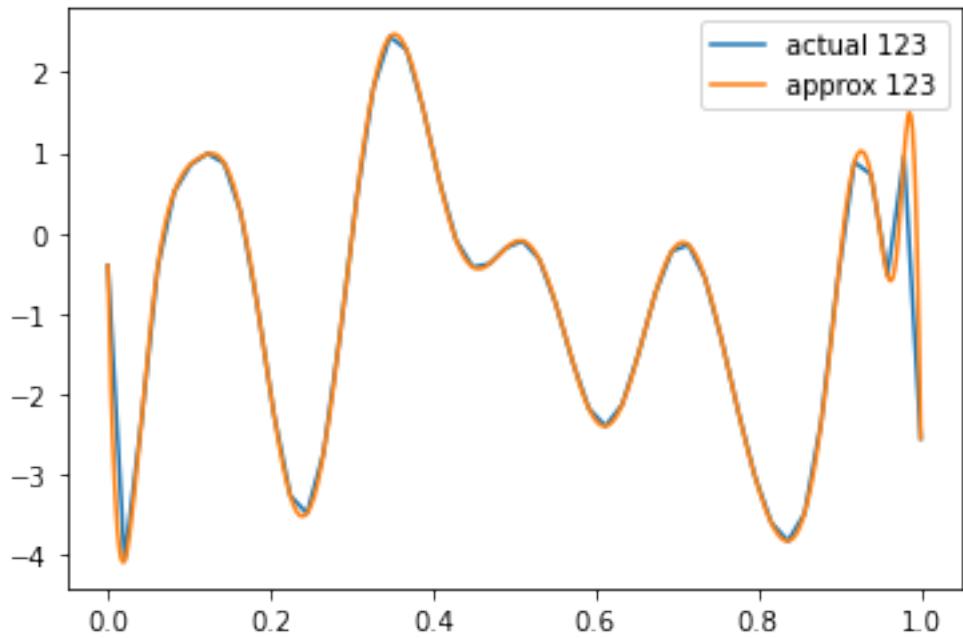
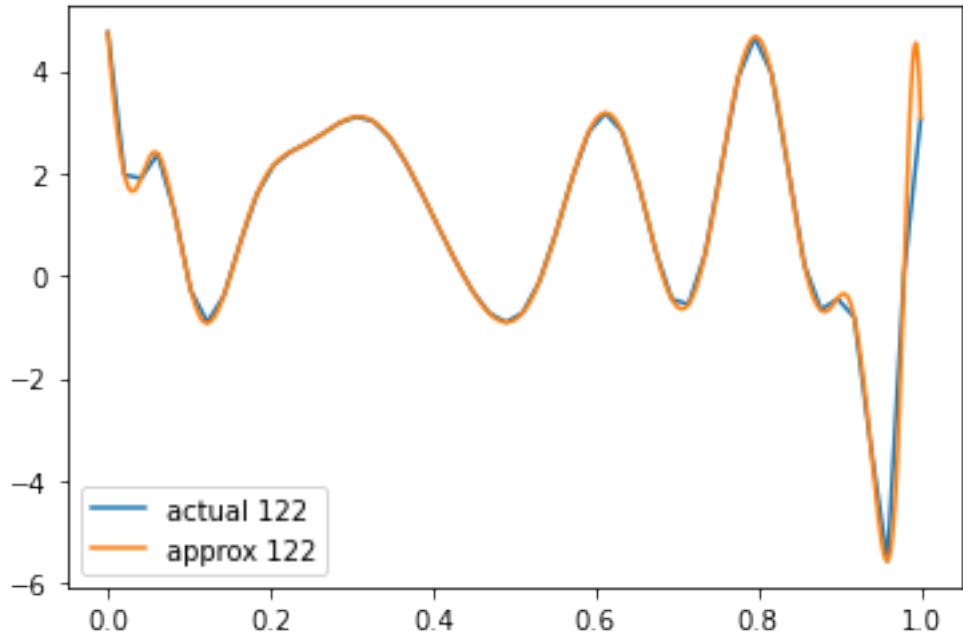


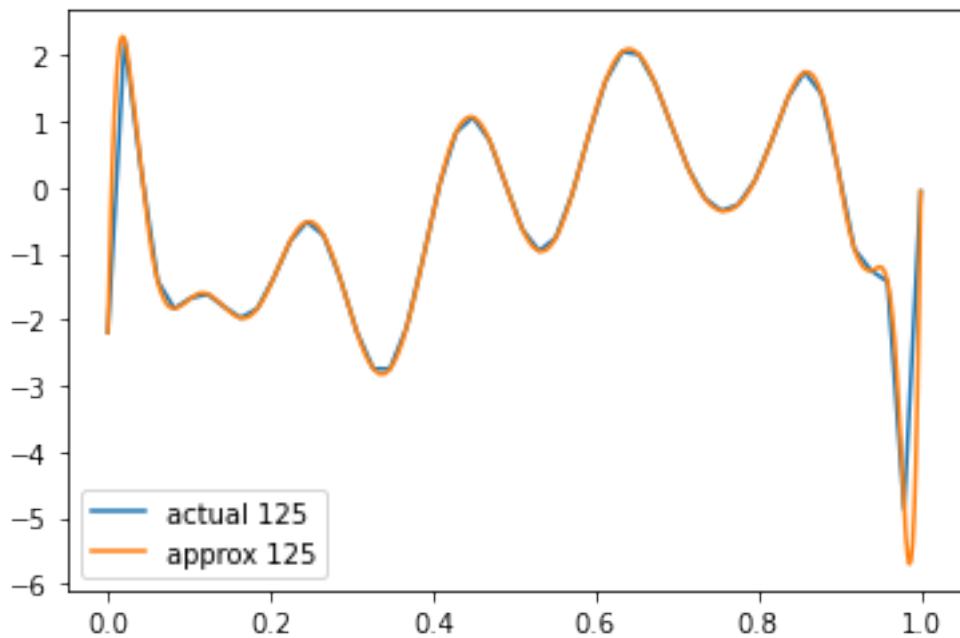
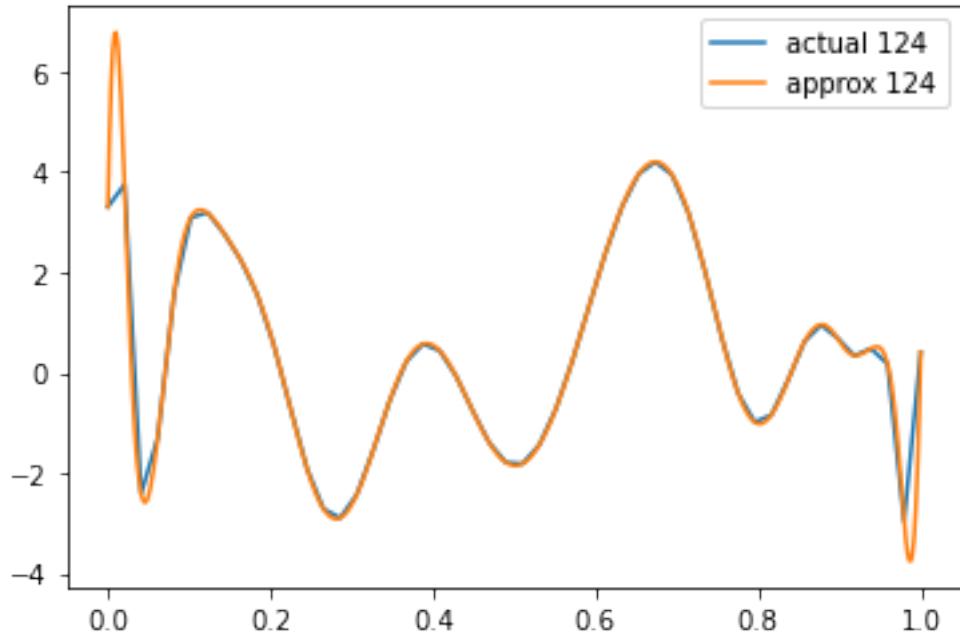


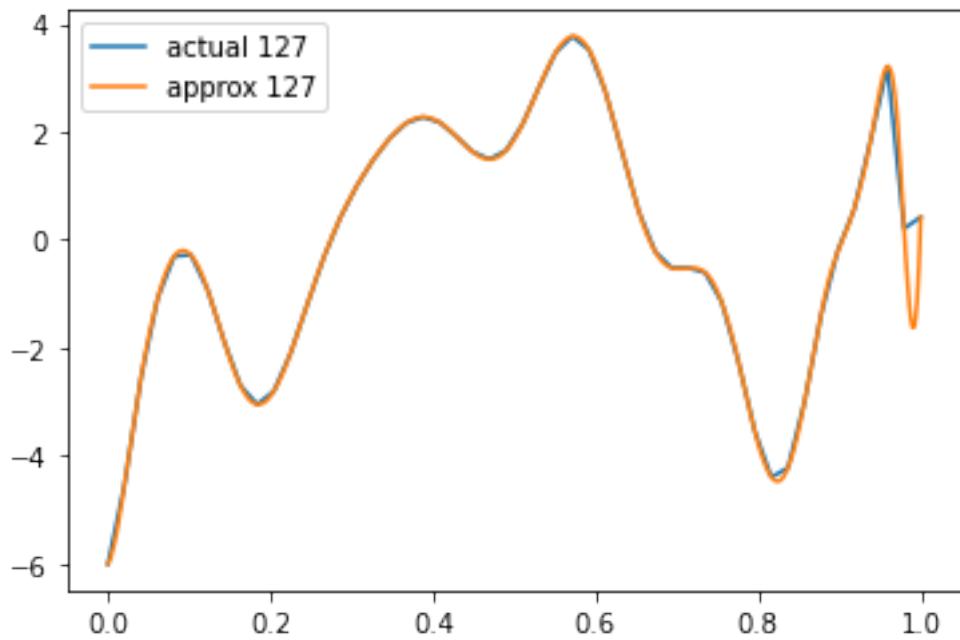
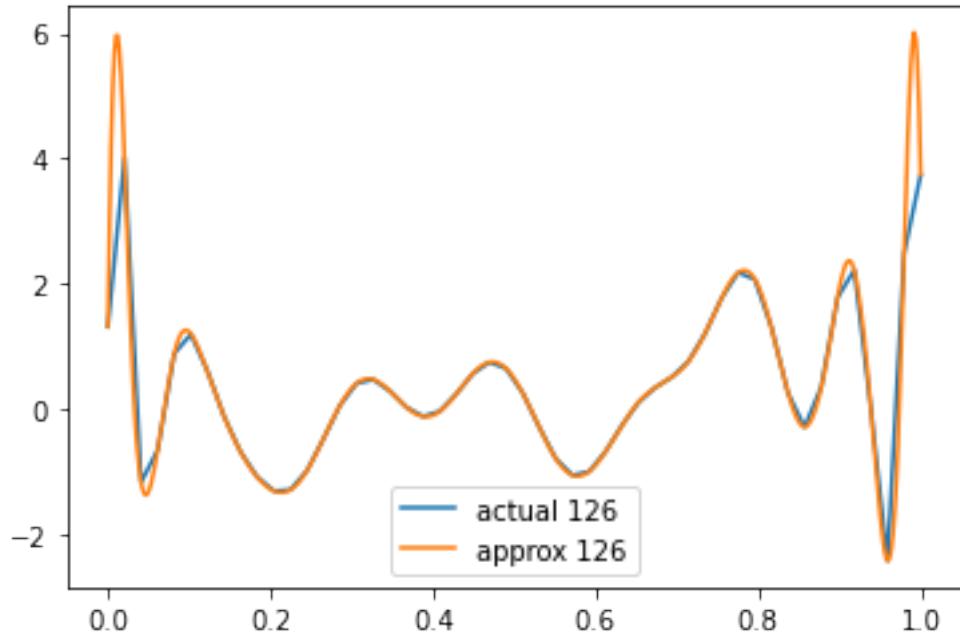


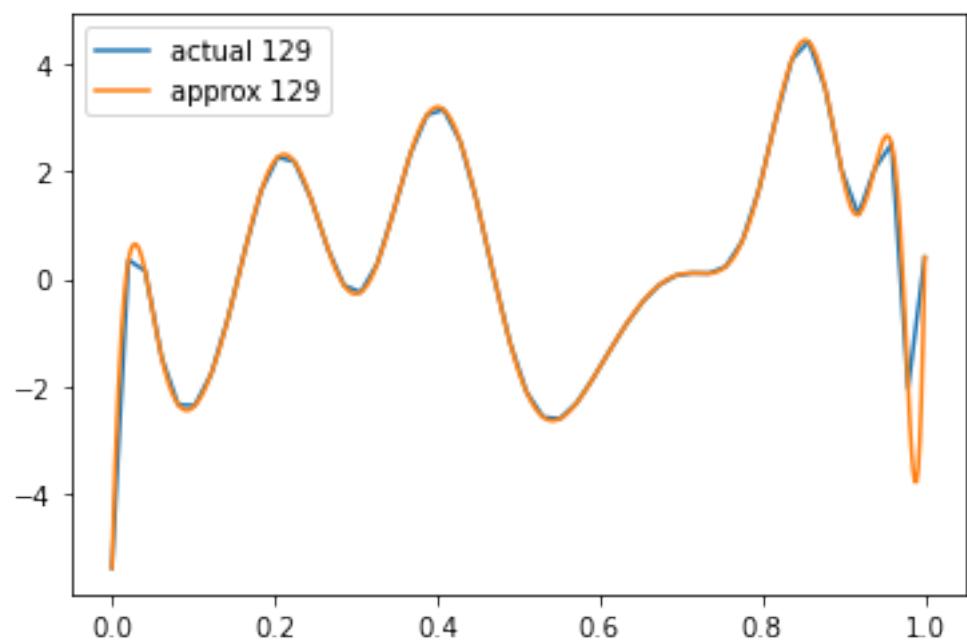
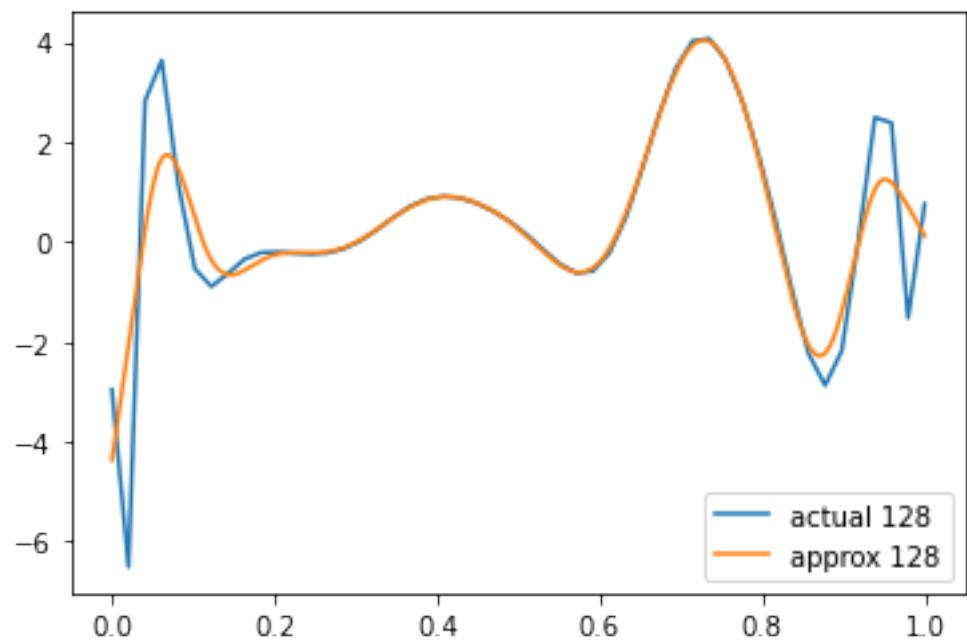


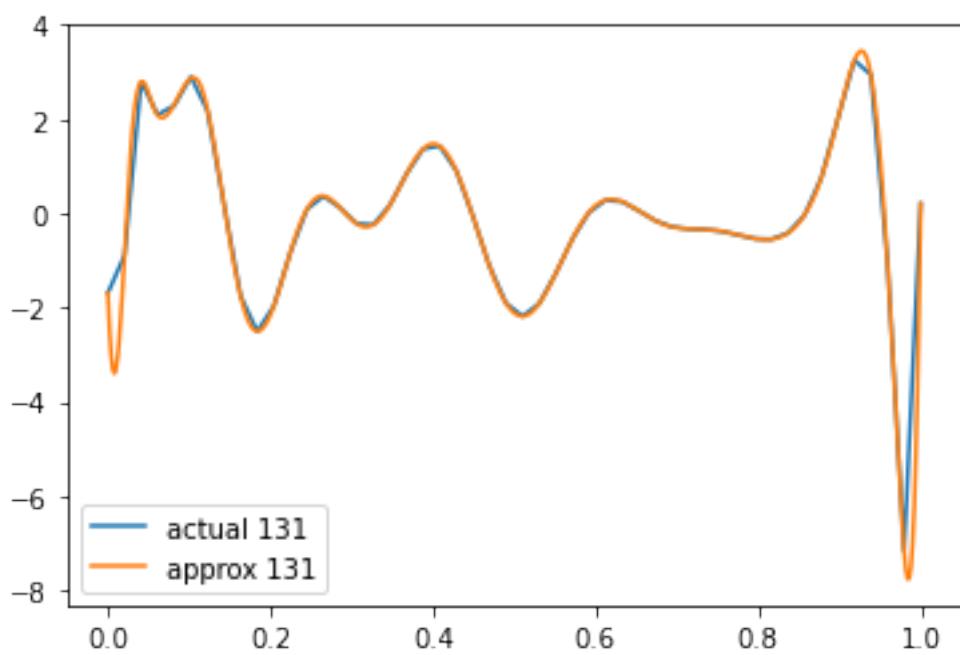
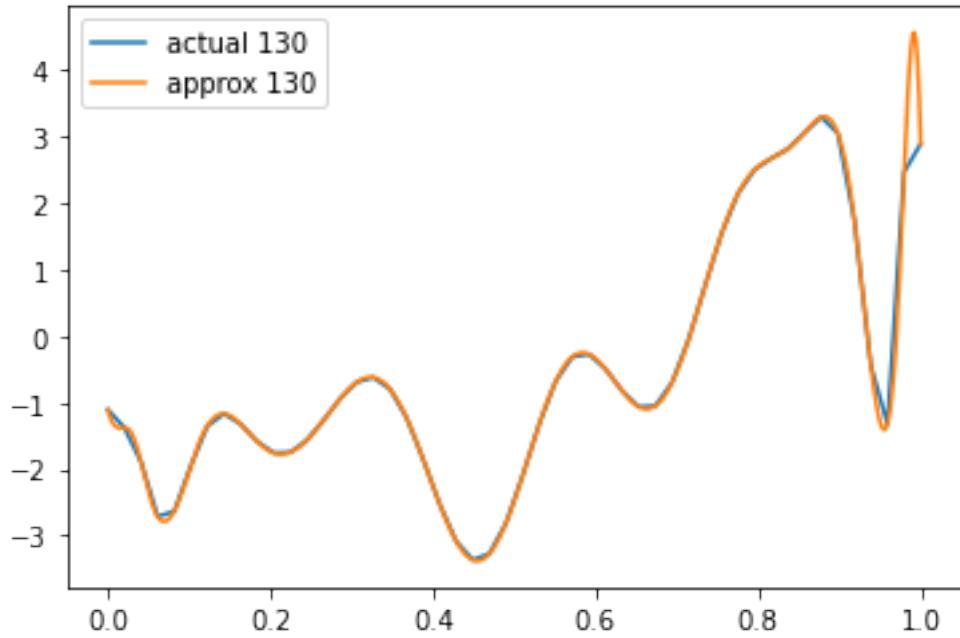


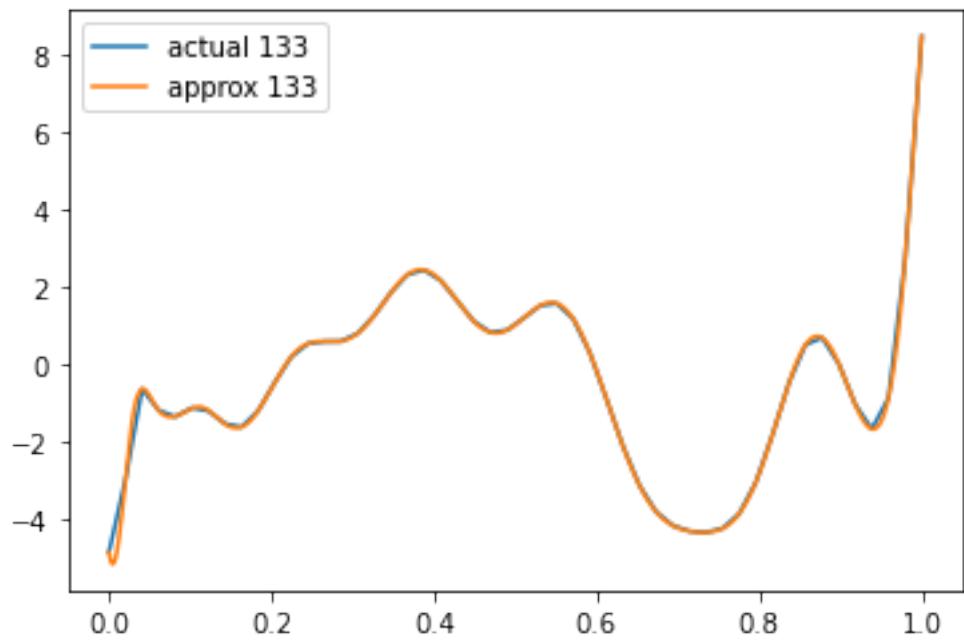
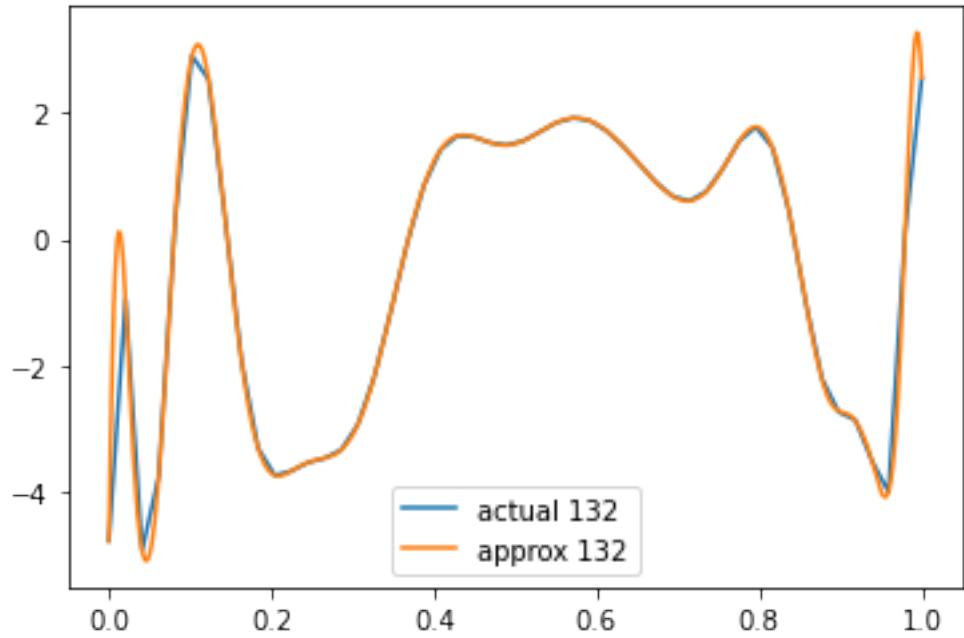


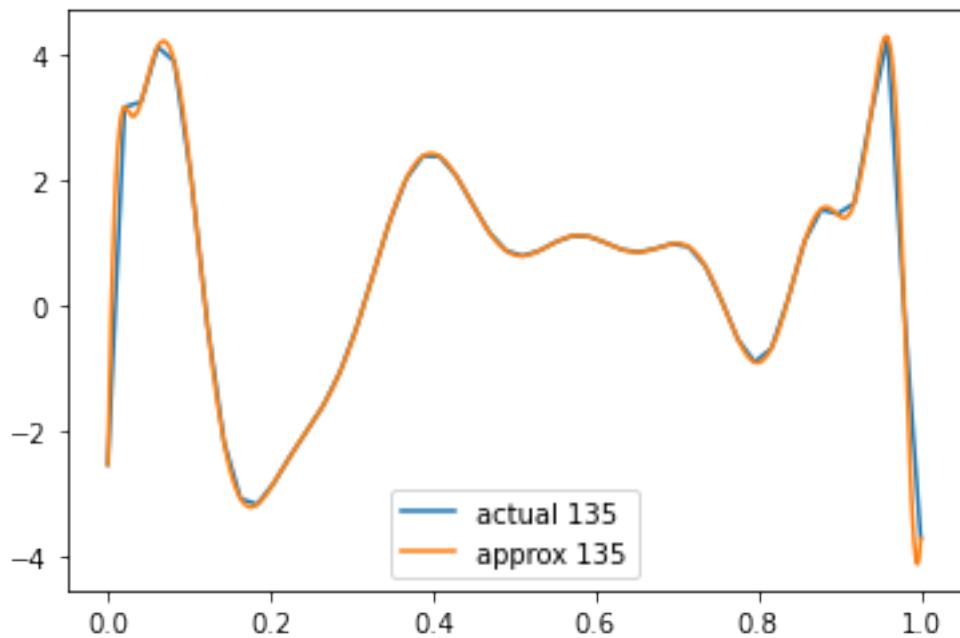
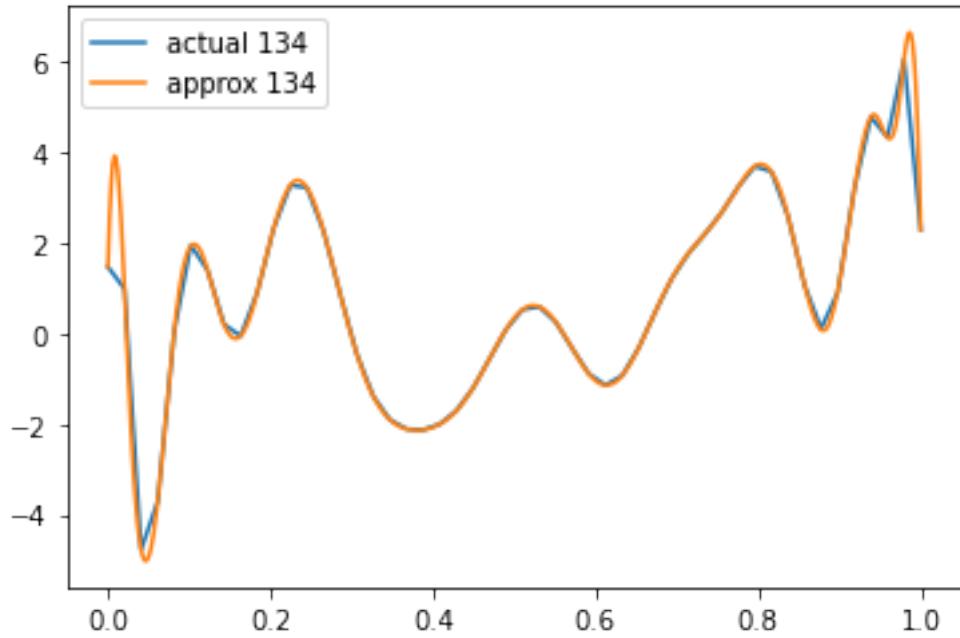


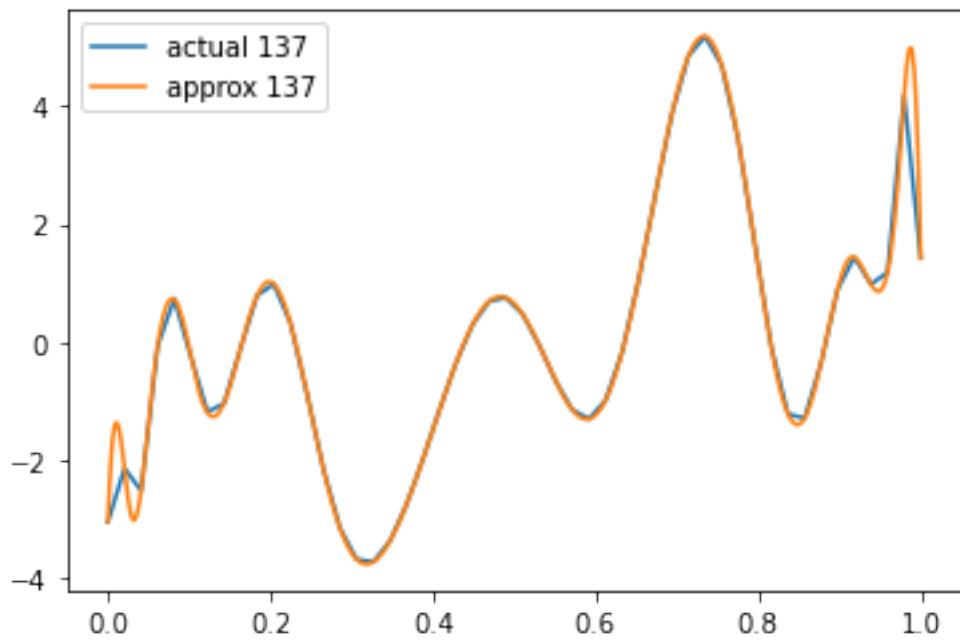
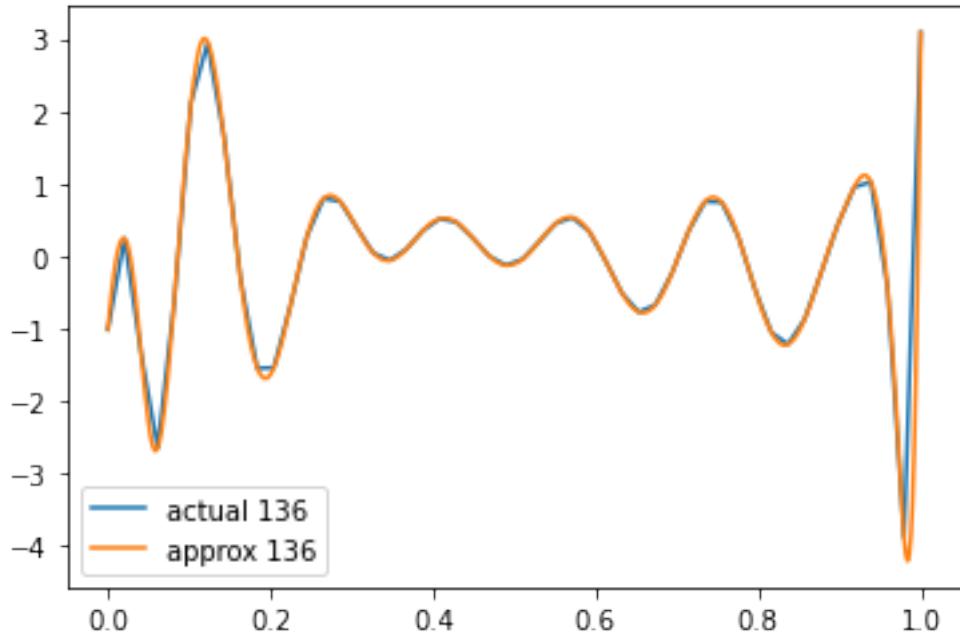


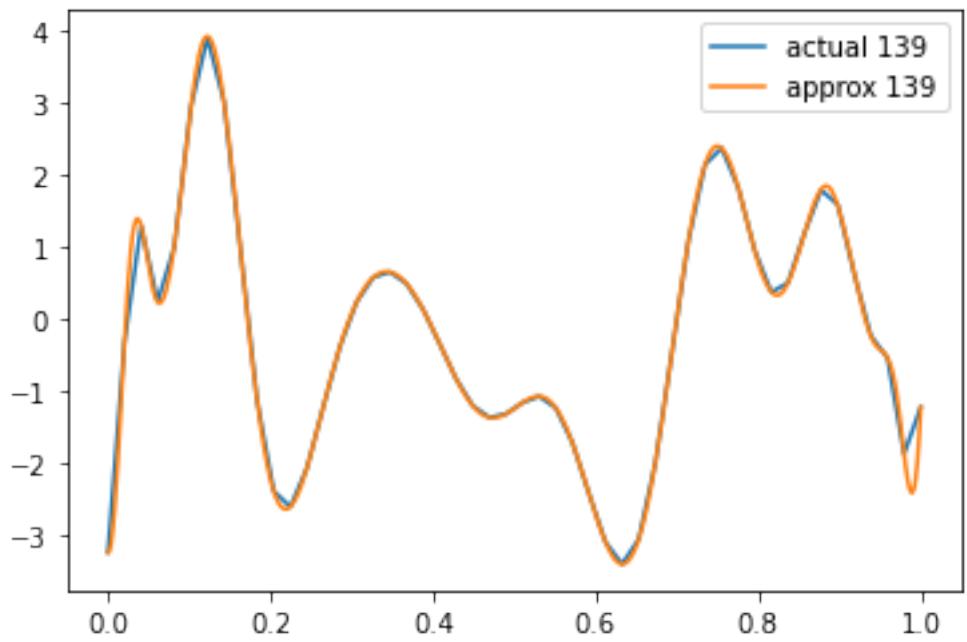
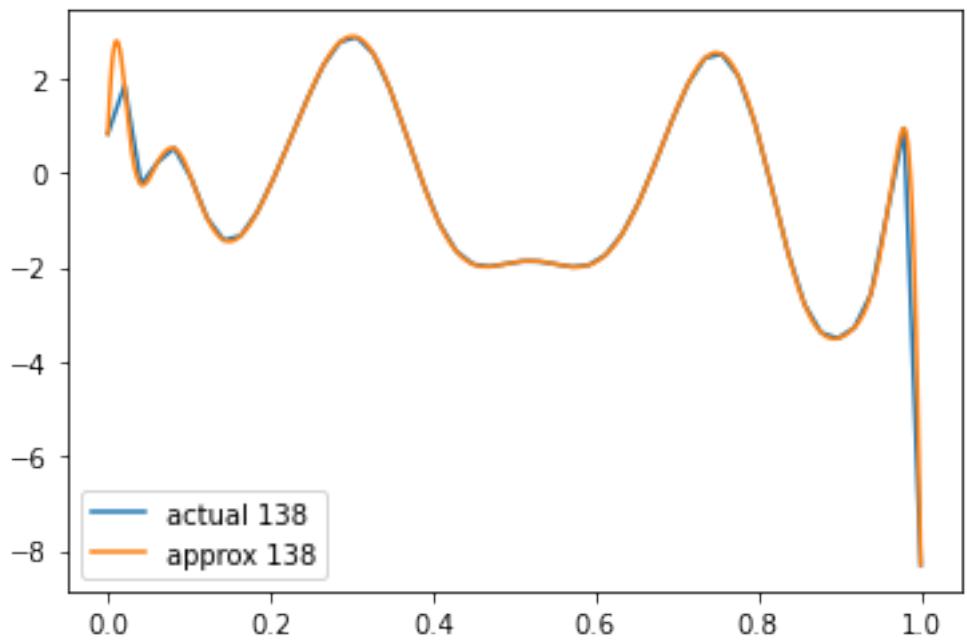


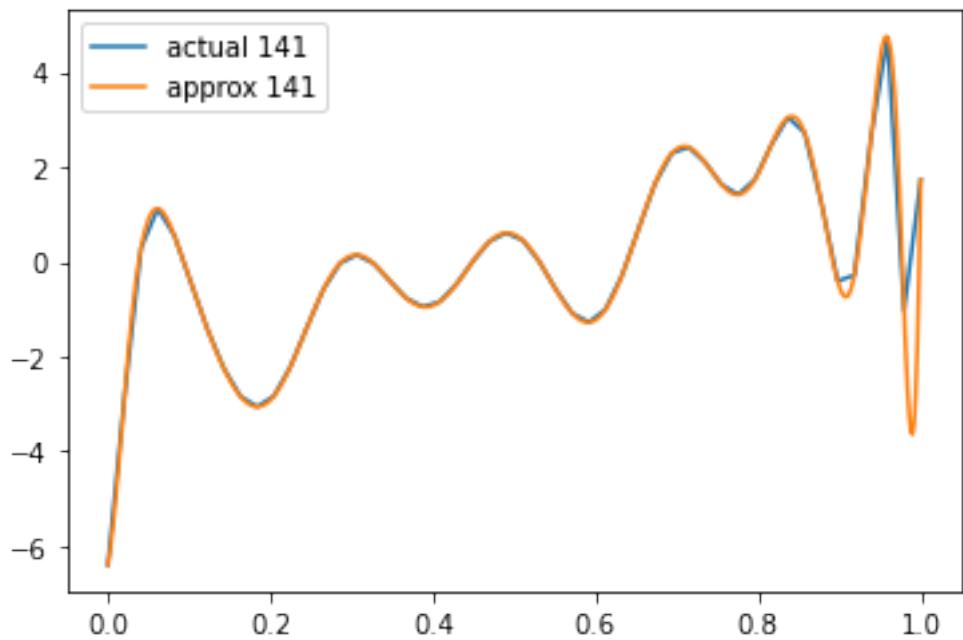
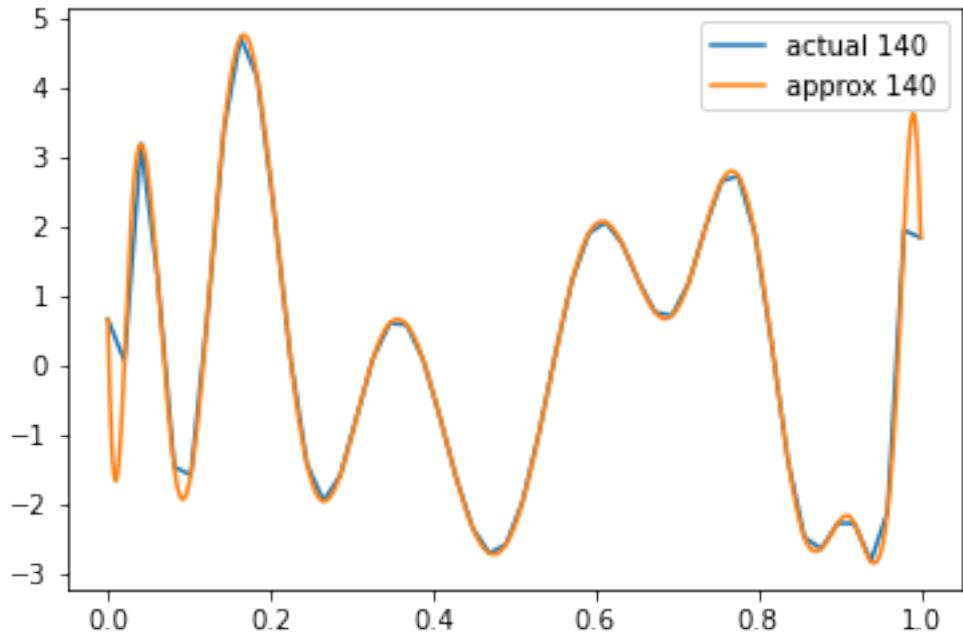


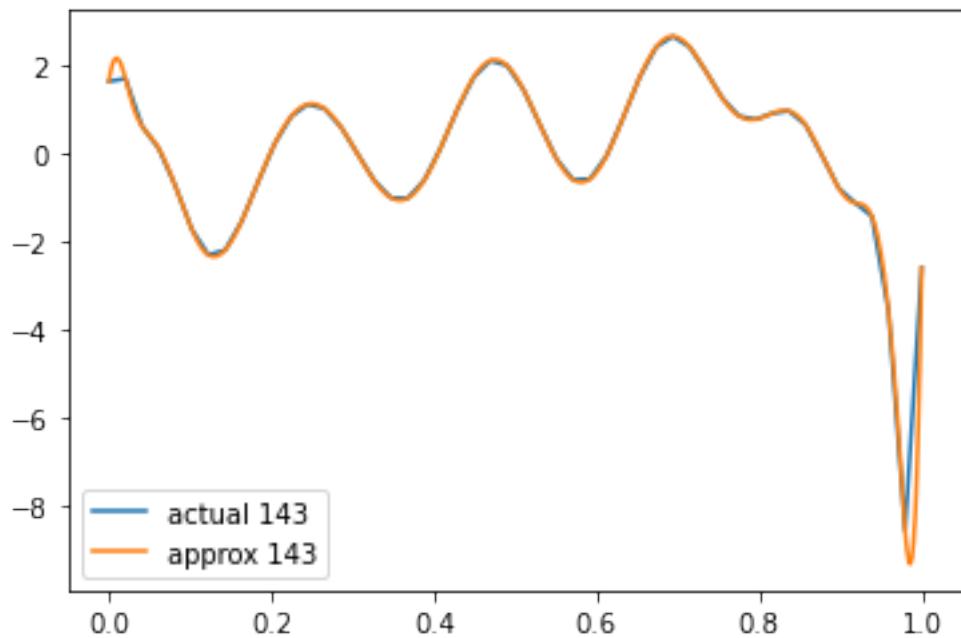
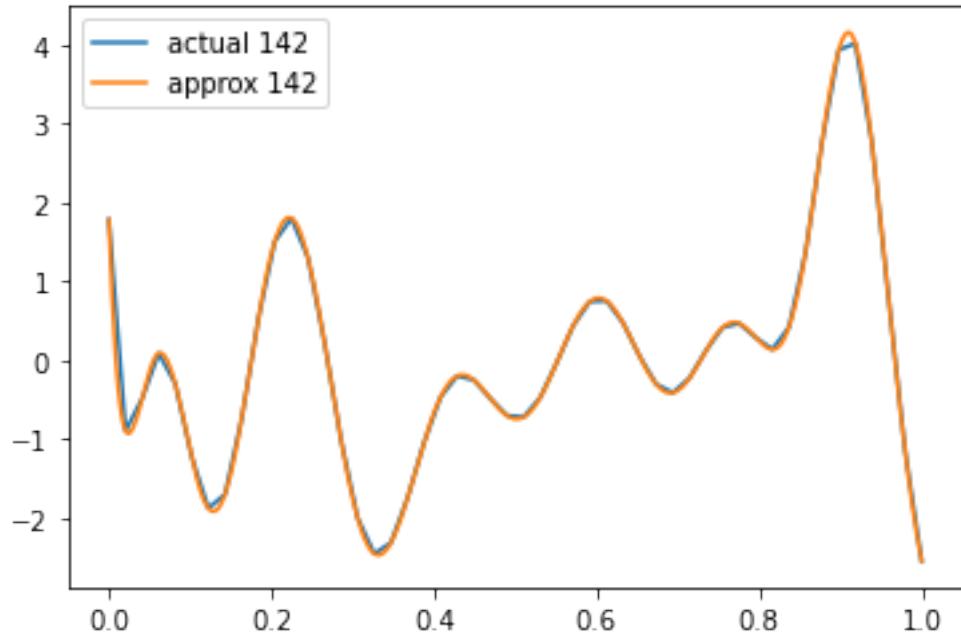


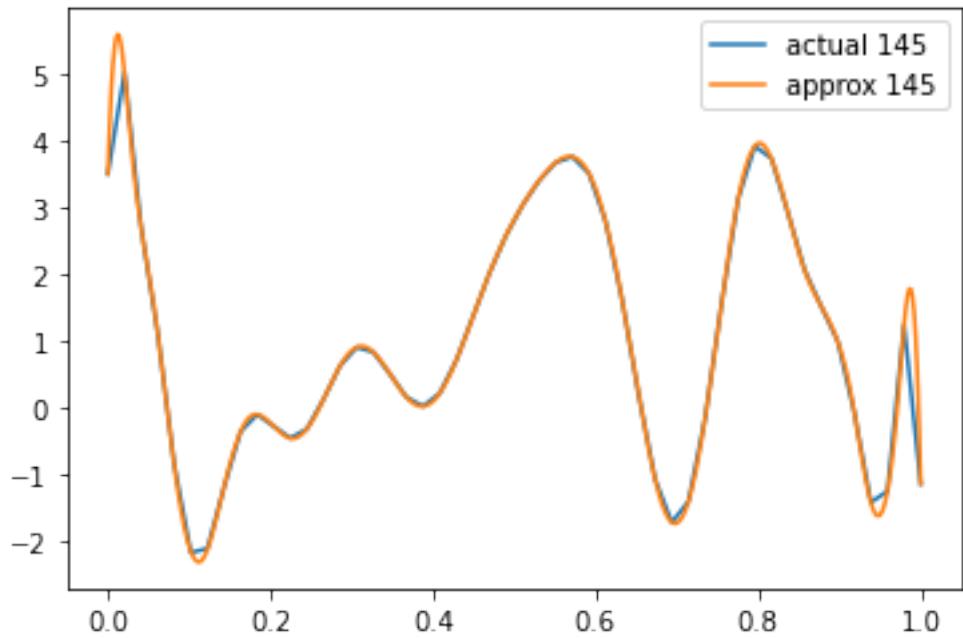
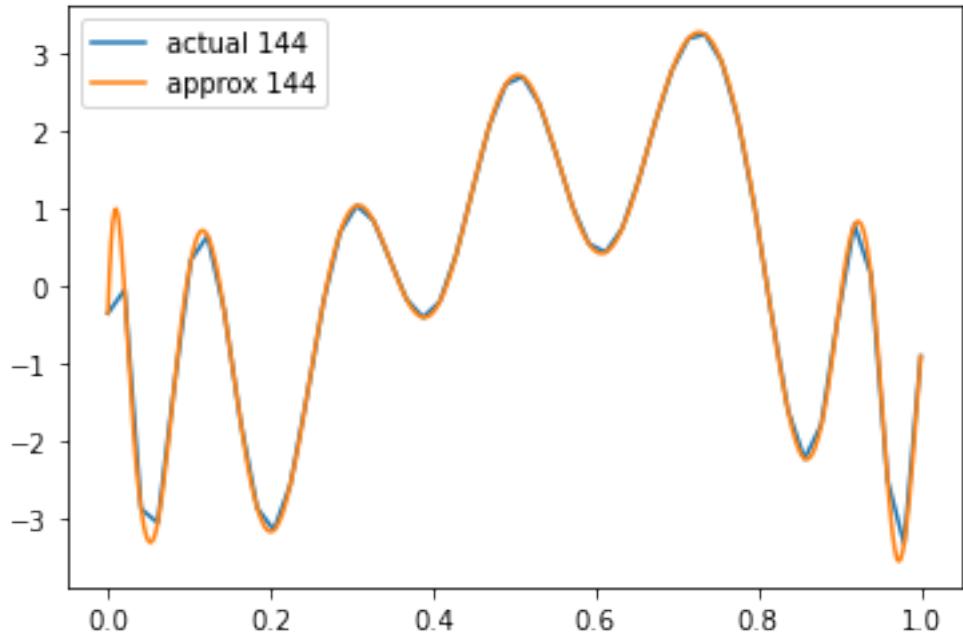


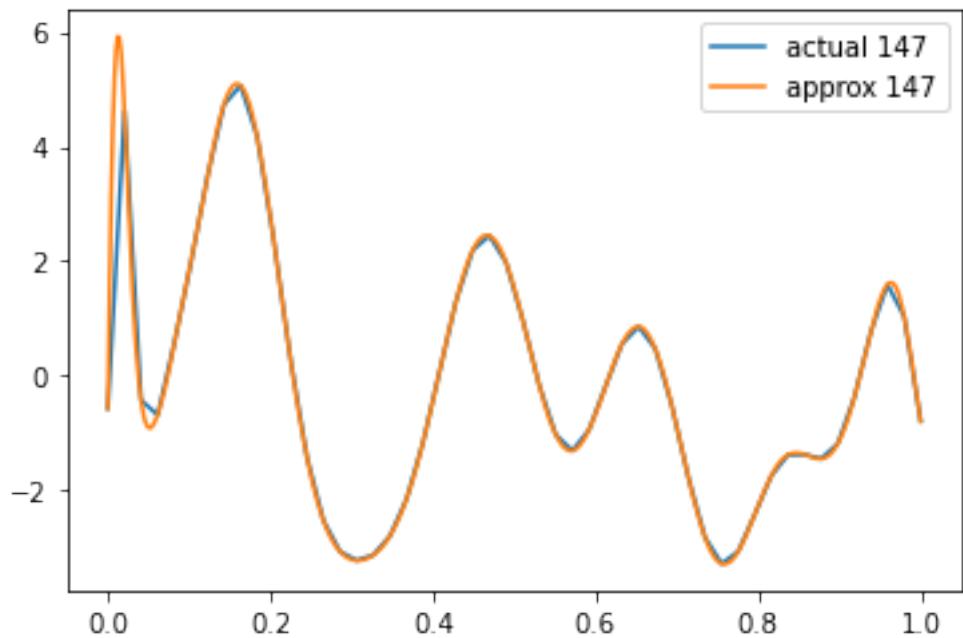
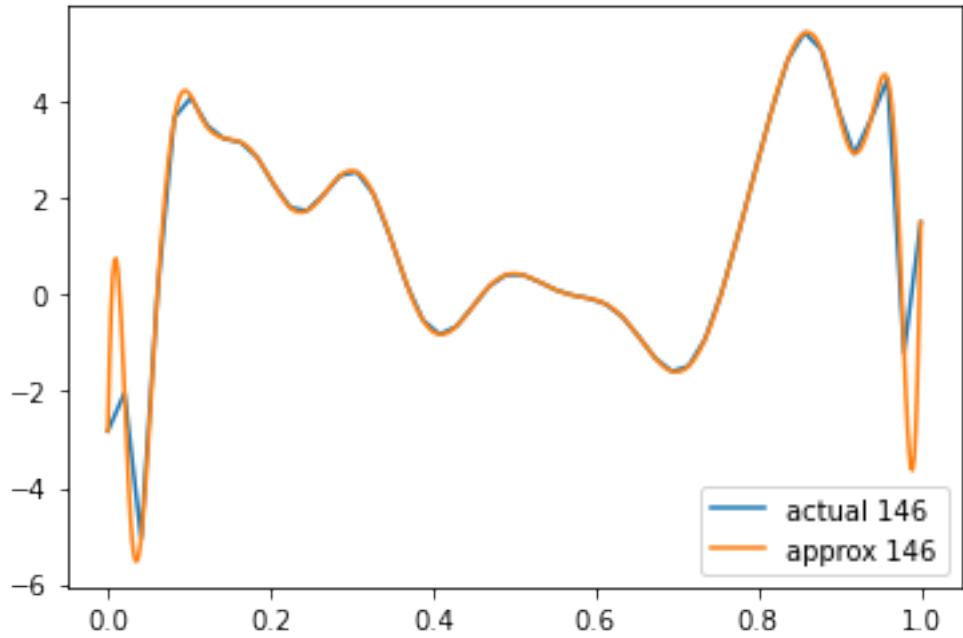


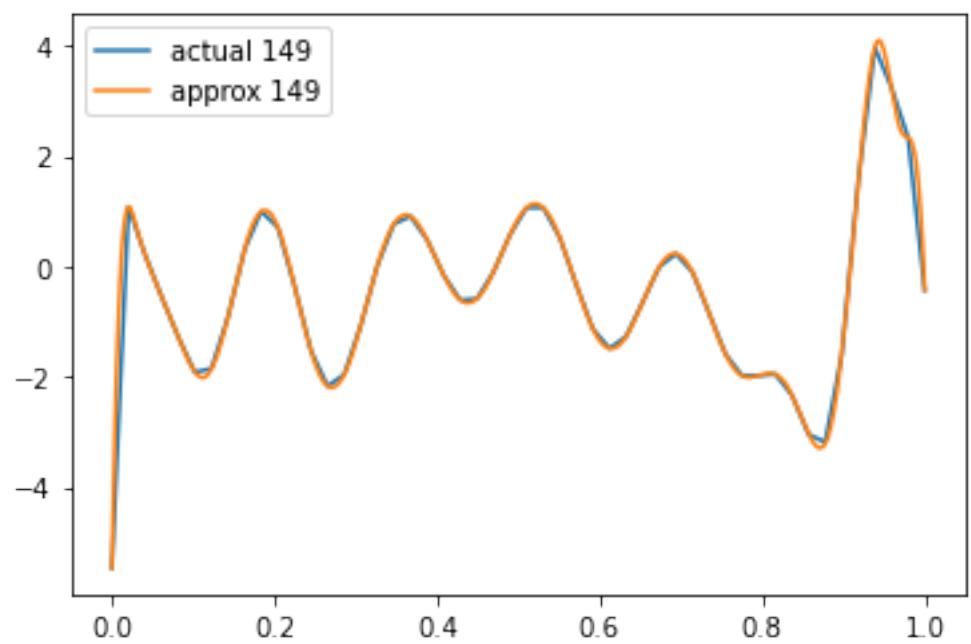
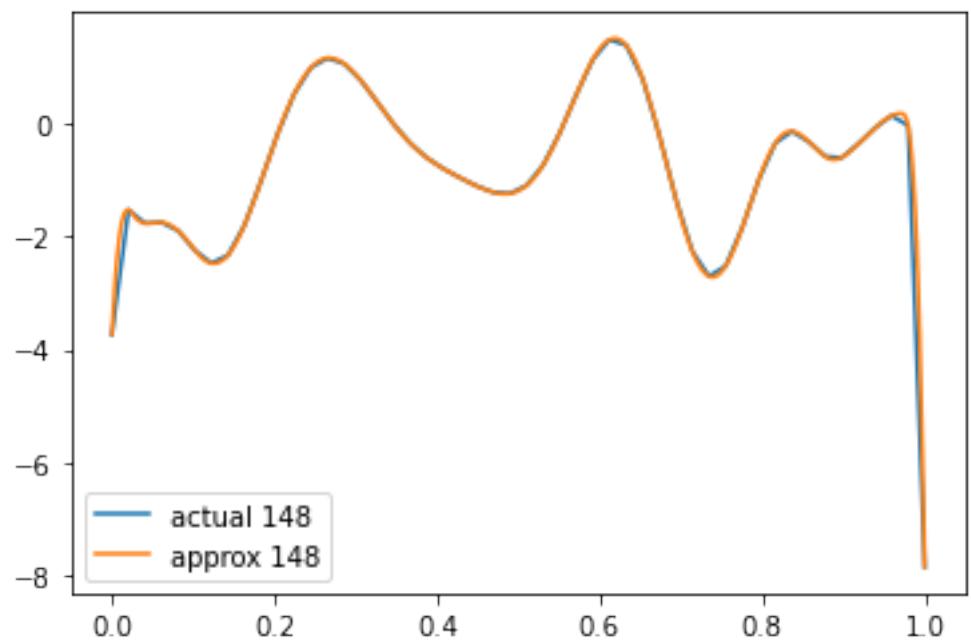


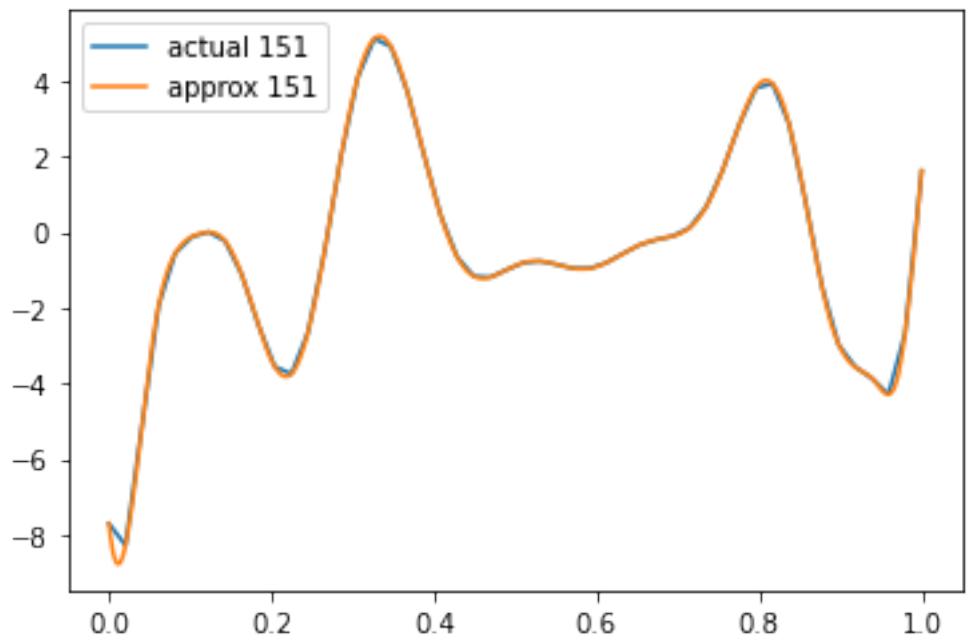
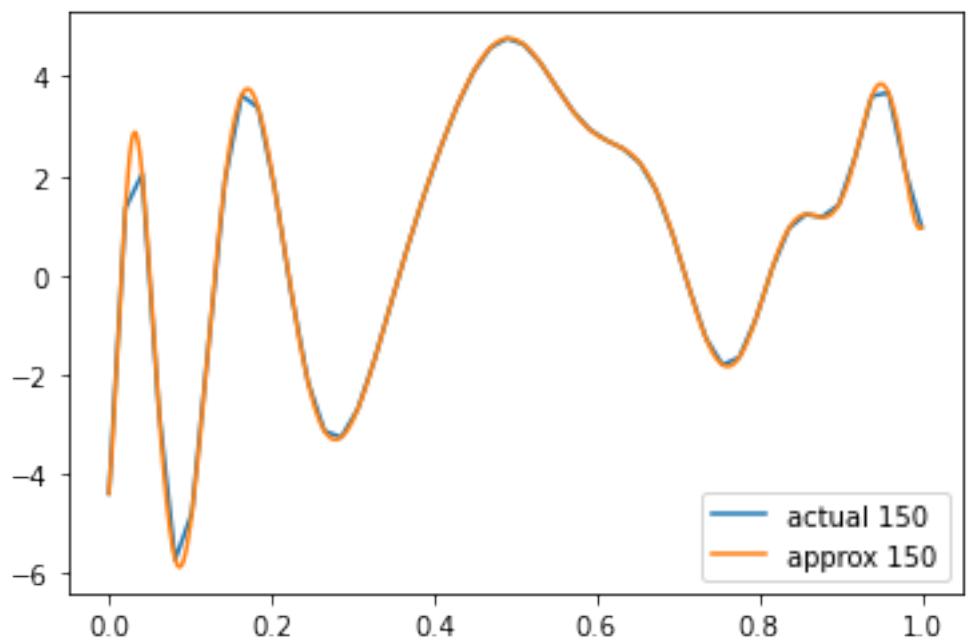


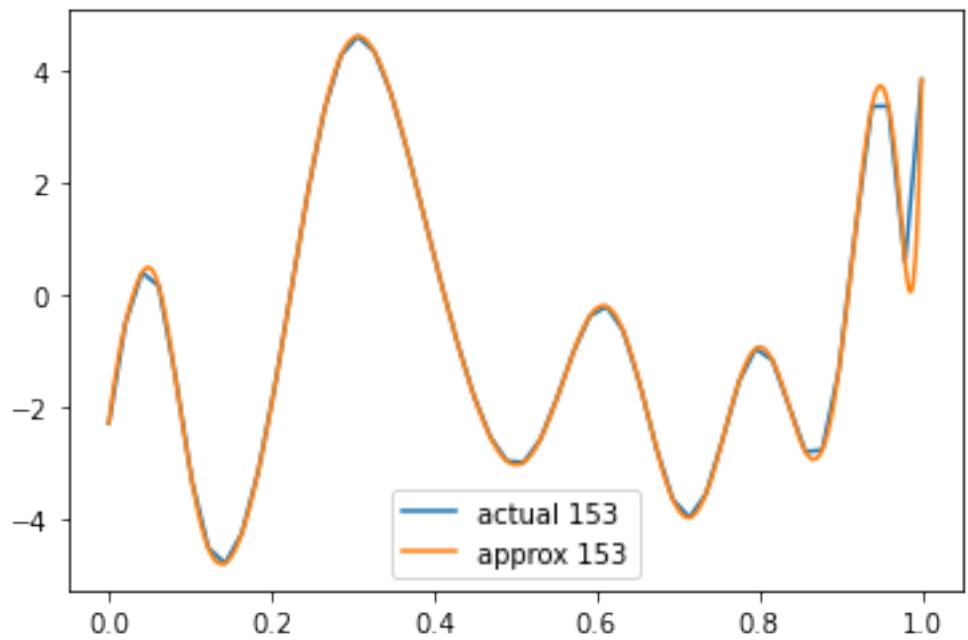
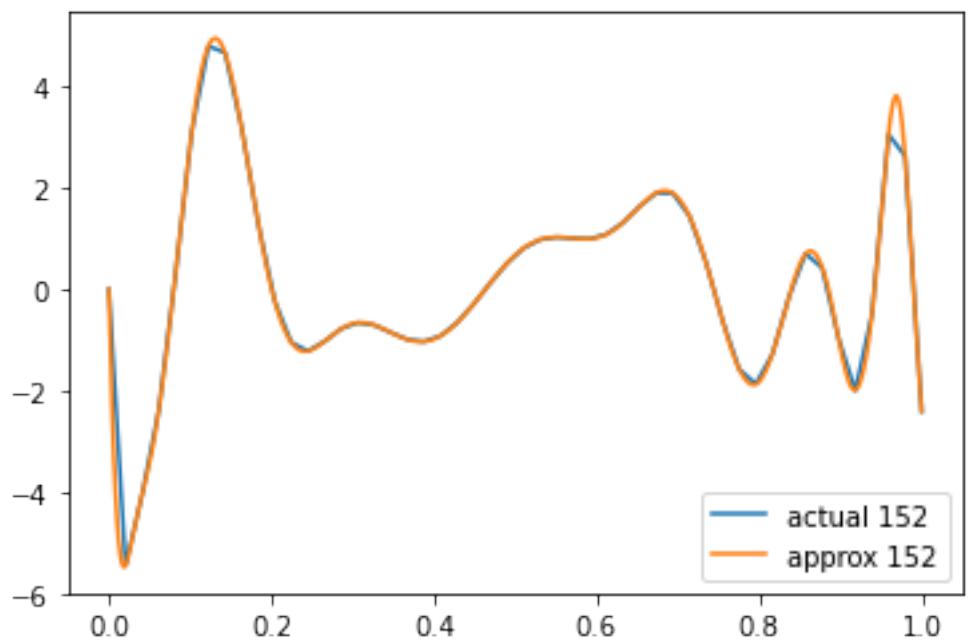


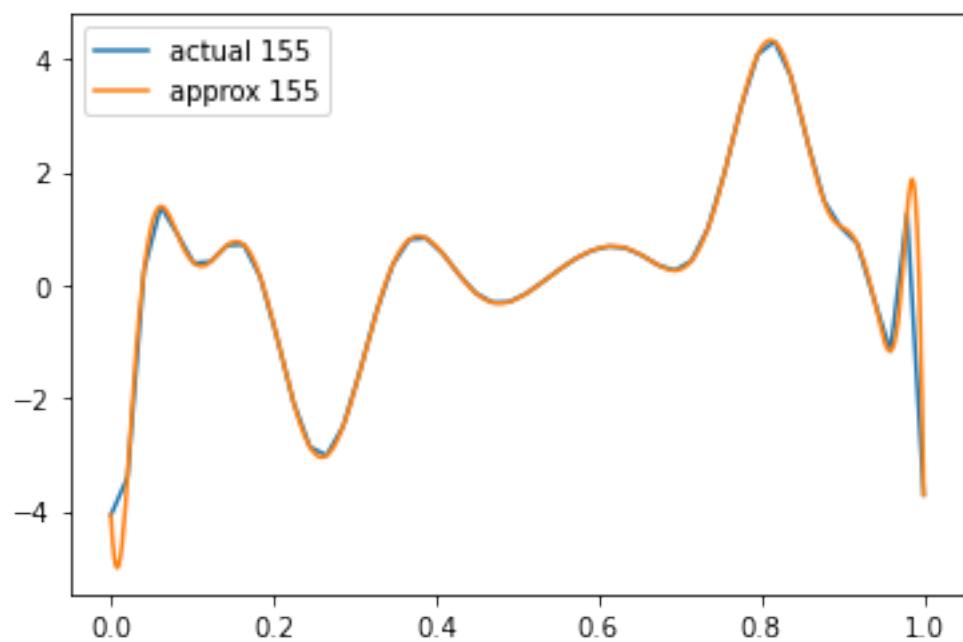
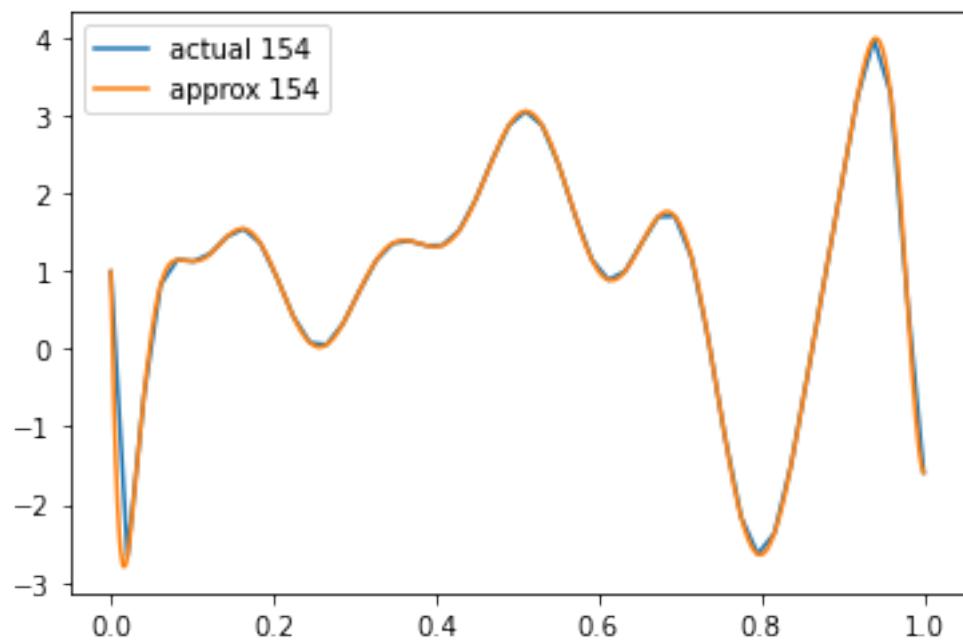


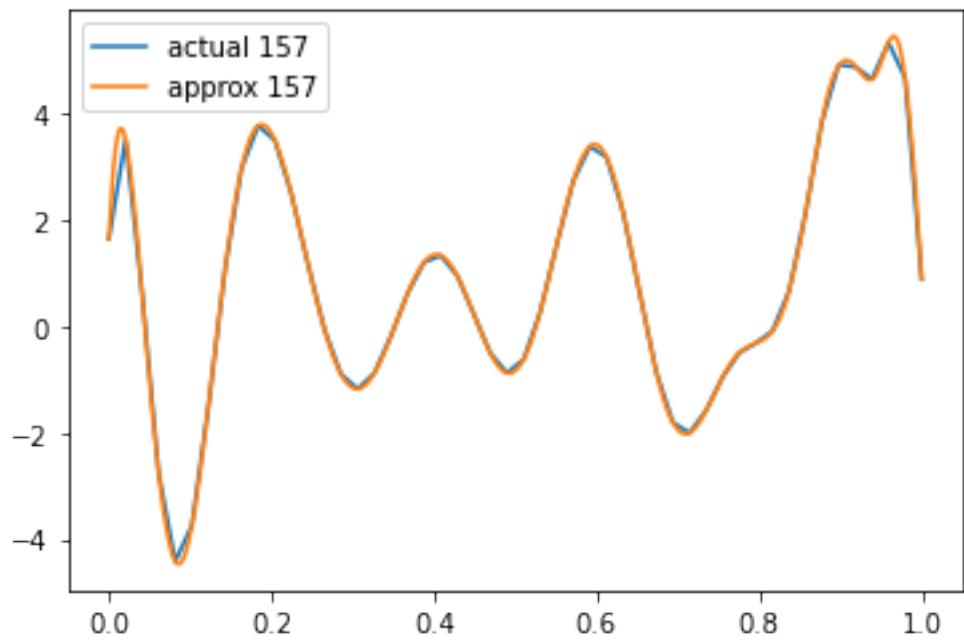
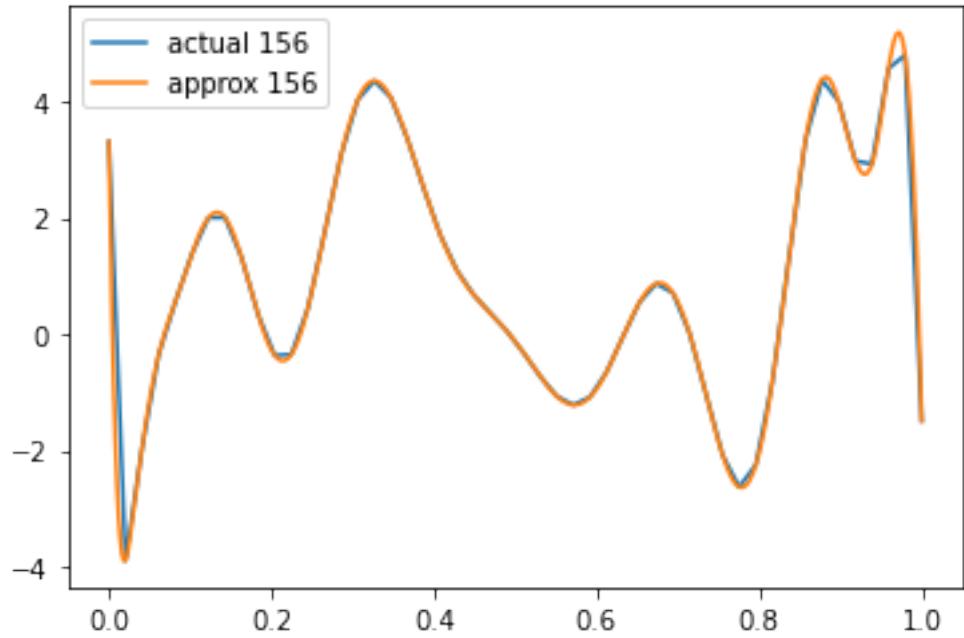


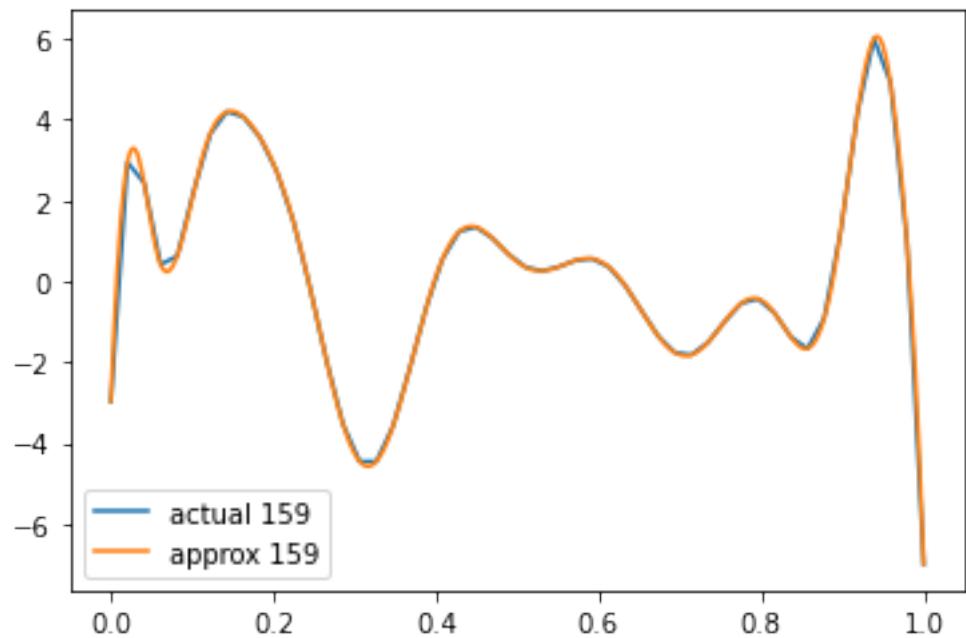
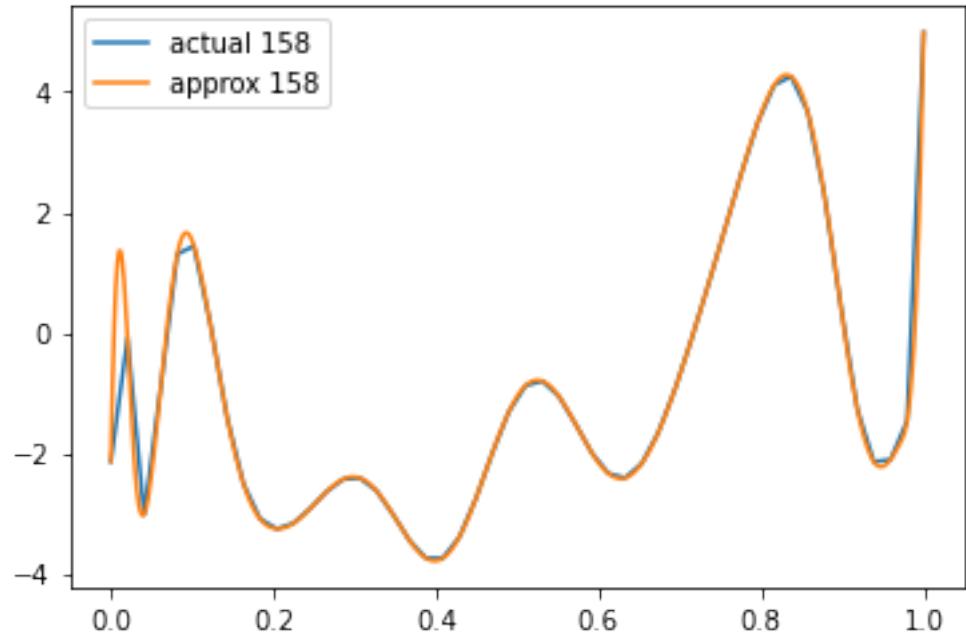


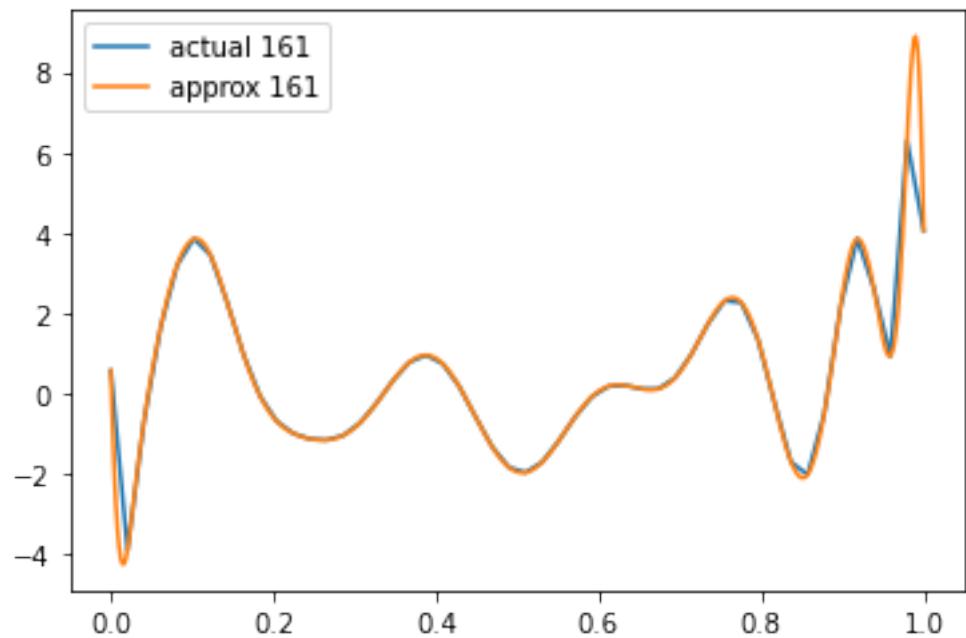
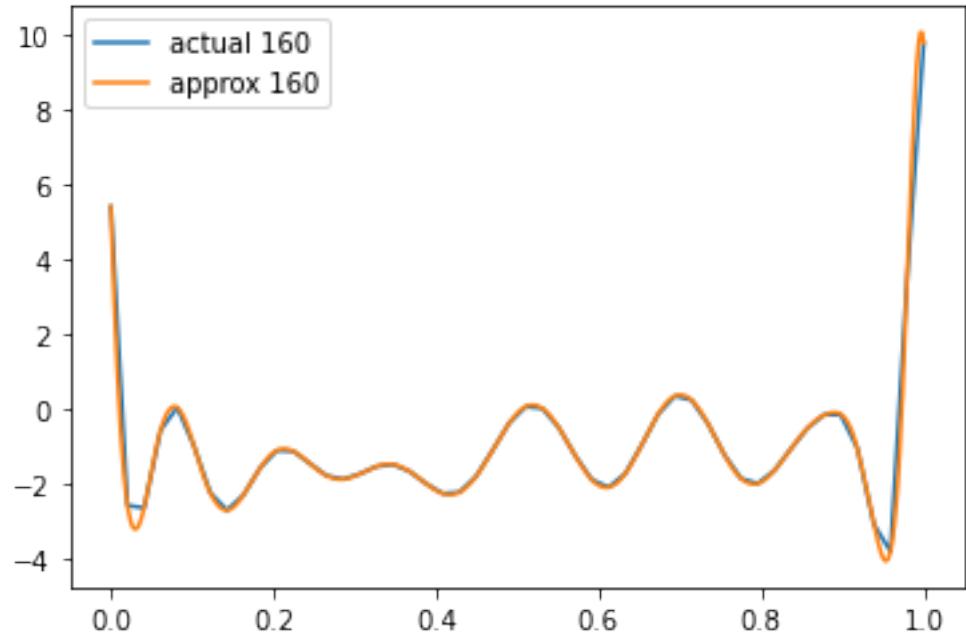


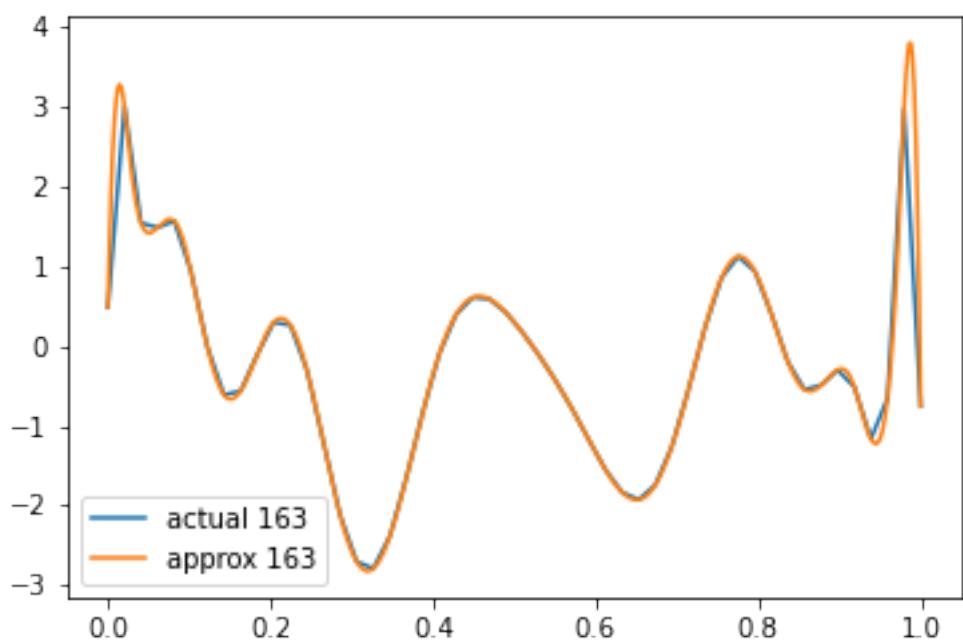
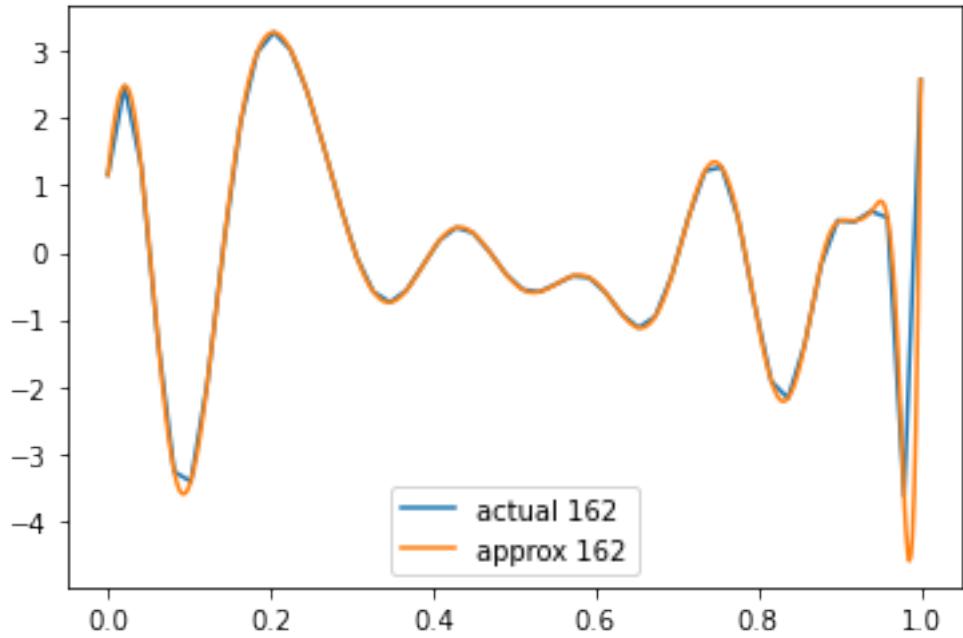


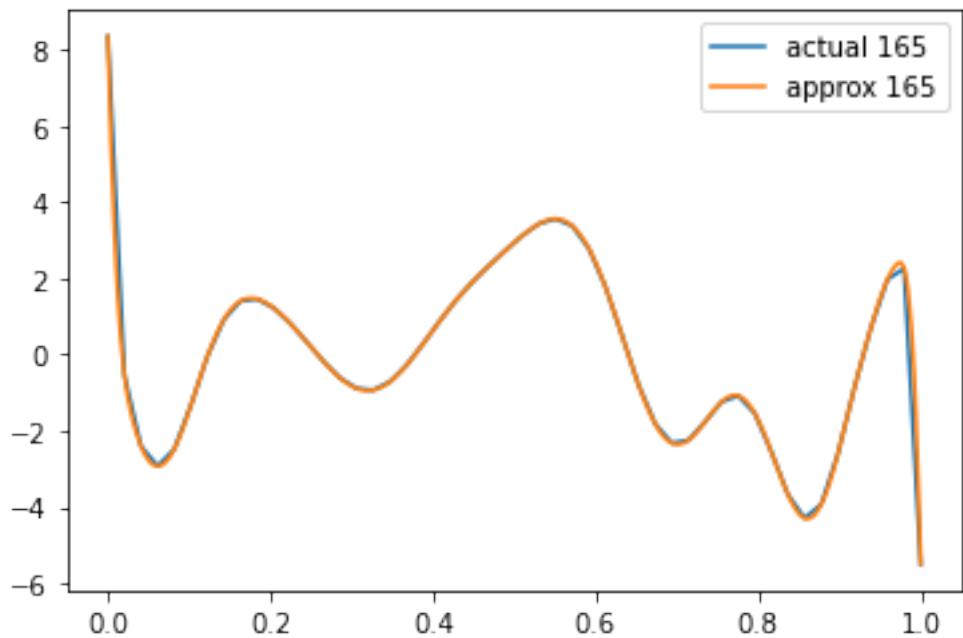
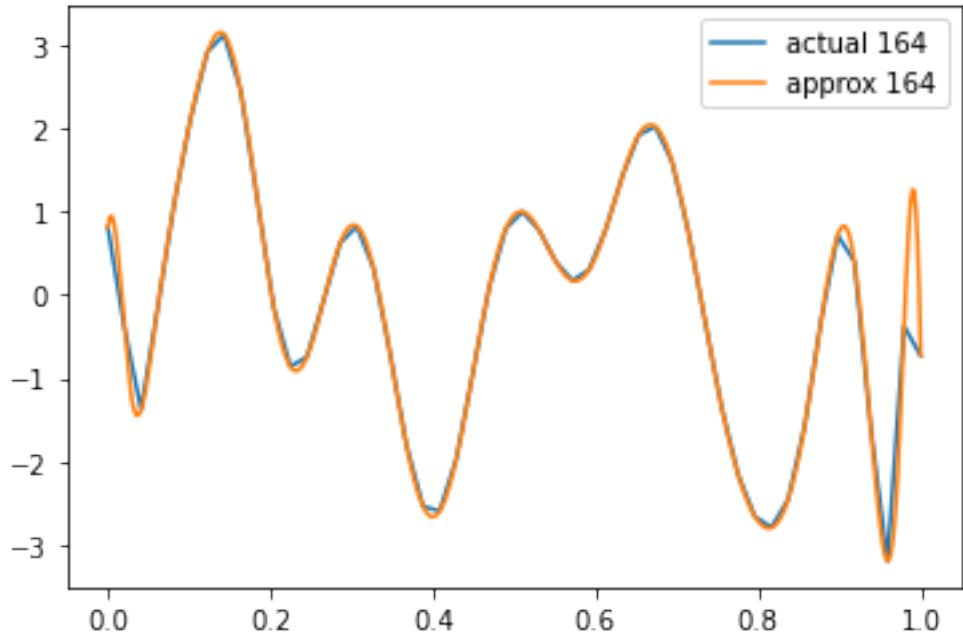


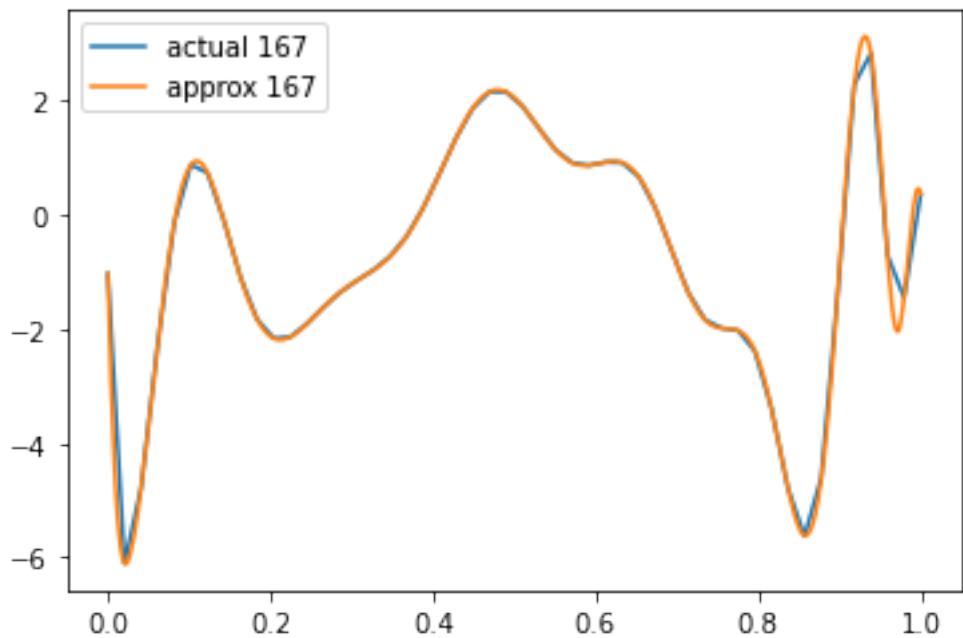
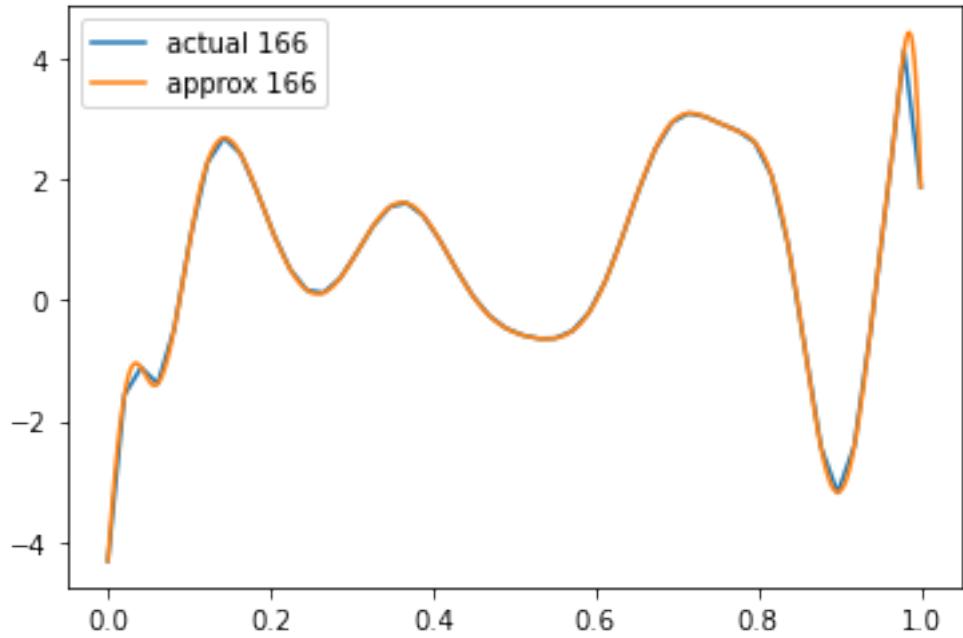


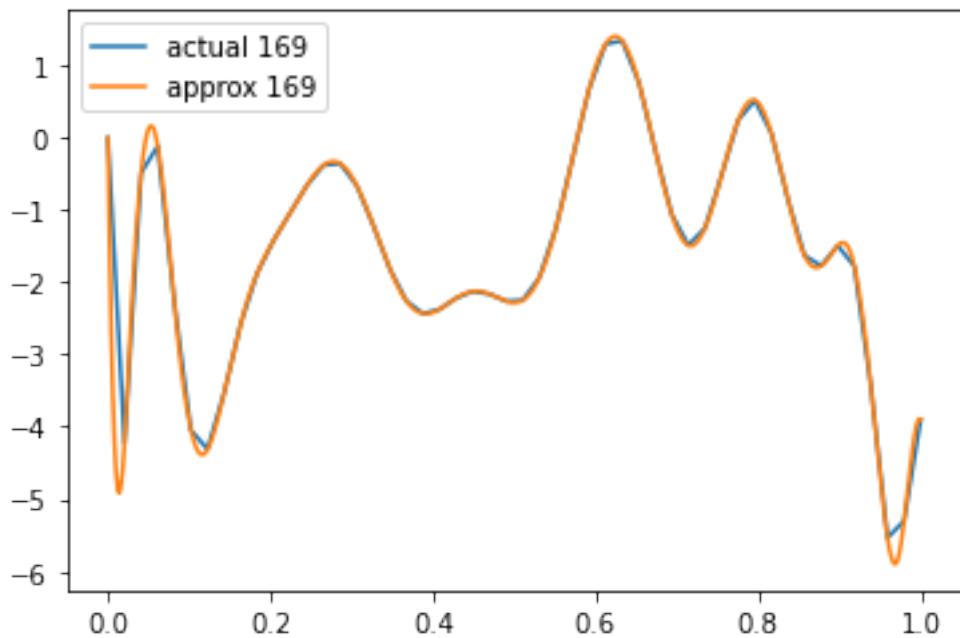
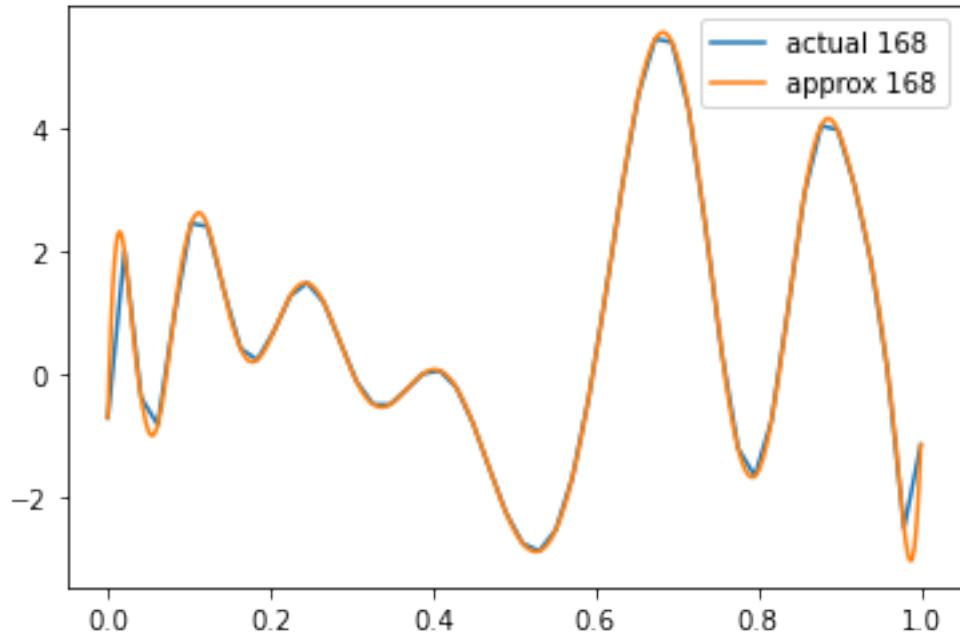


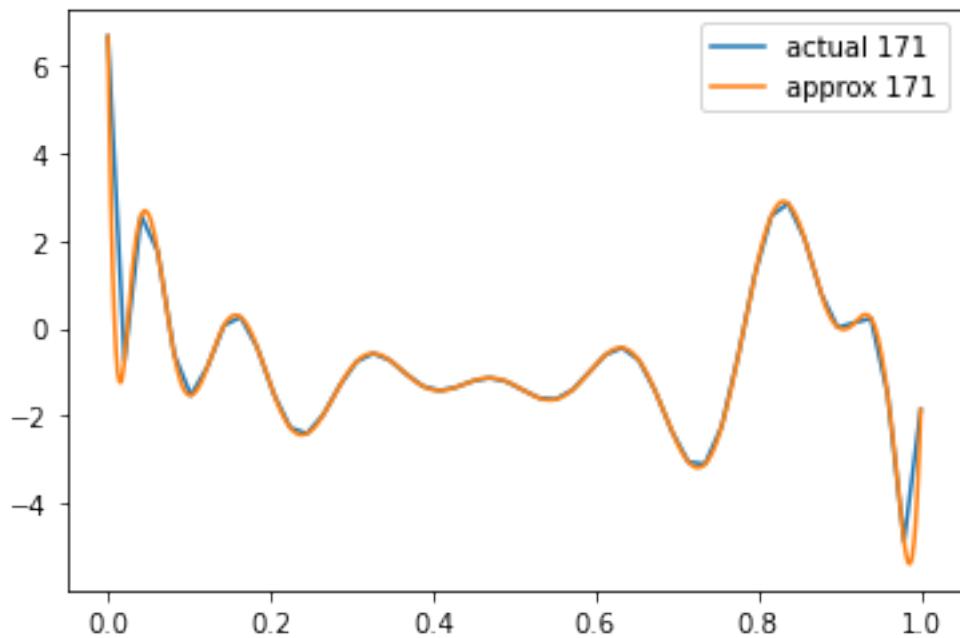
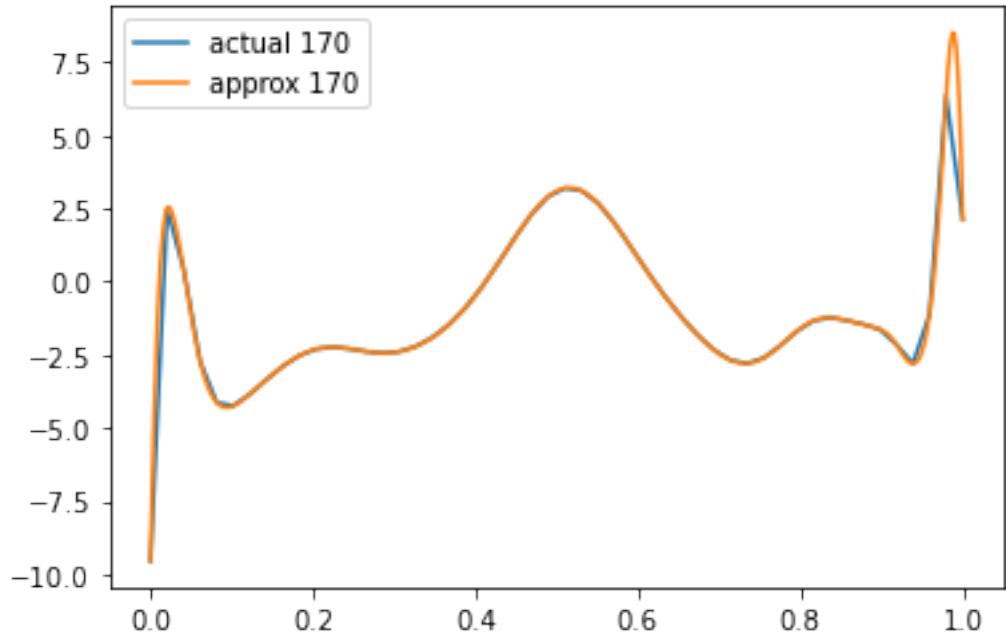


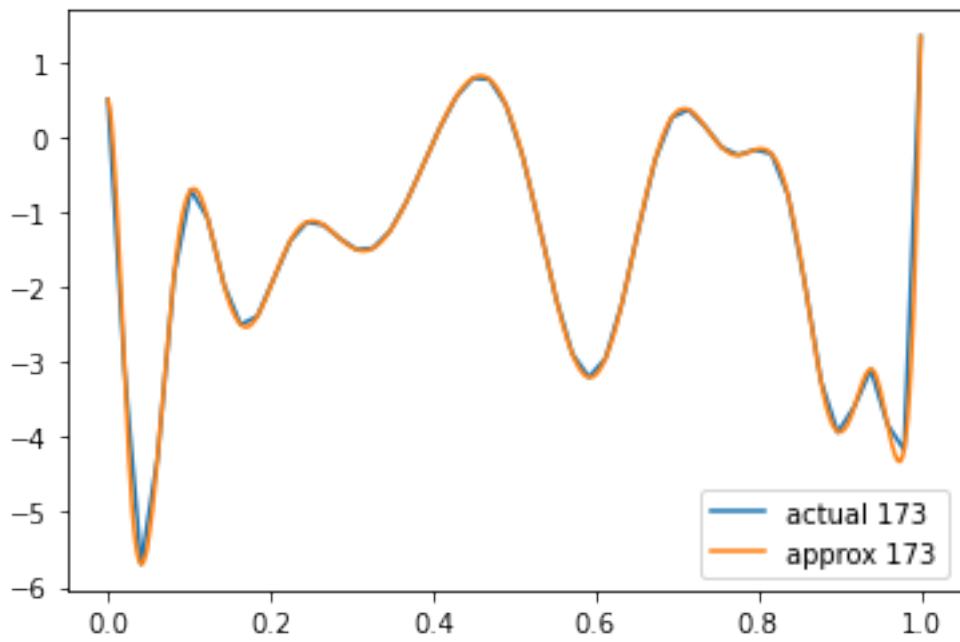
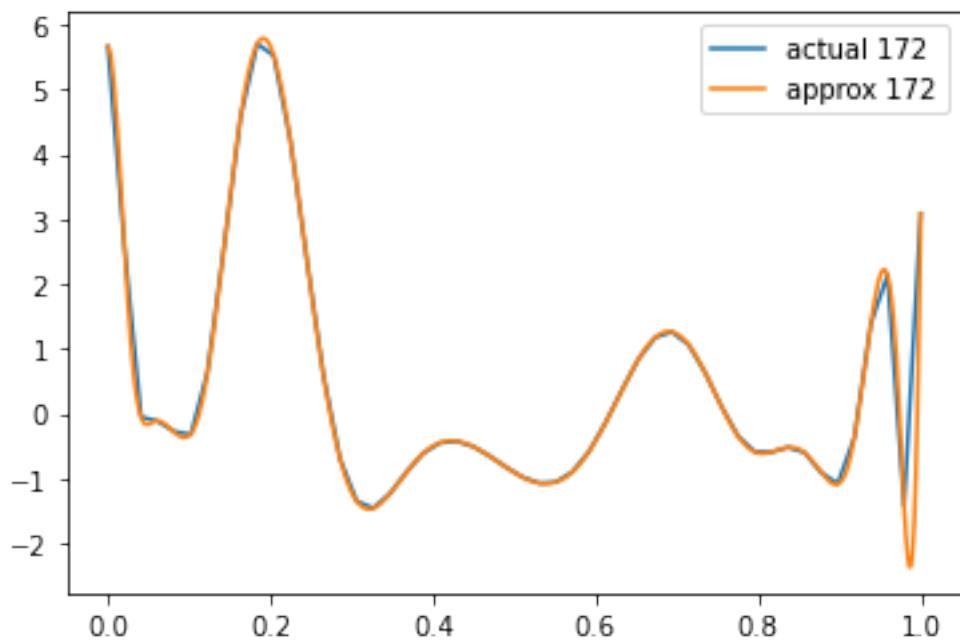


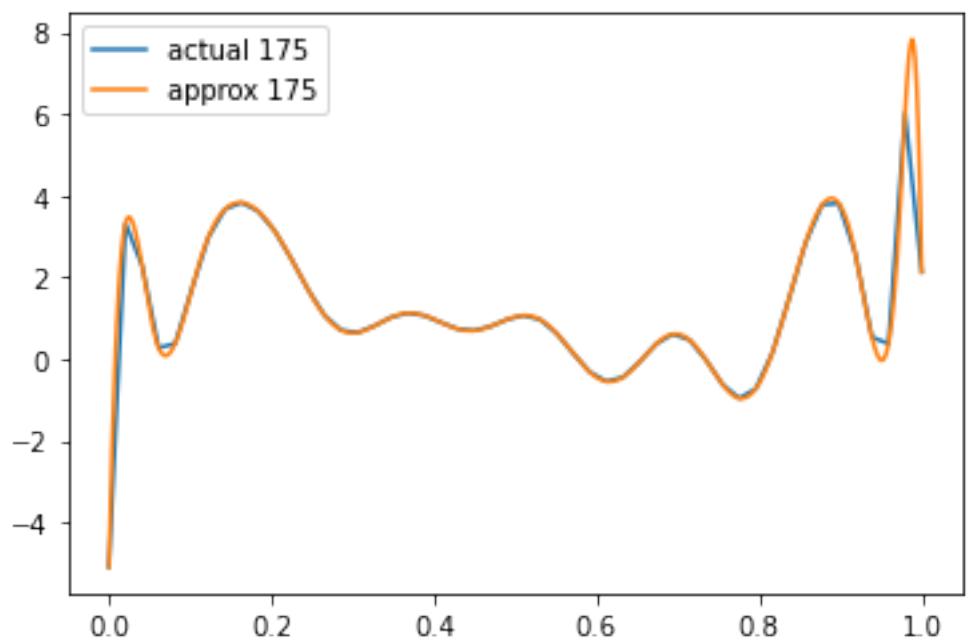
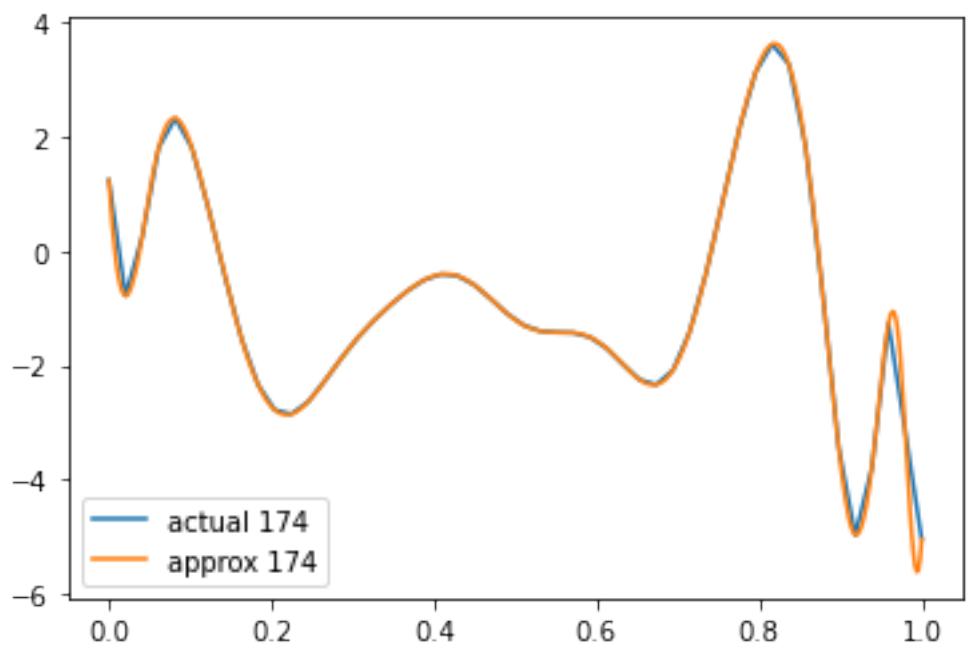


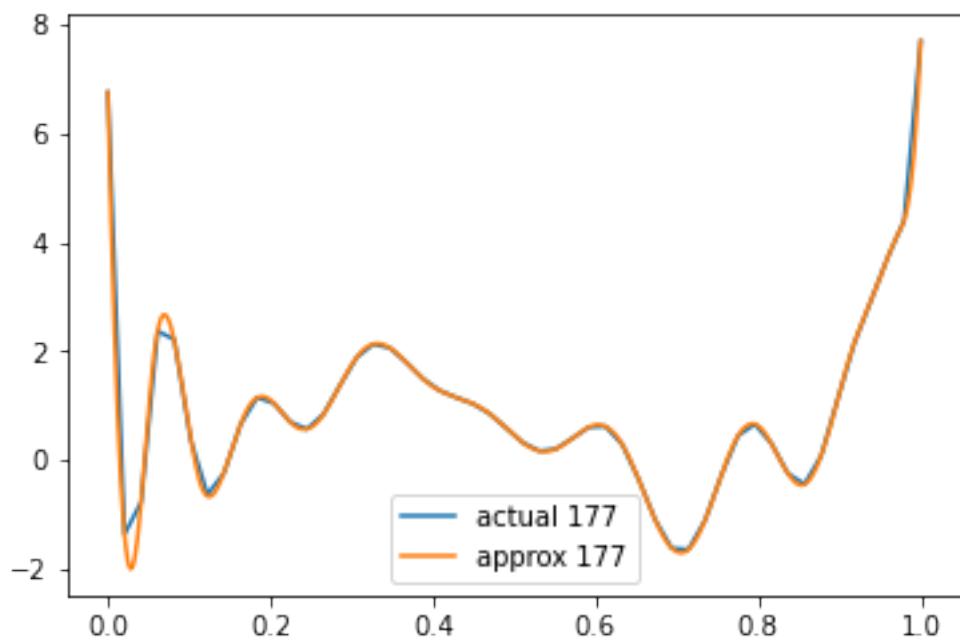
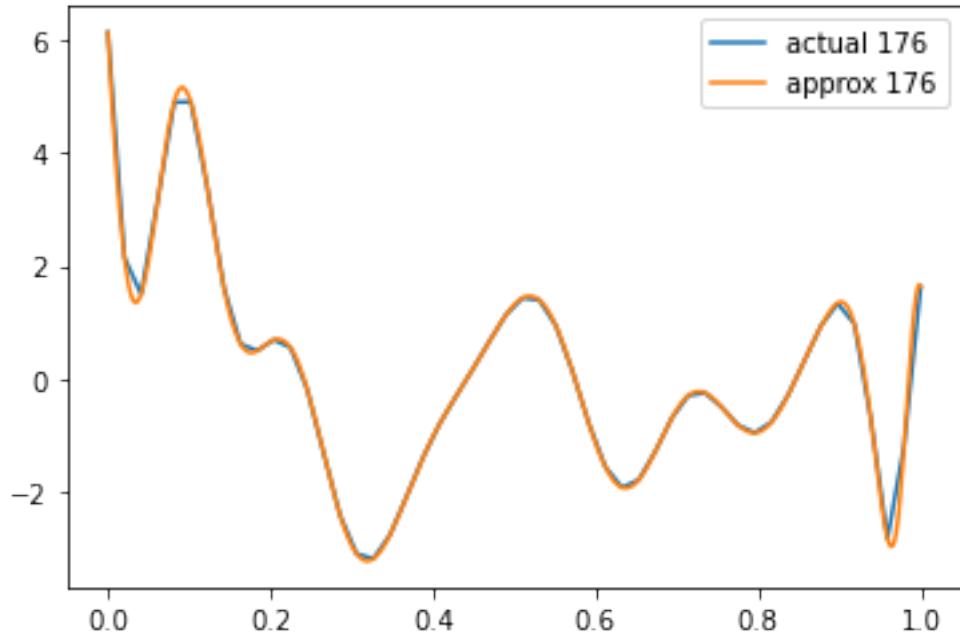


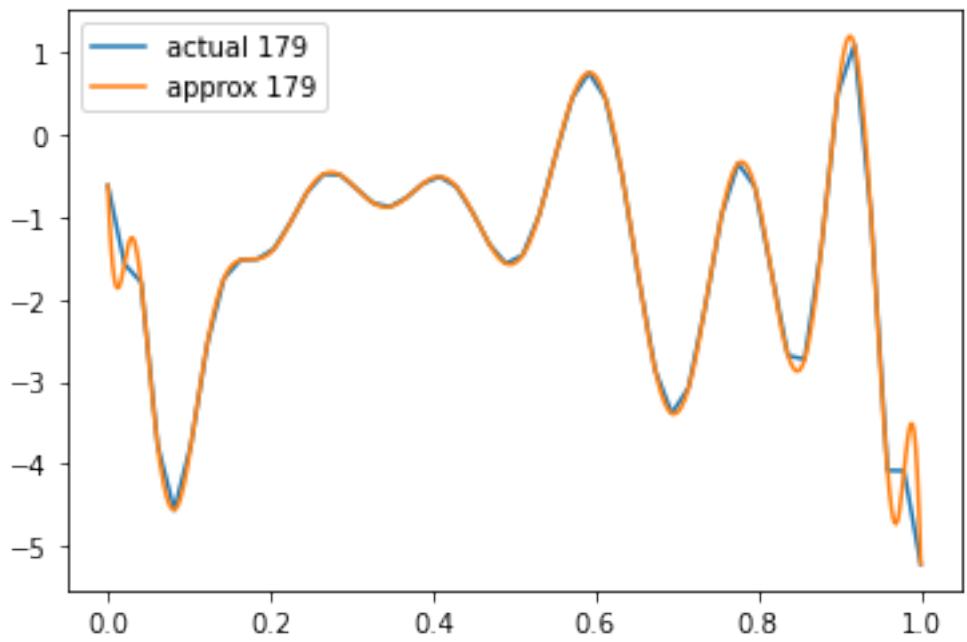
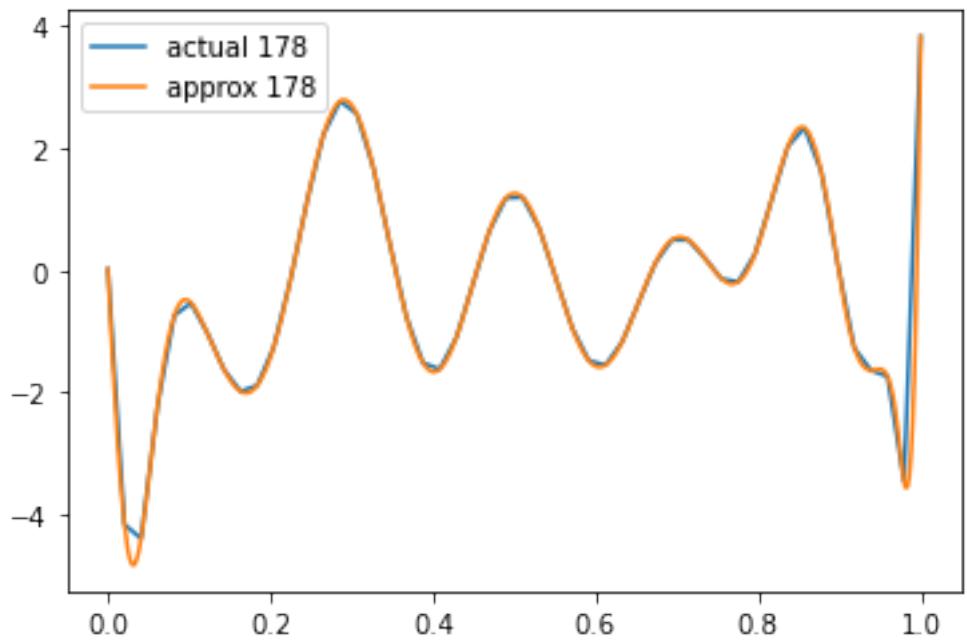


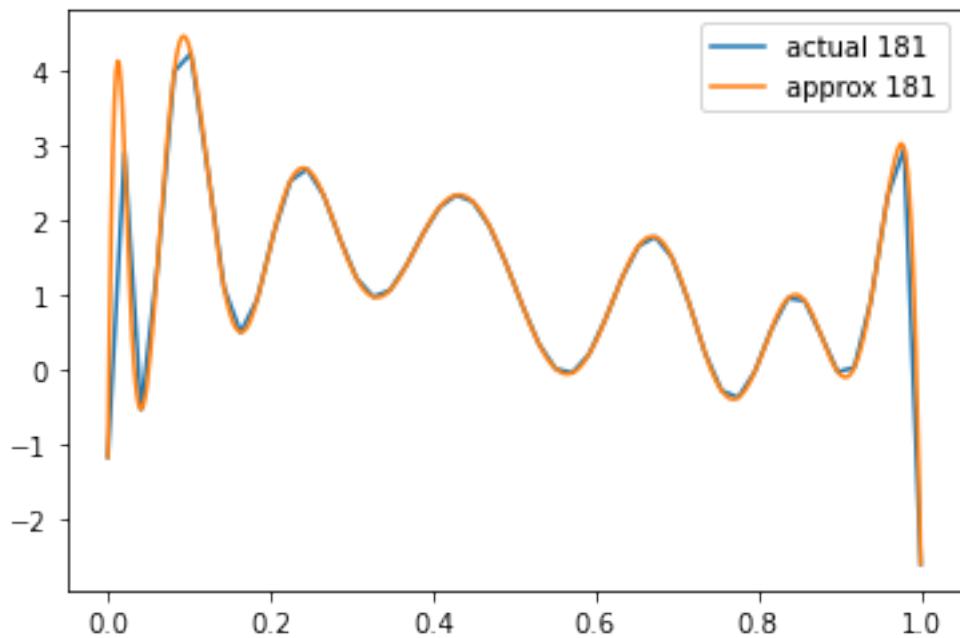
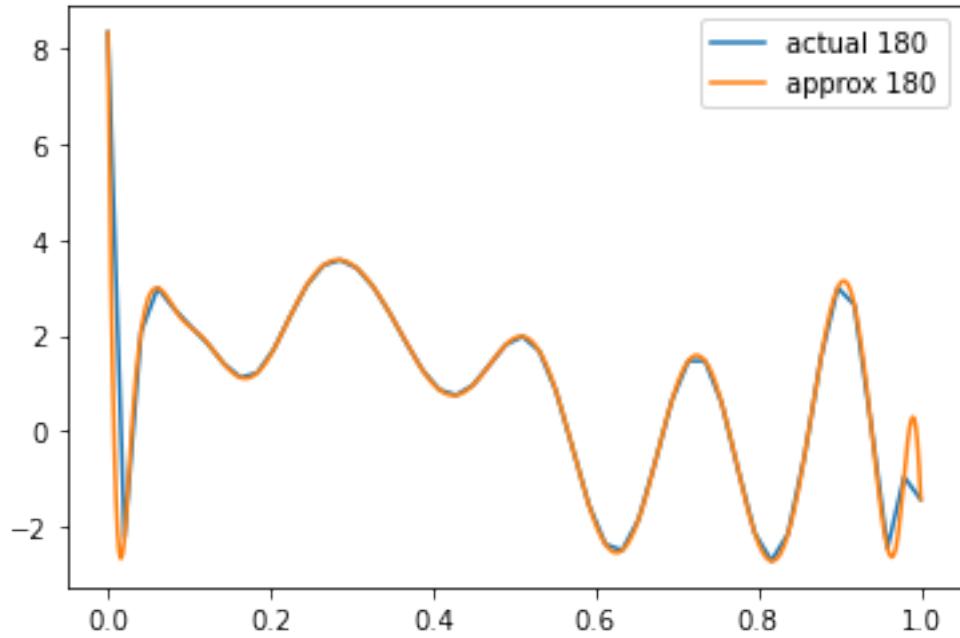


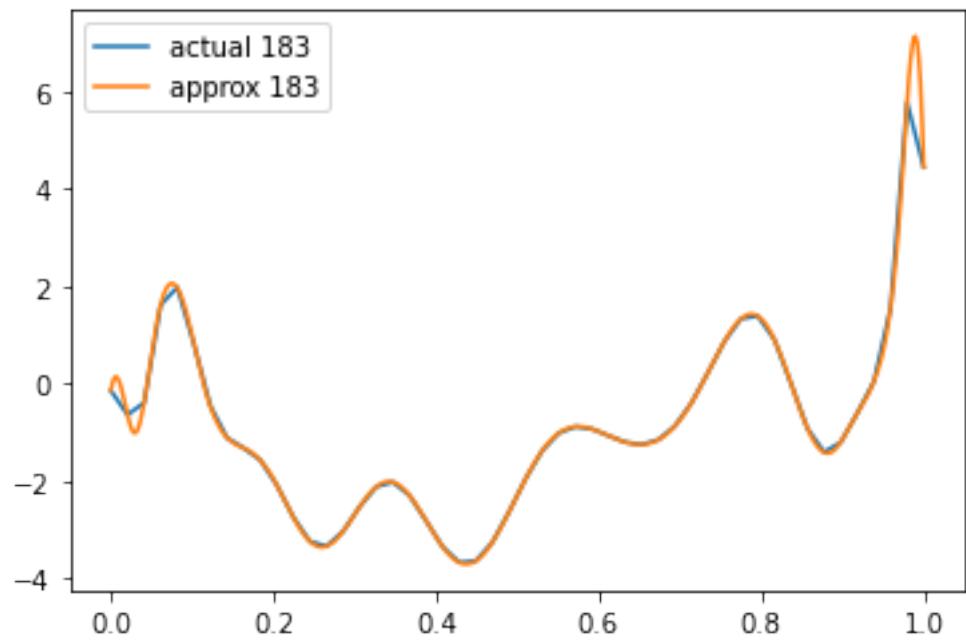
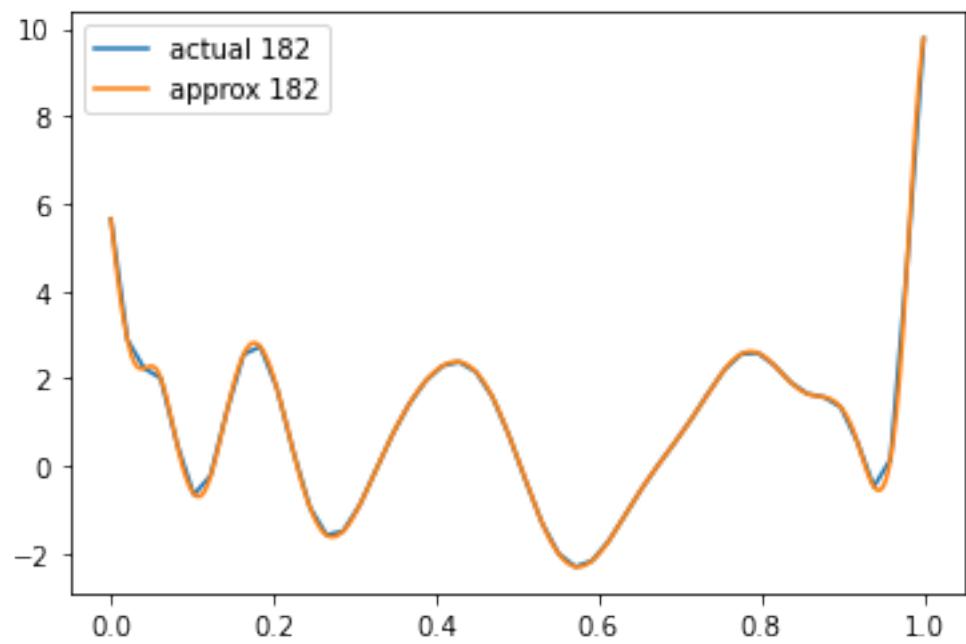


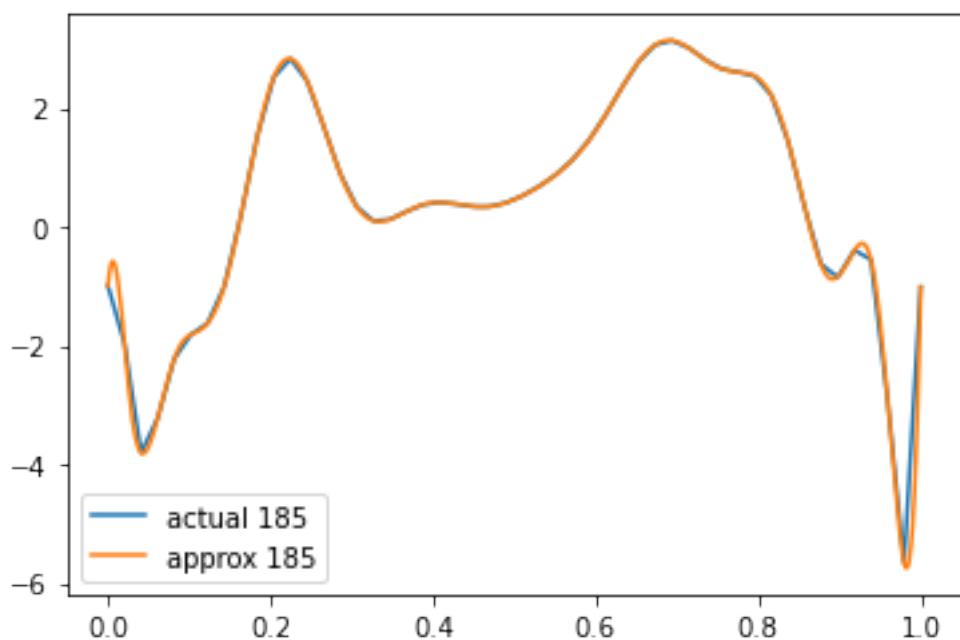
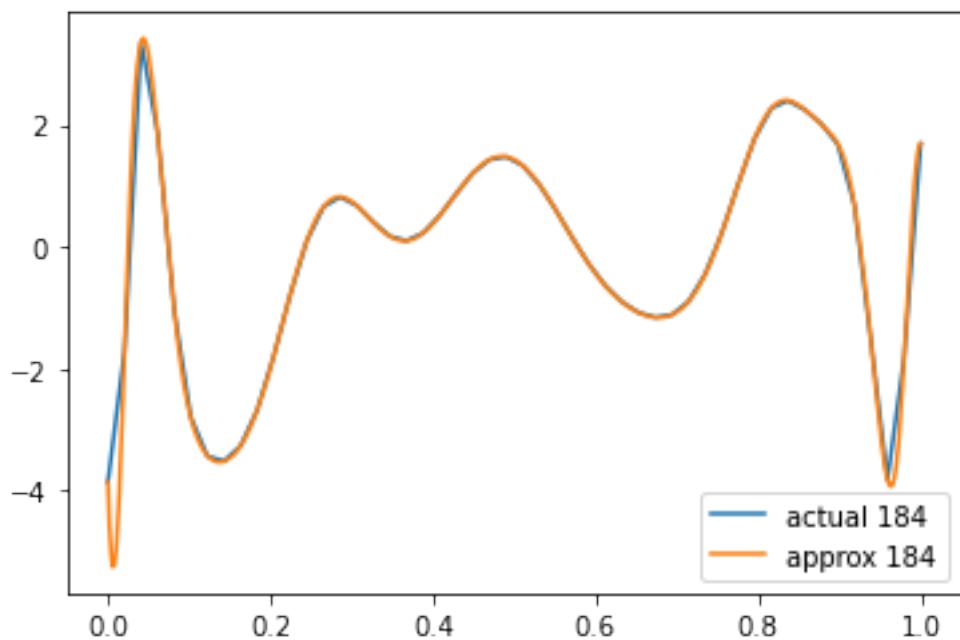


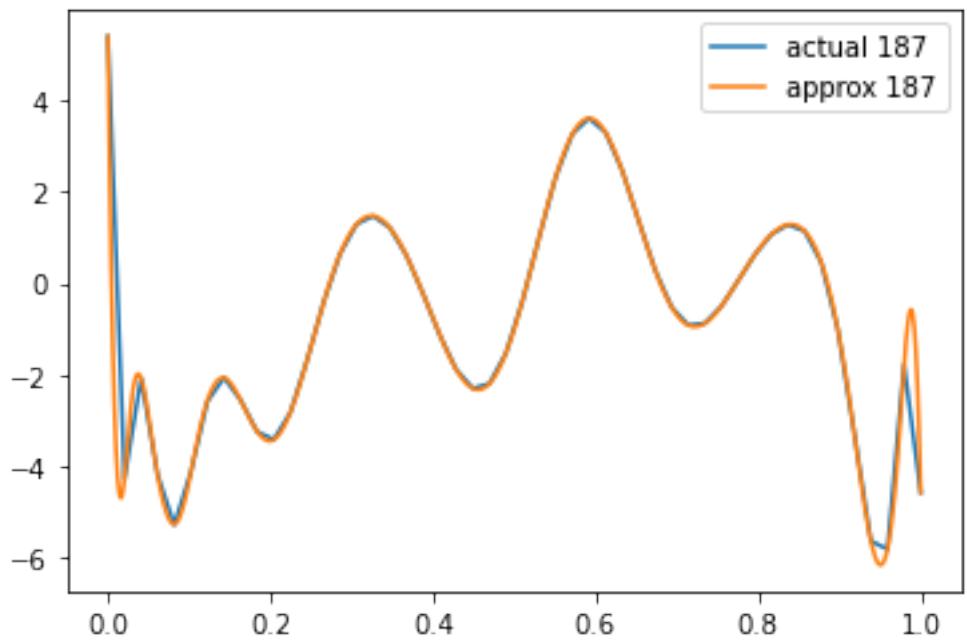
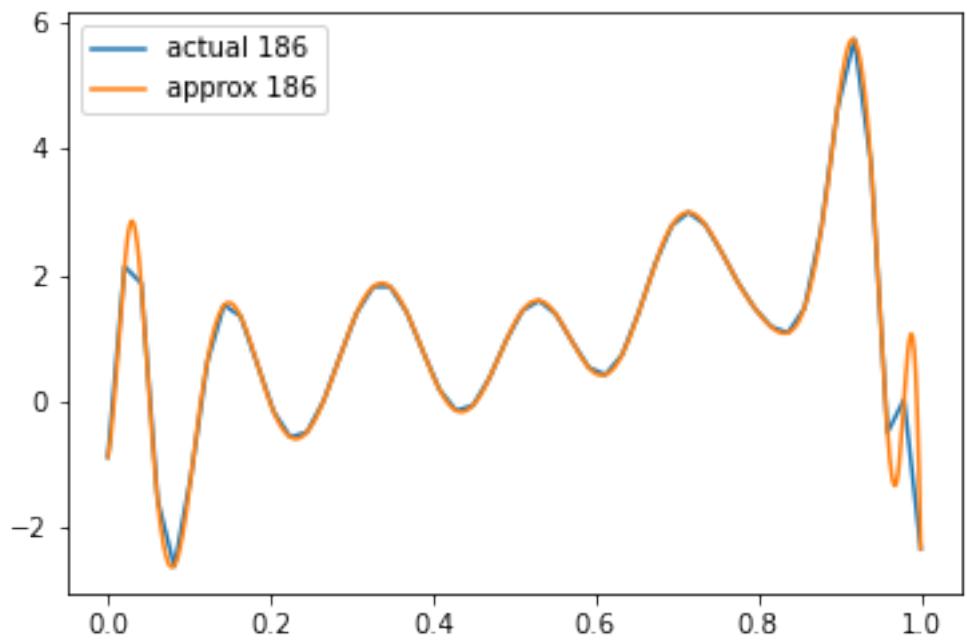


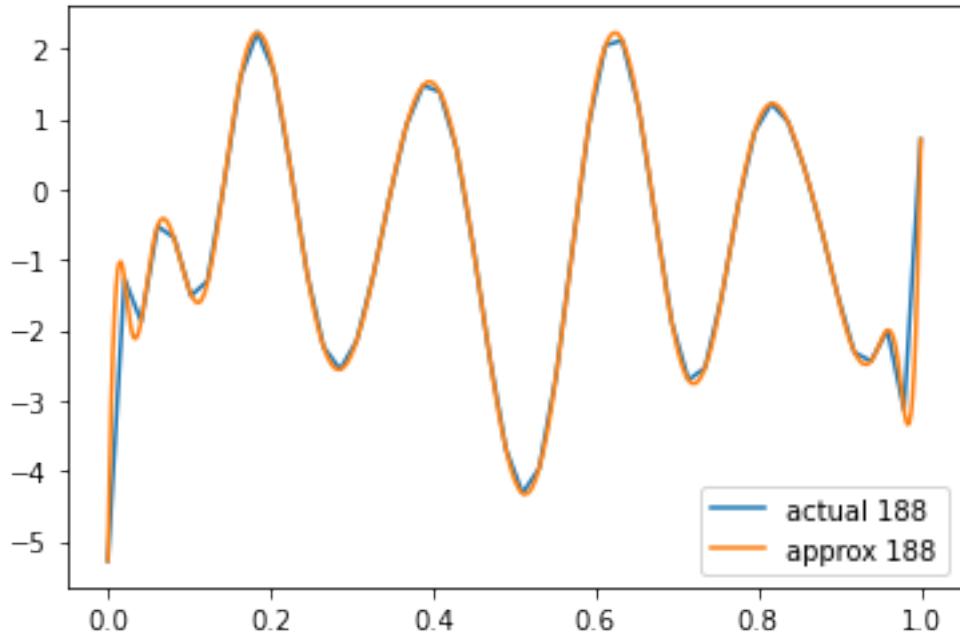




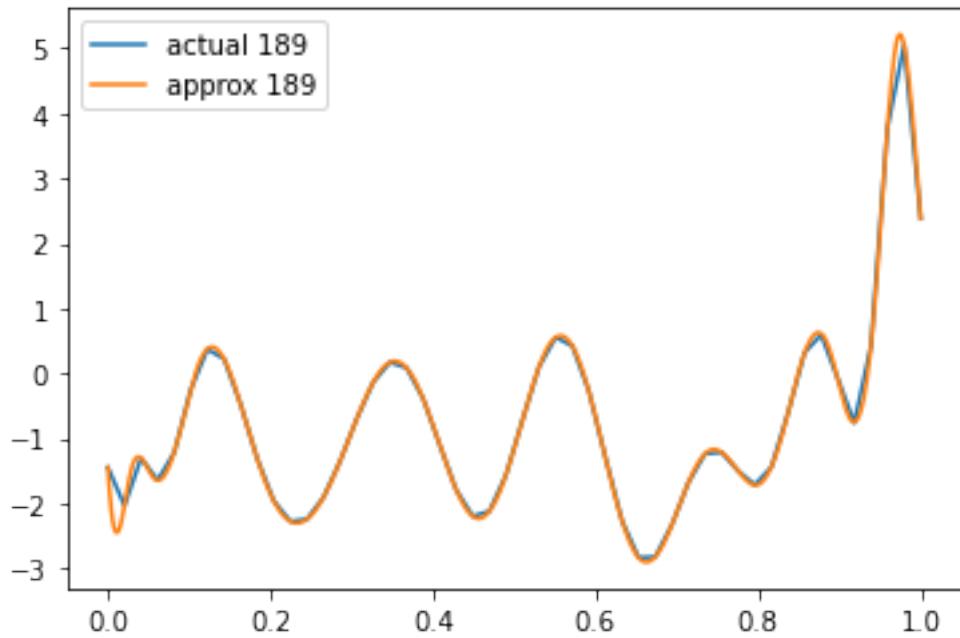


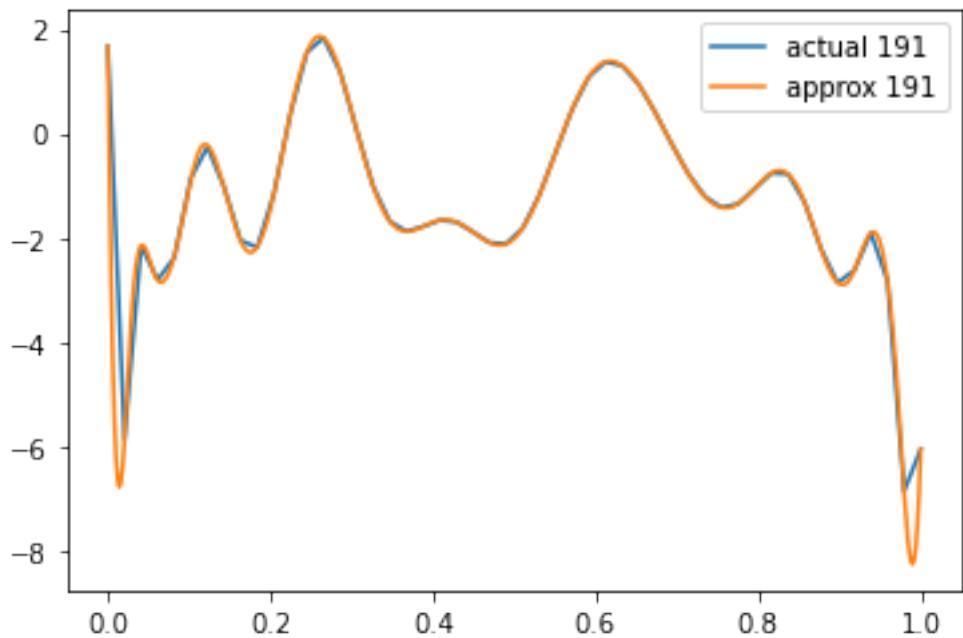
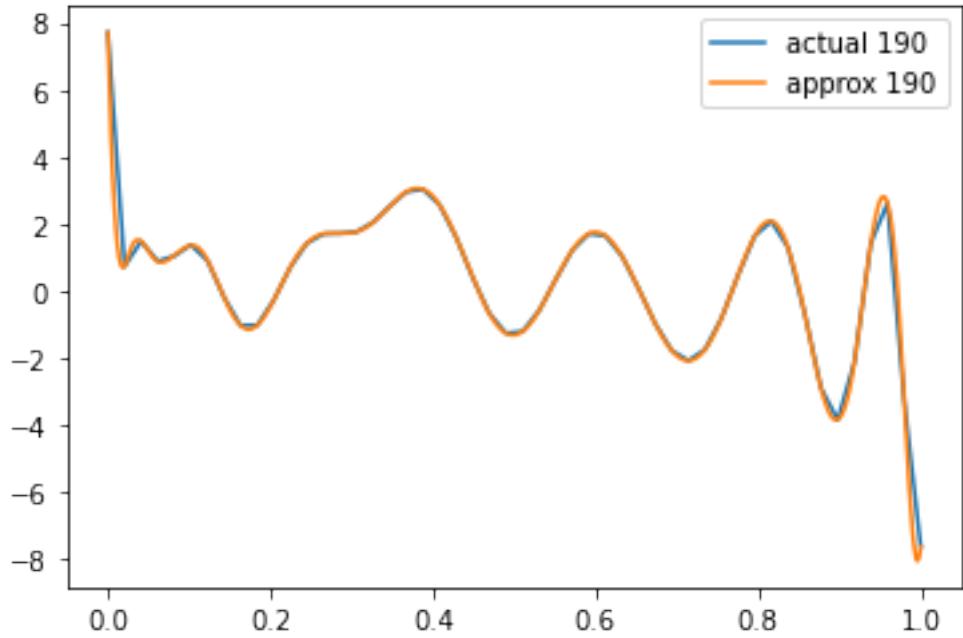


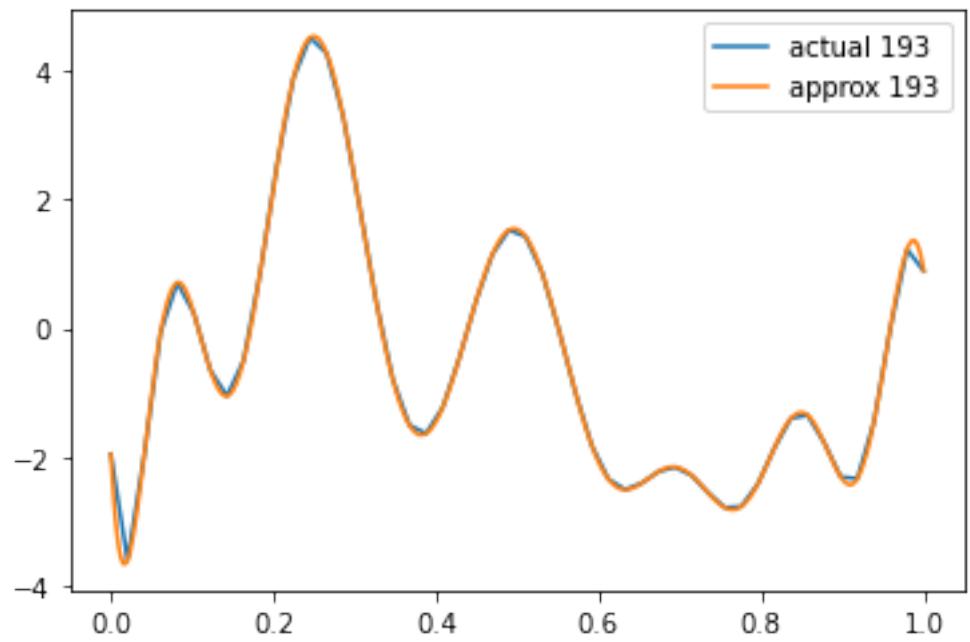
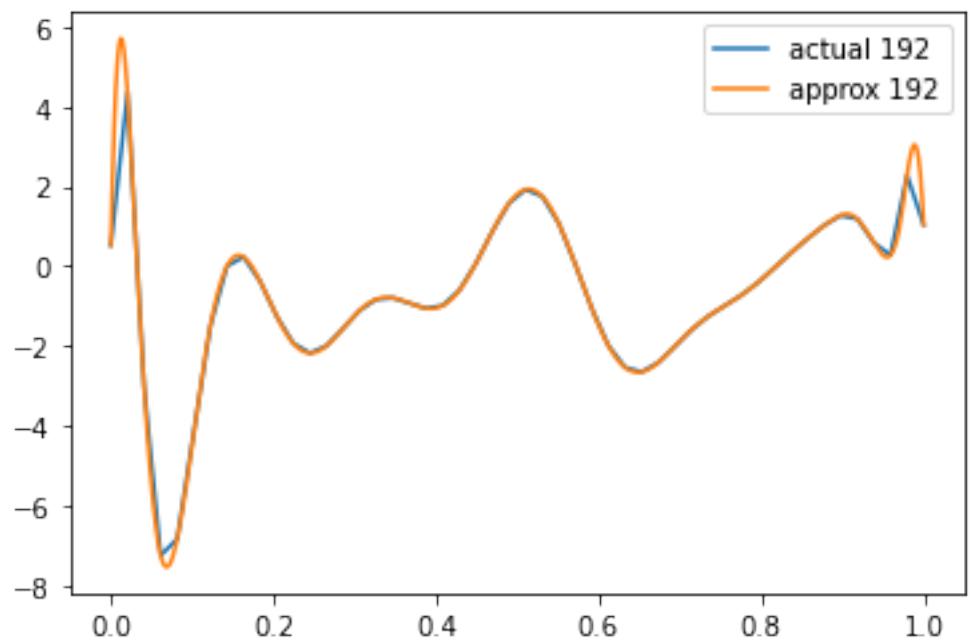


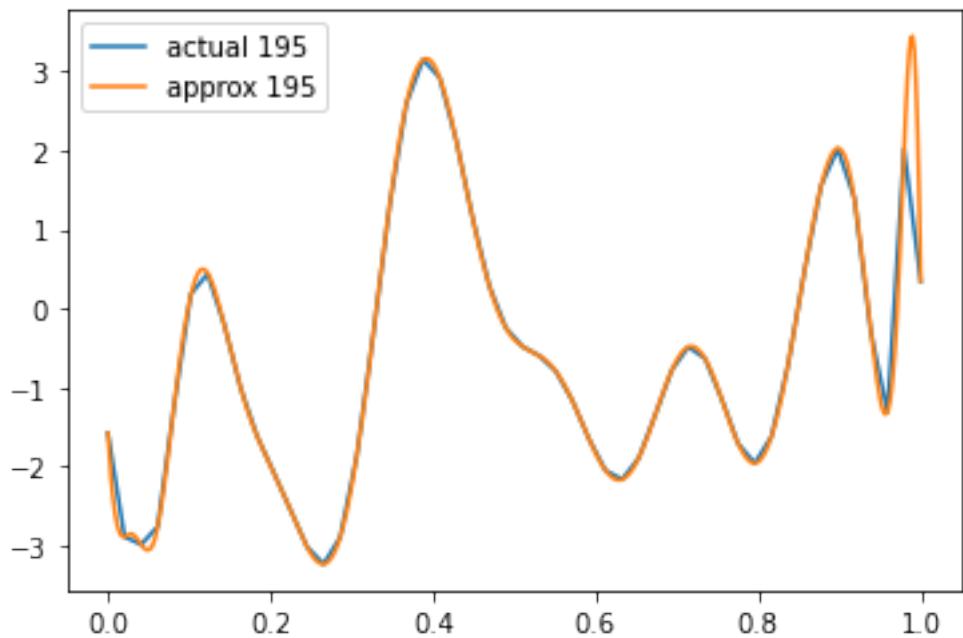
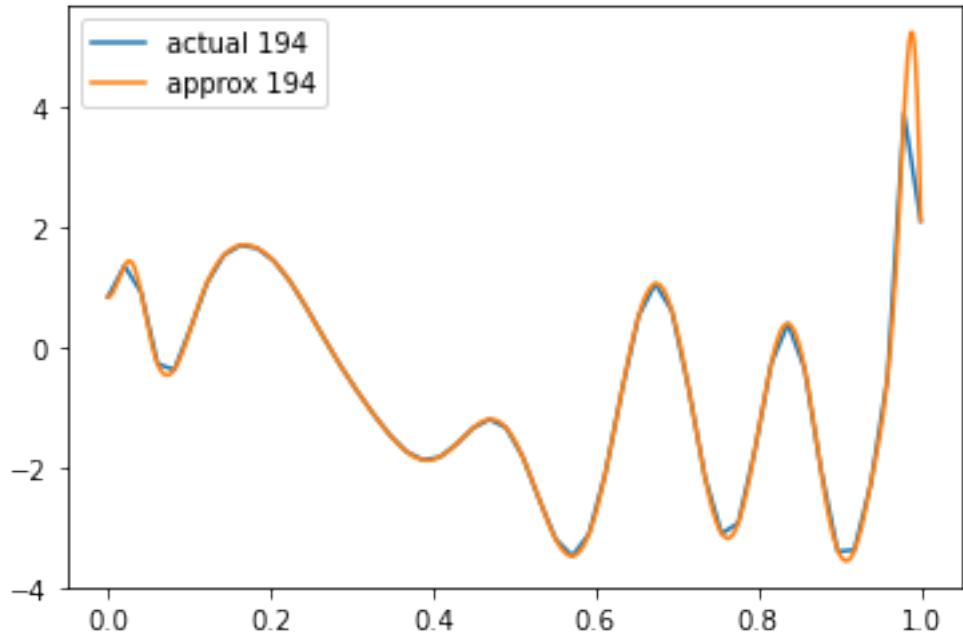


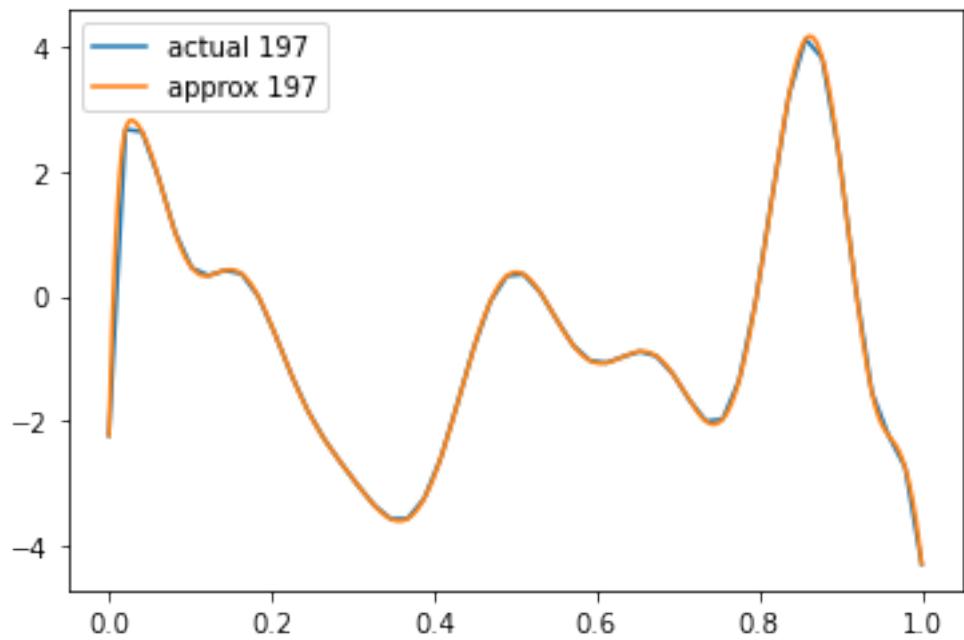
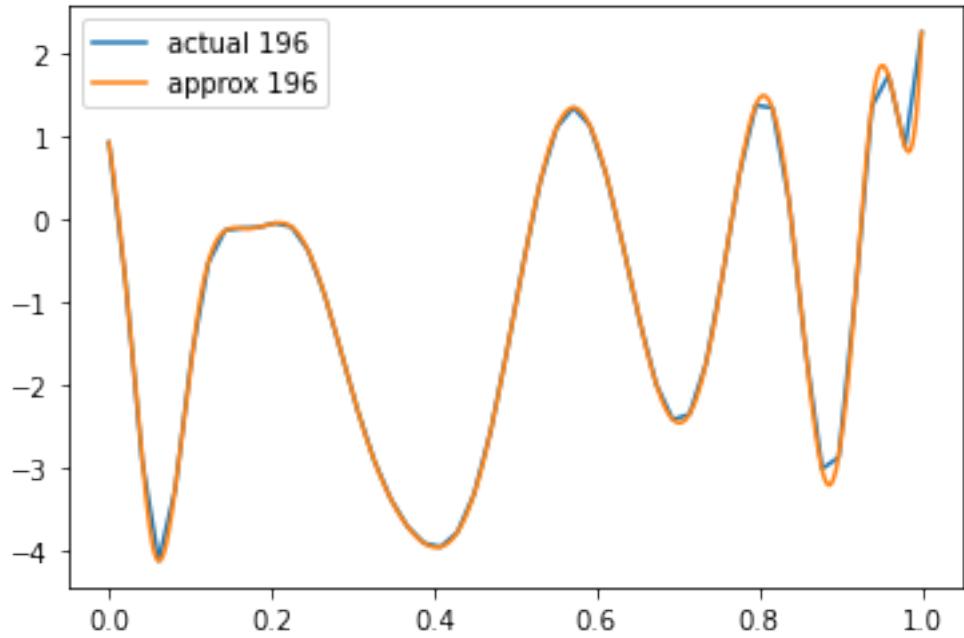
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c:\Users\Diego\anaconda3\lib\site-packages\scipy\optimize\optimize.py:282:  
RuntimeWarning: Values in x were outside bounds during a minimize step, clipping  
to bounds  
    warnings.warn("Values in x were outside bounds during a "
```

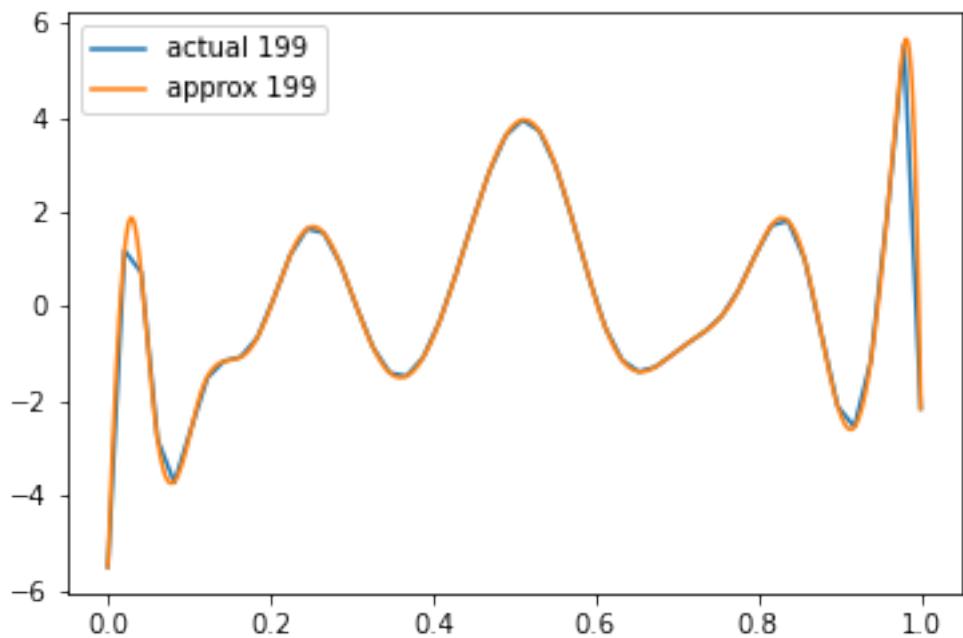
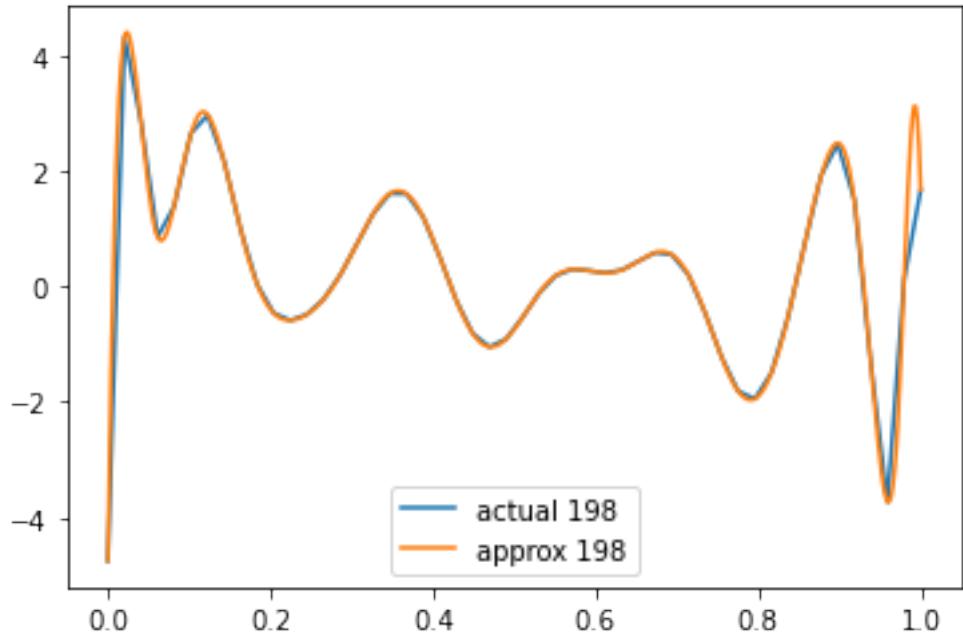


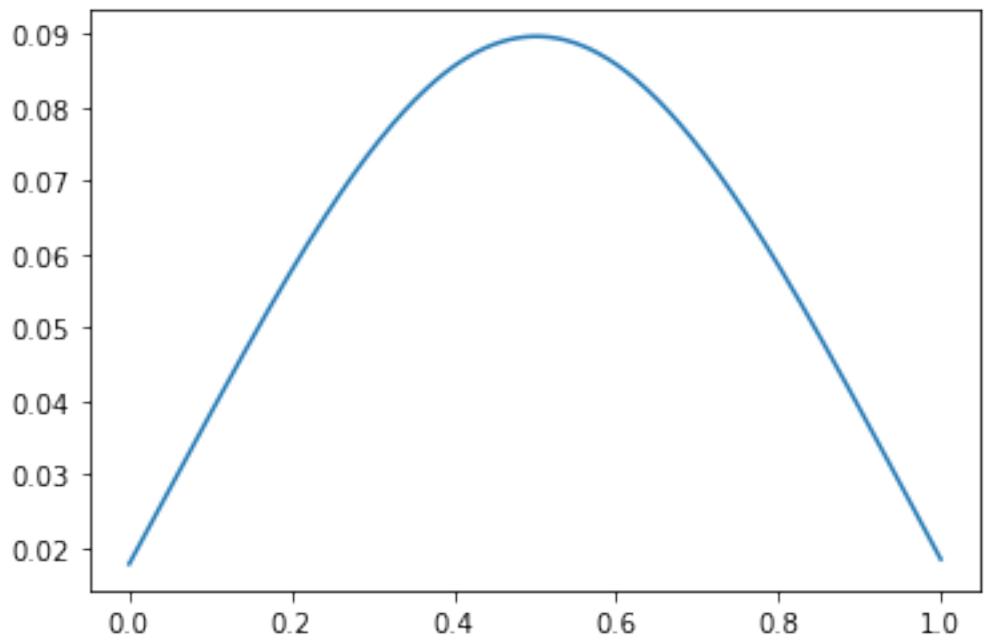
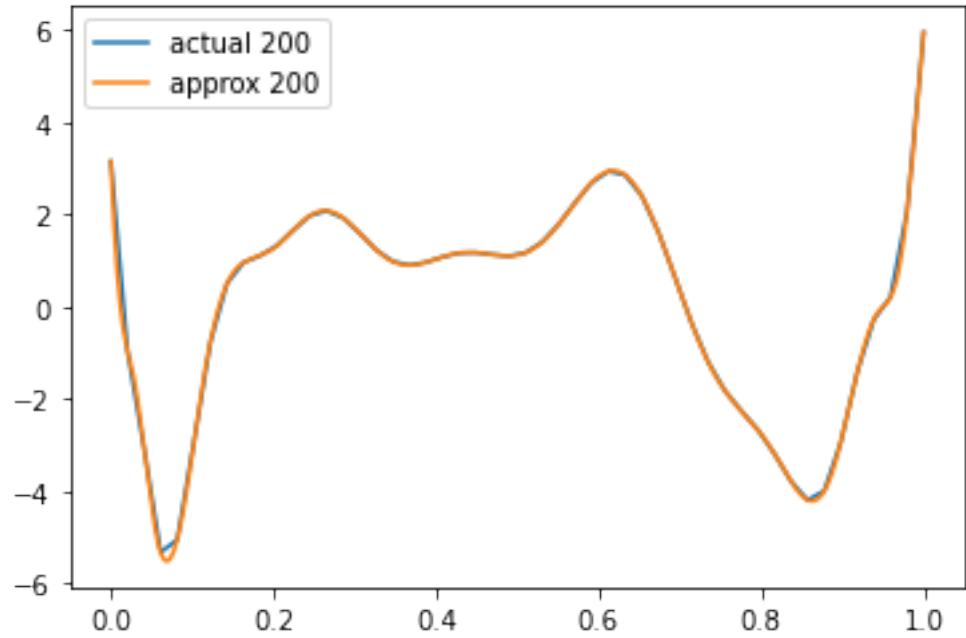


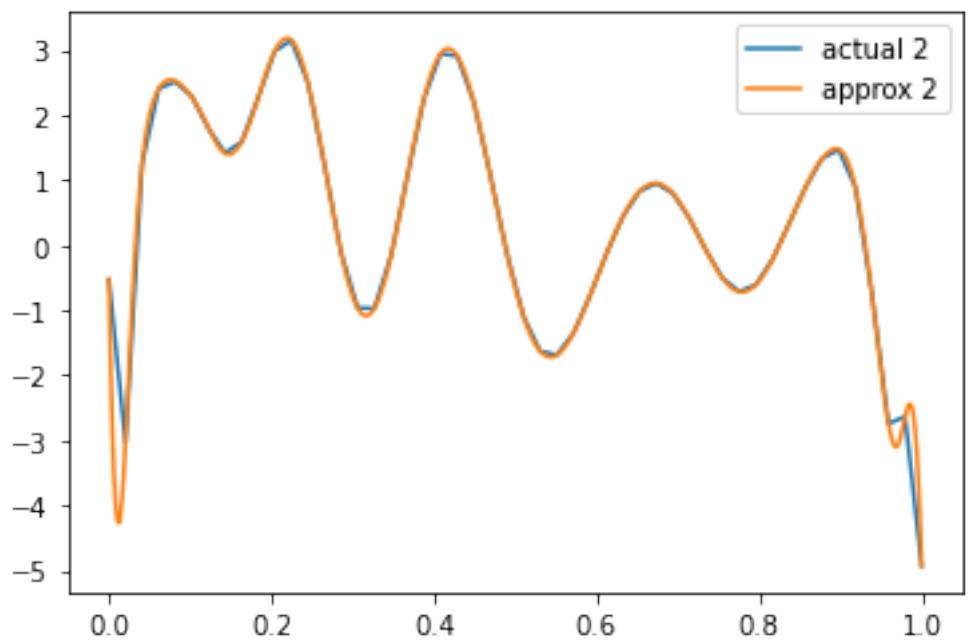
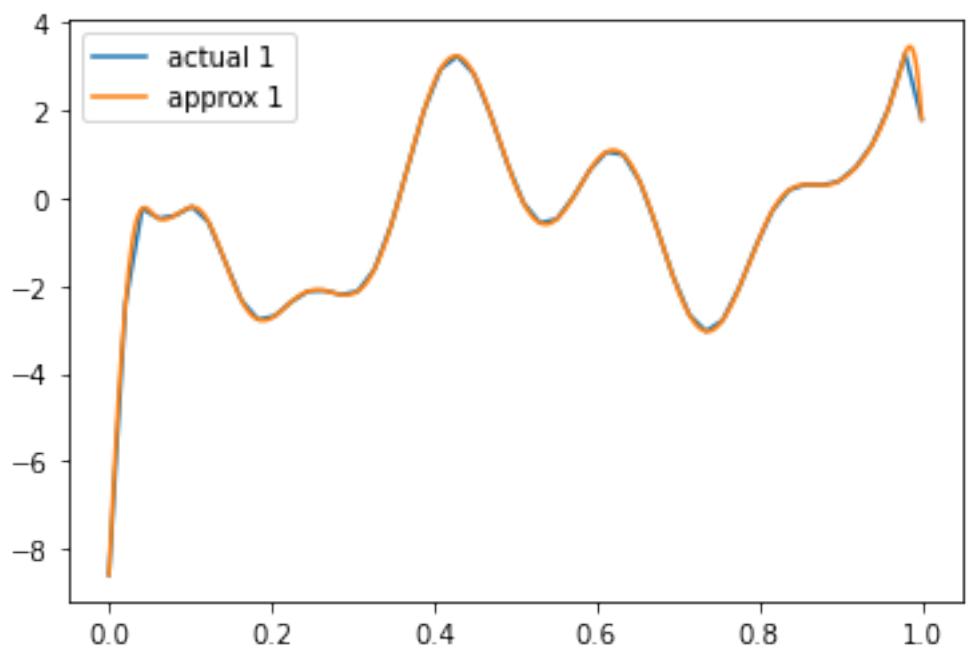


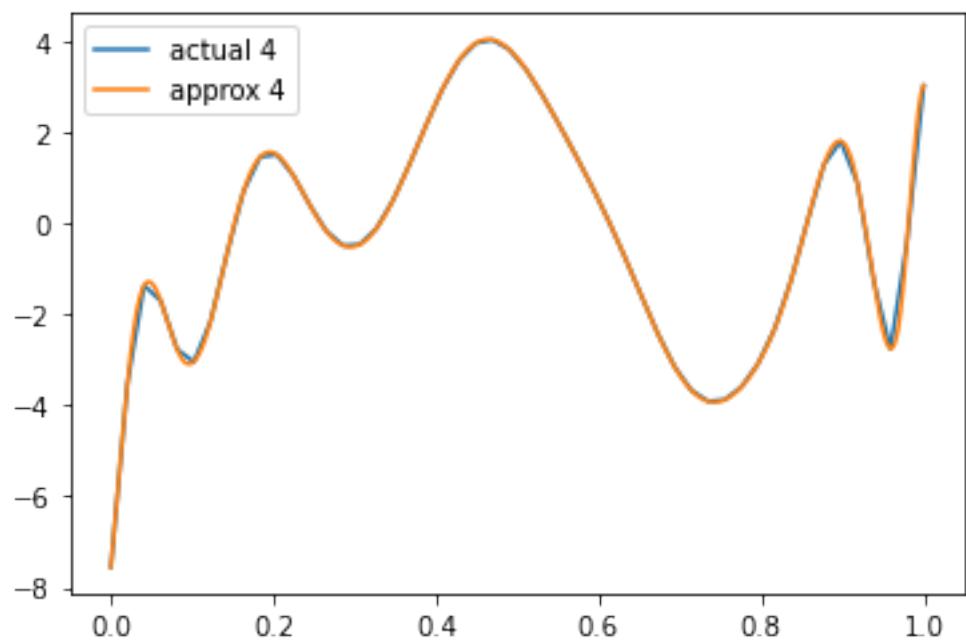
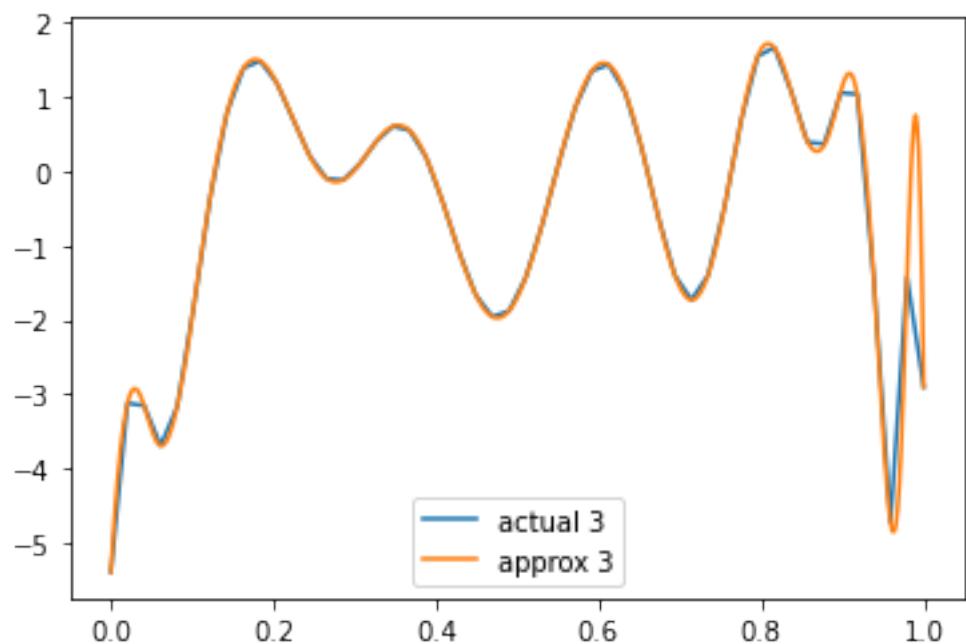


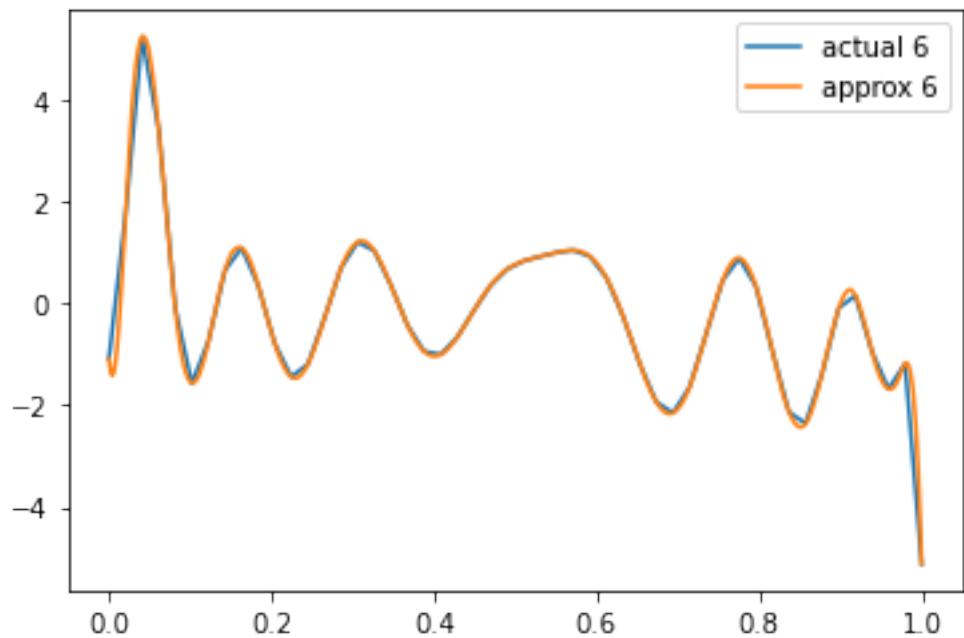
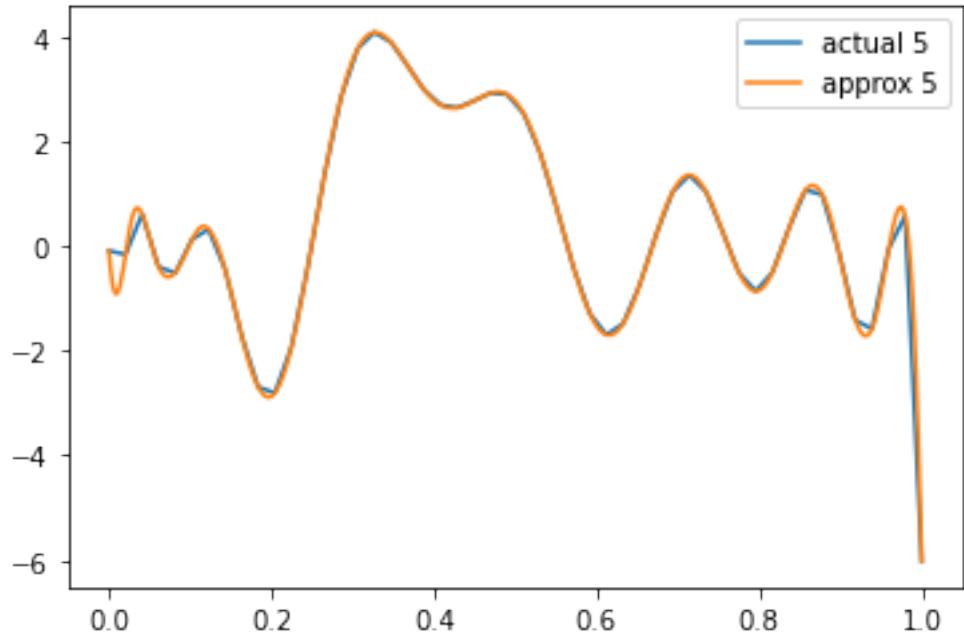


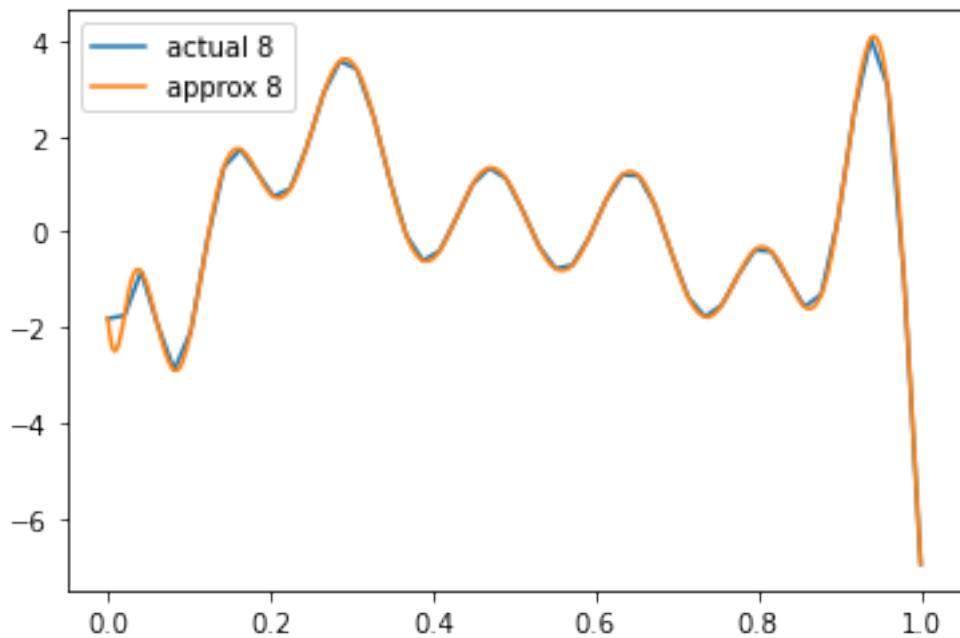
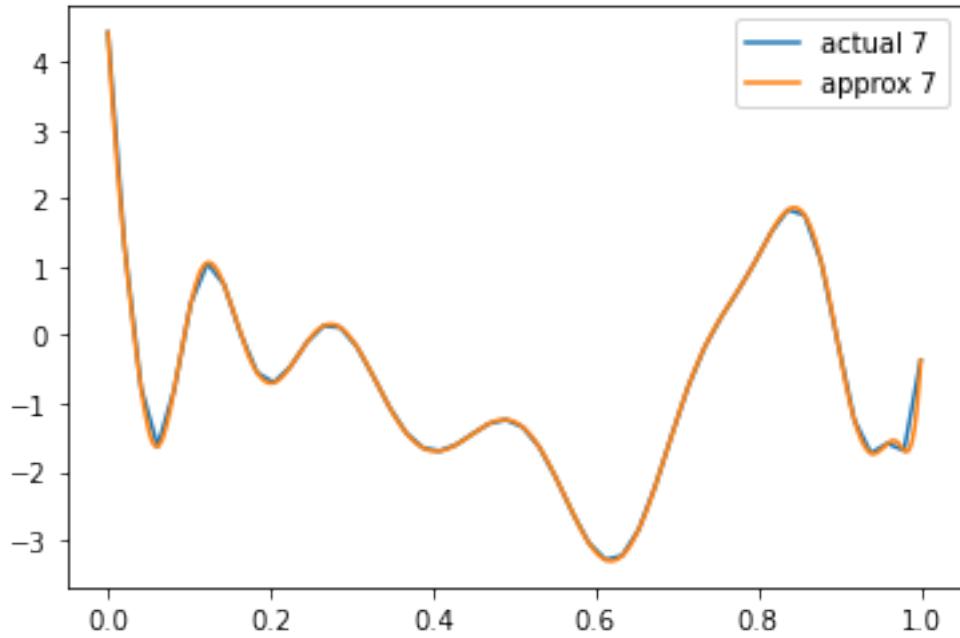


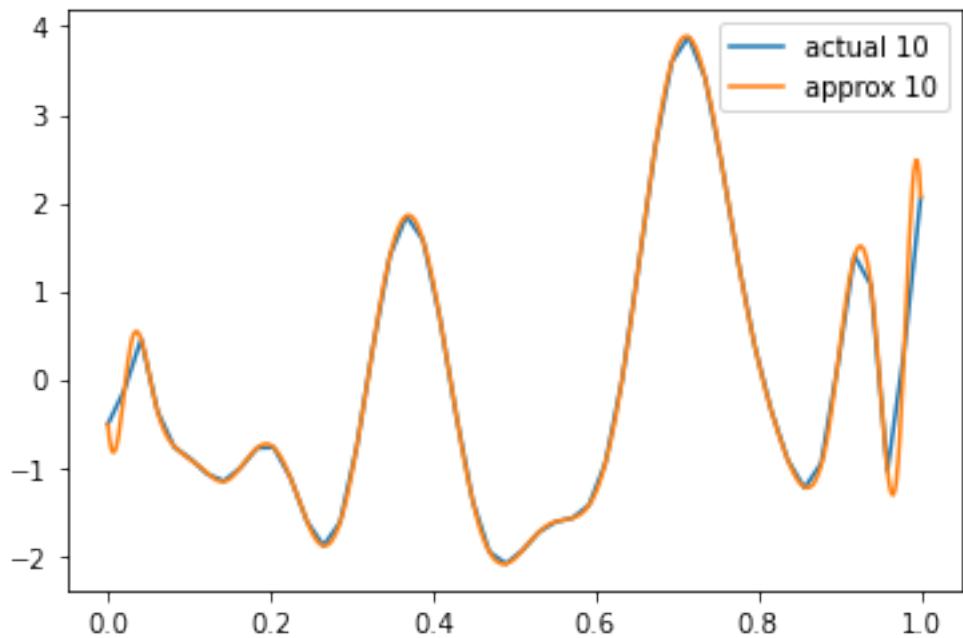
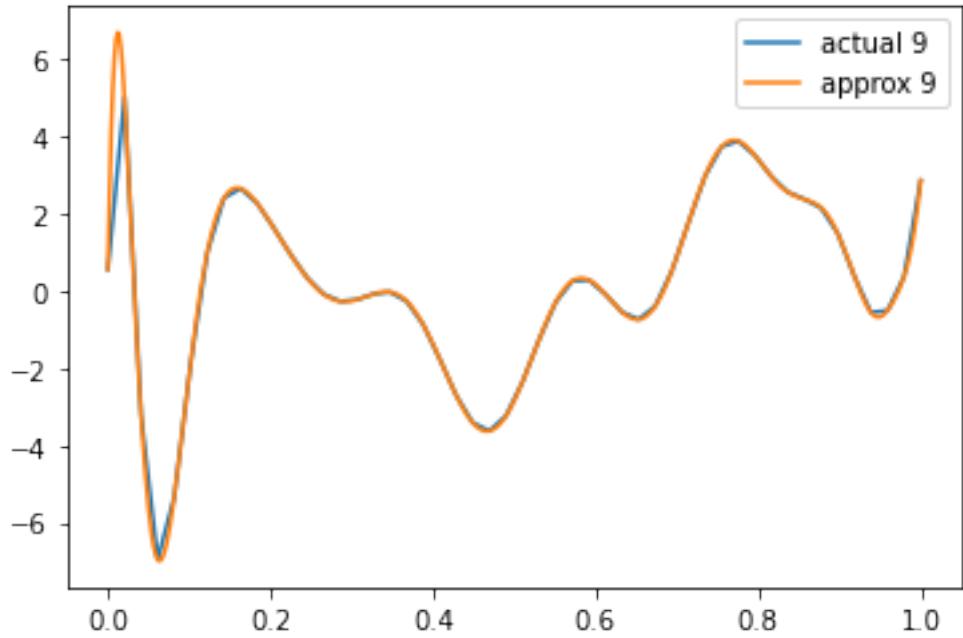


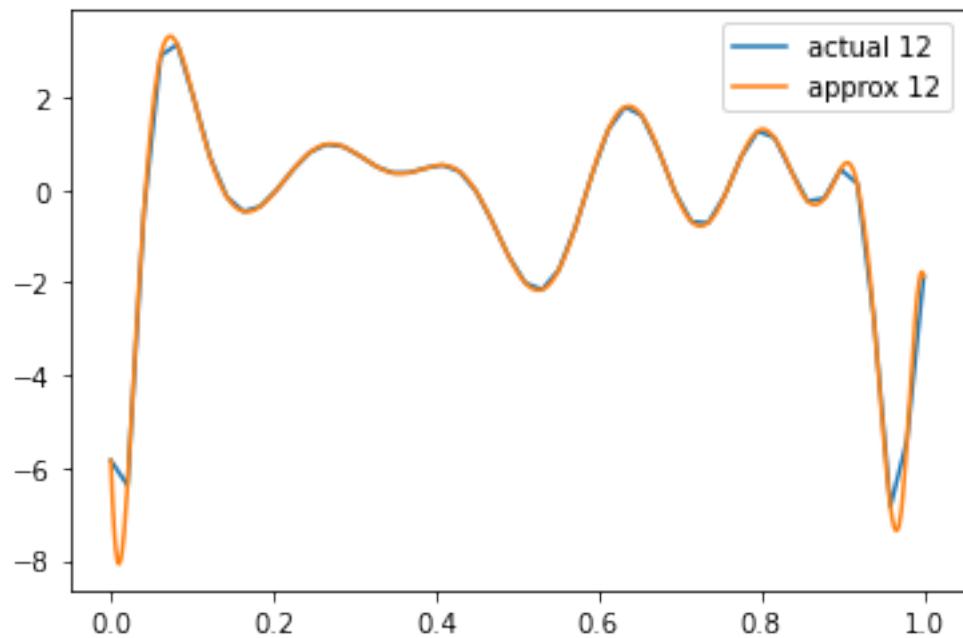
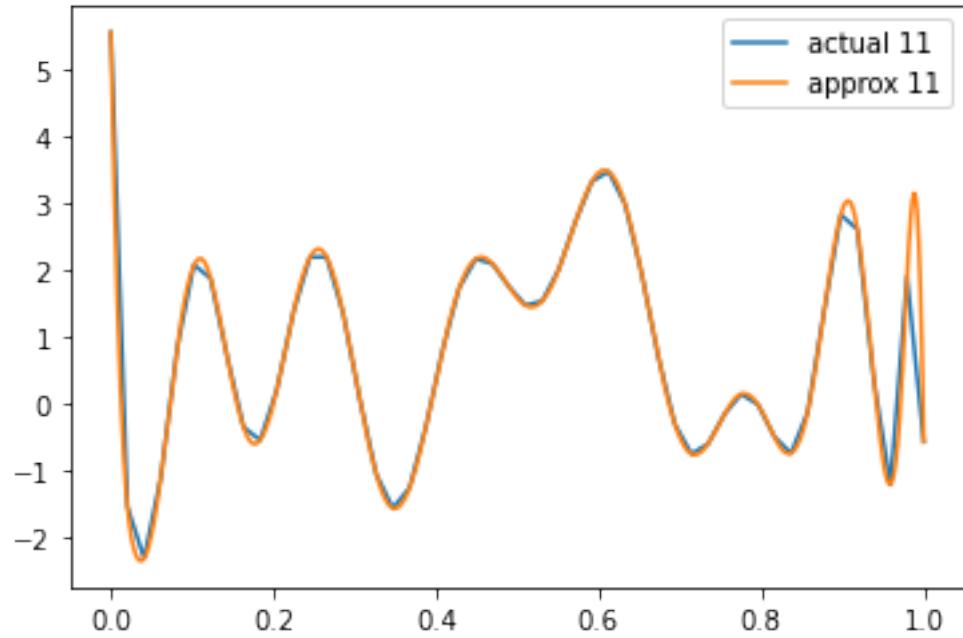


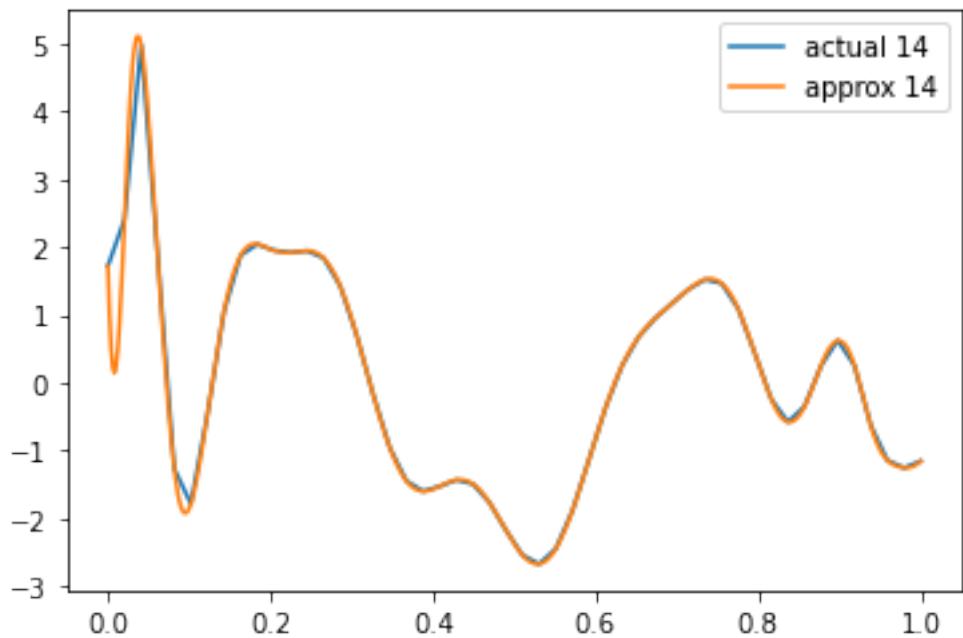
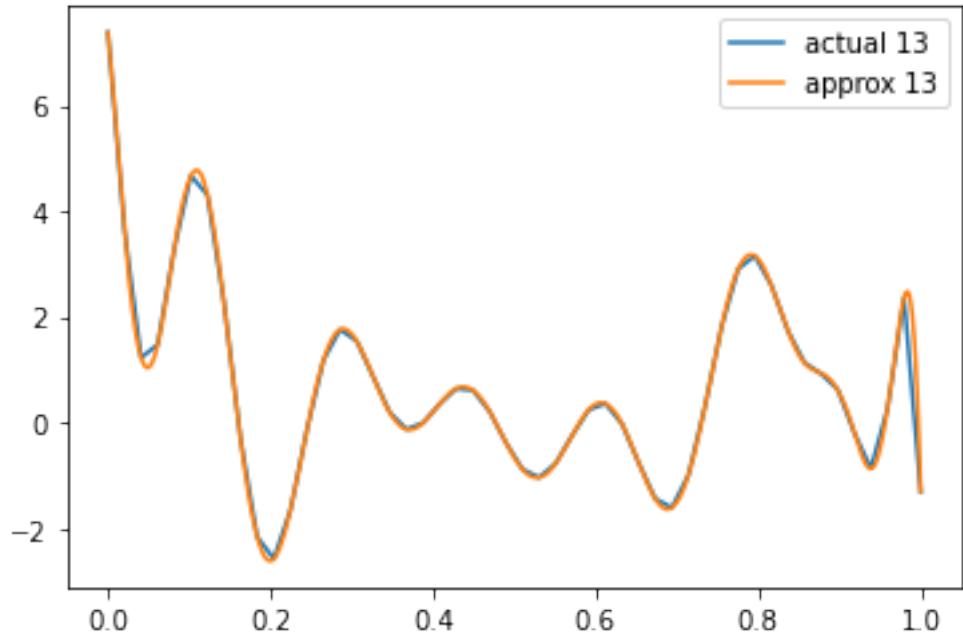


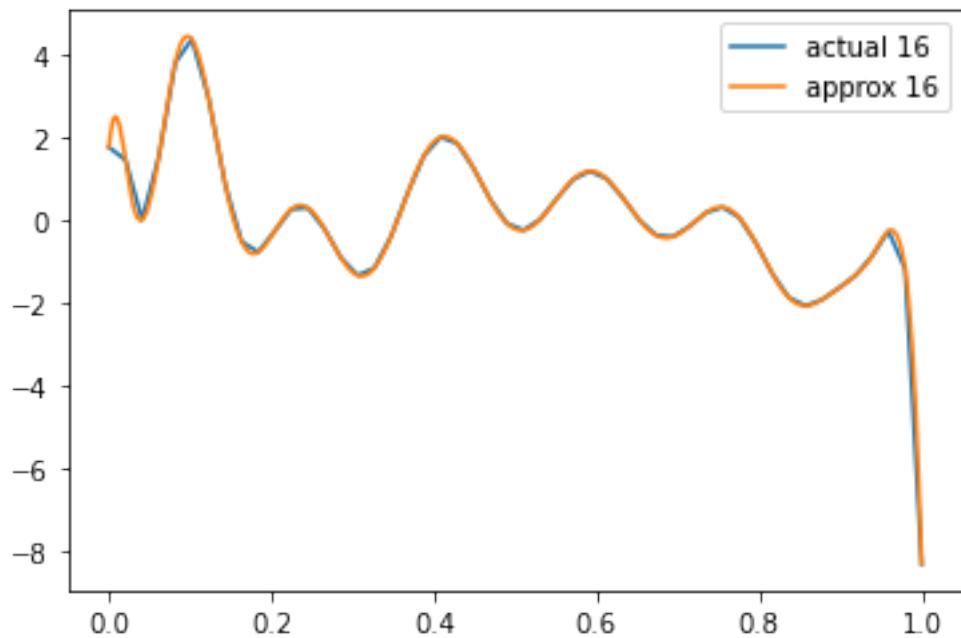
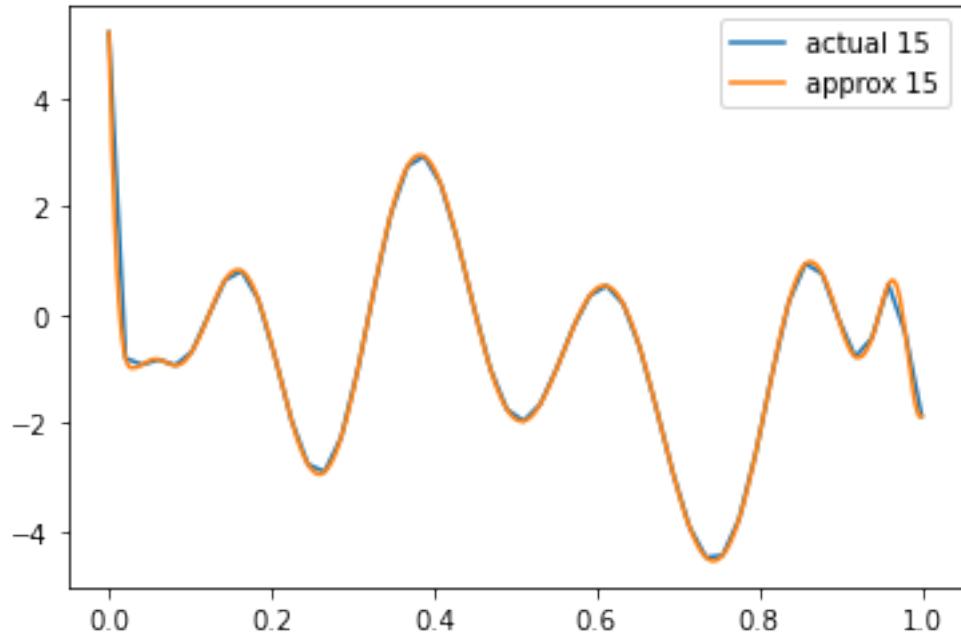


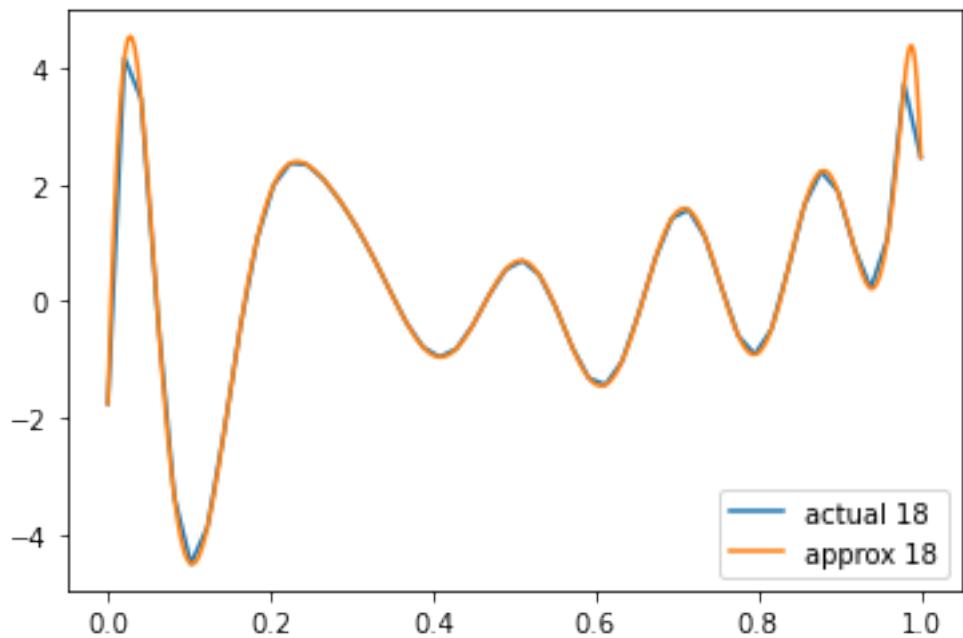
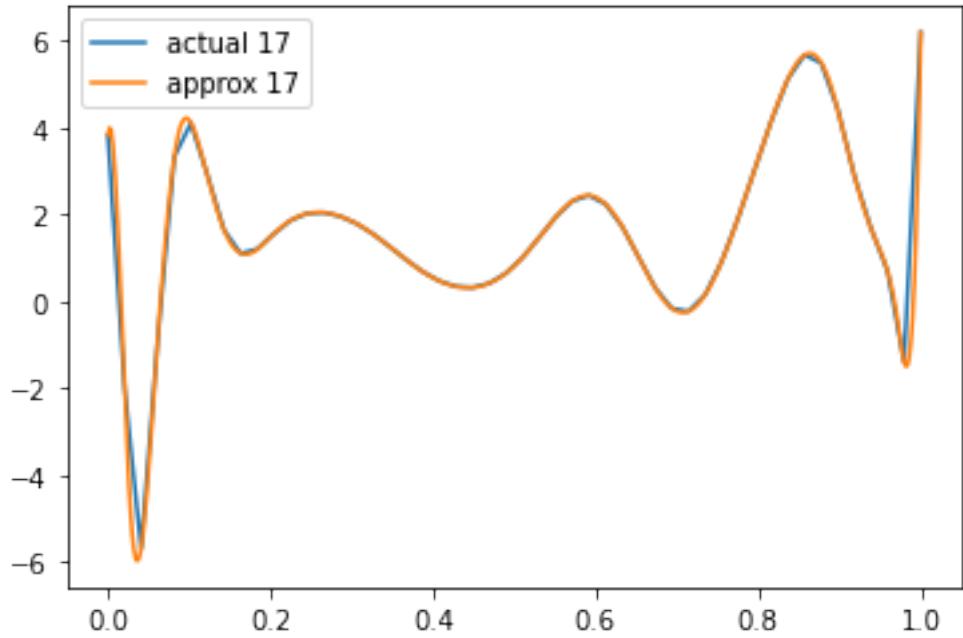


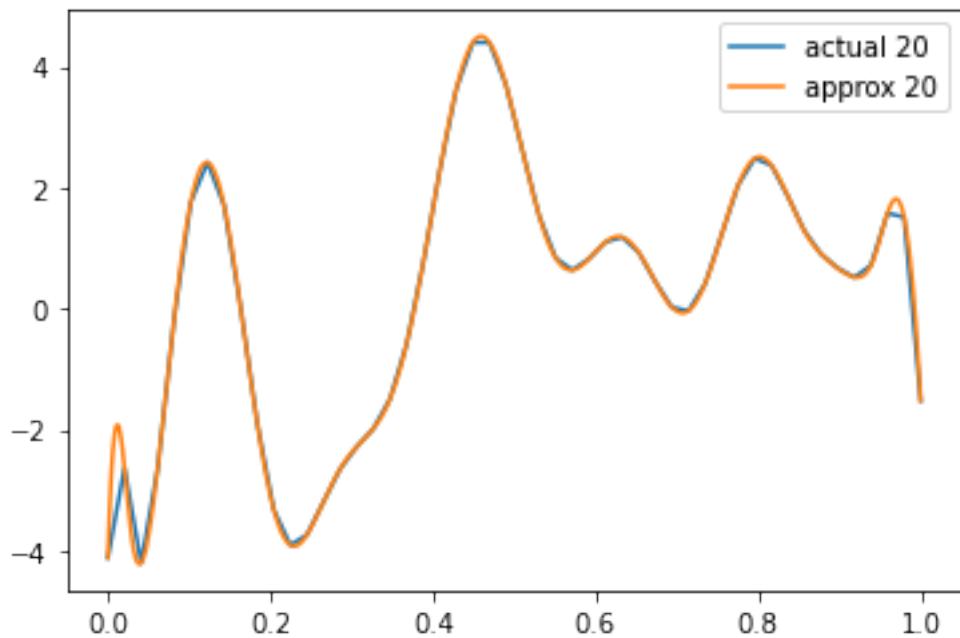
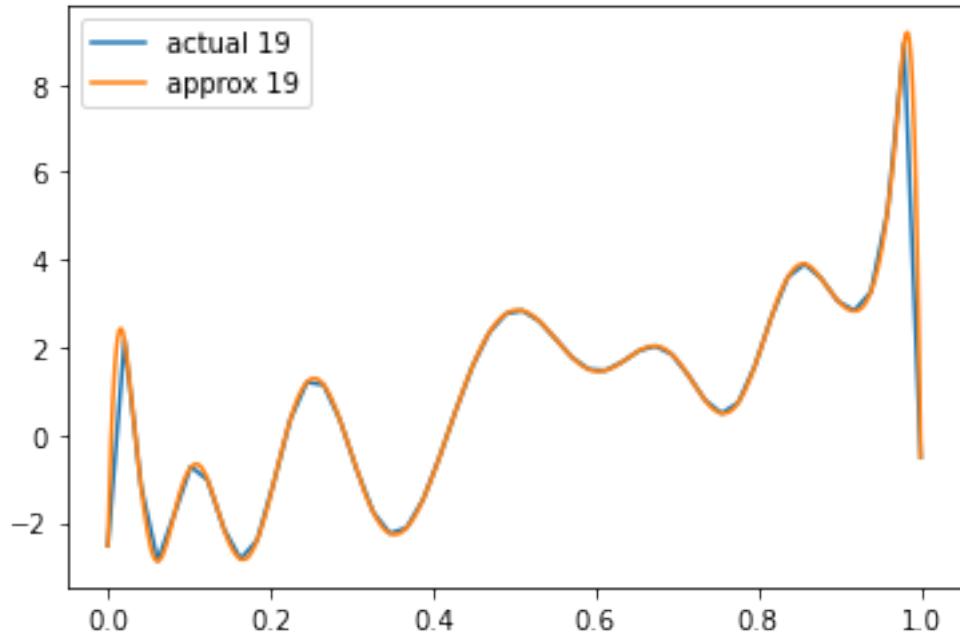


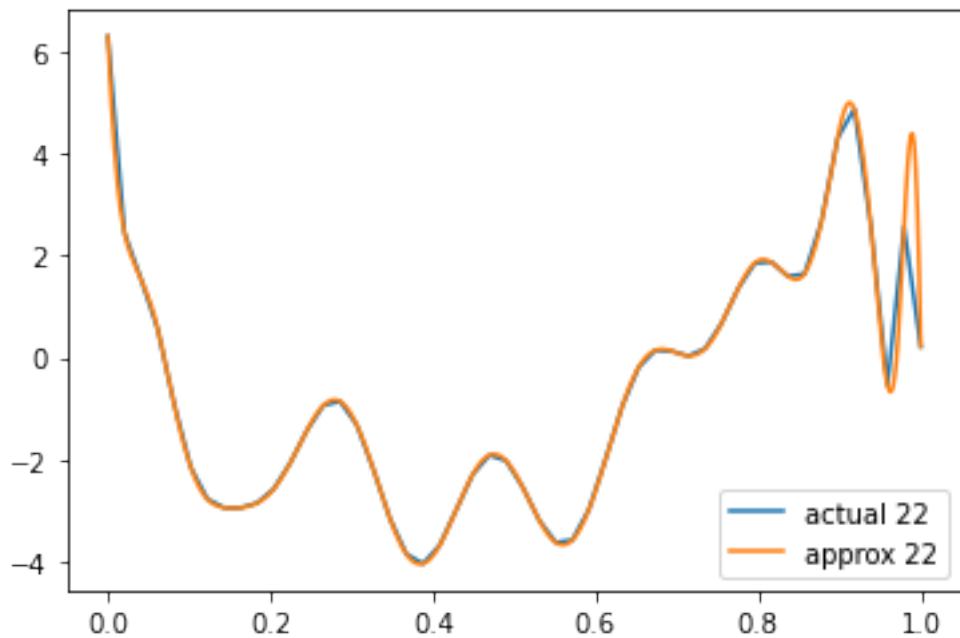
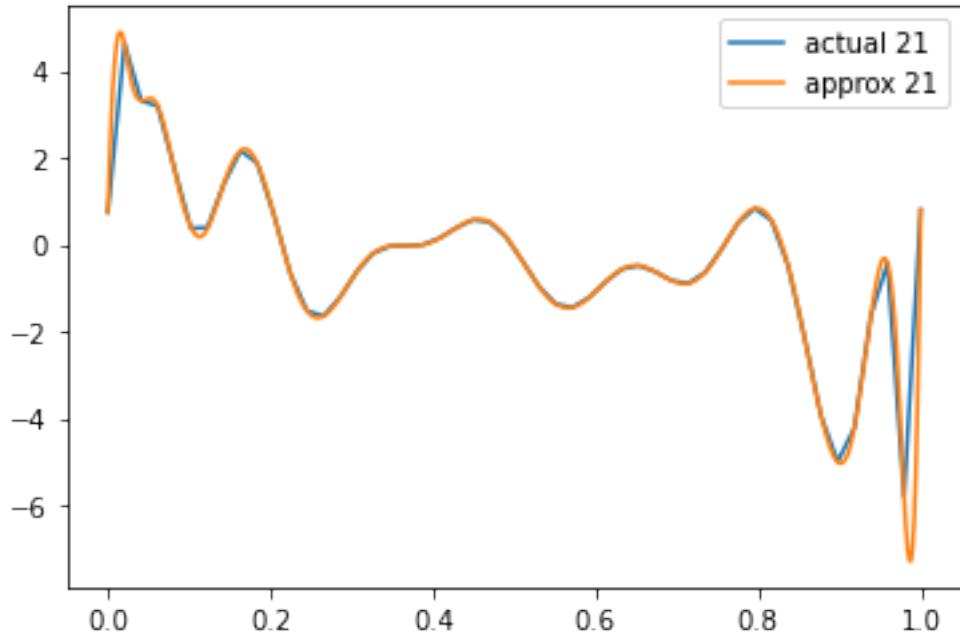


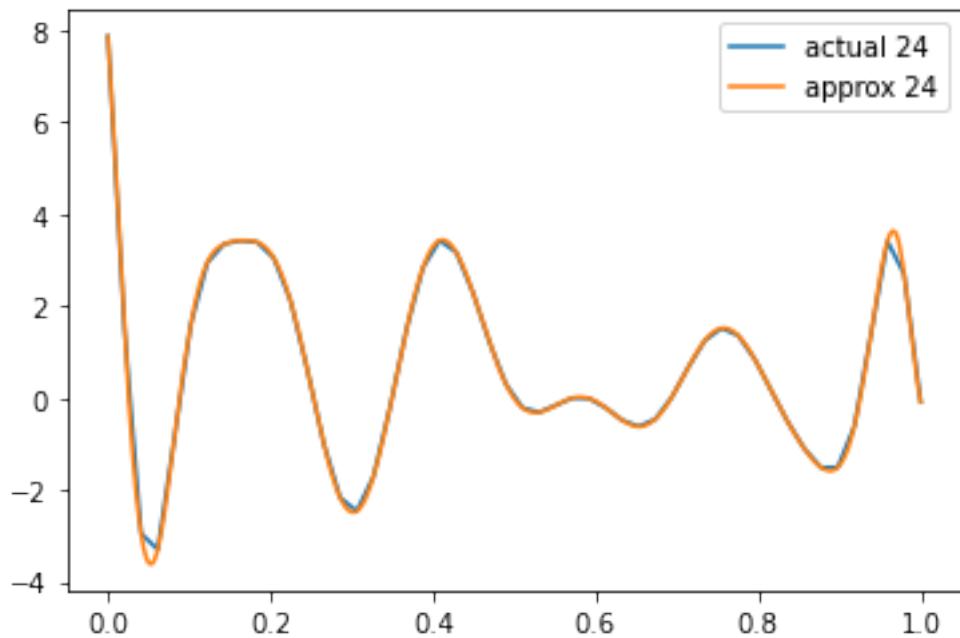
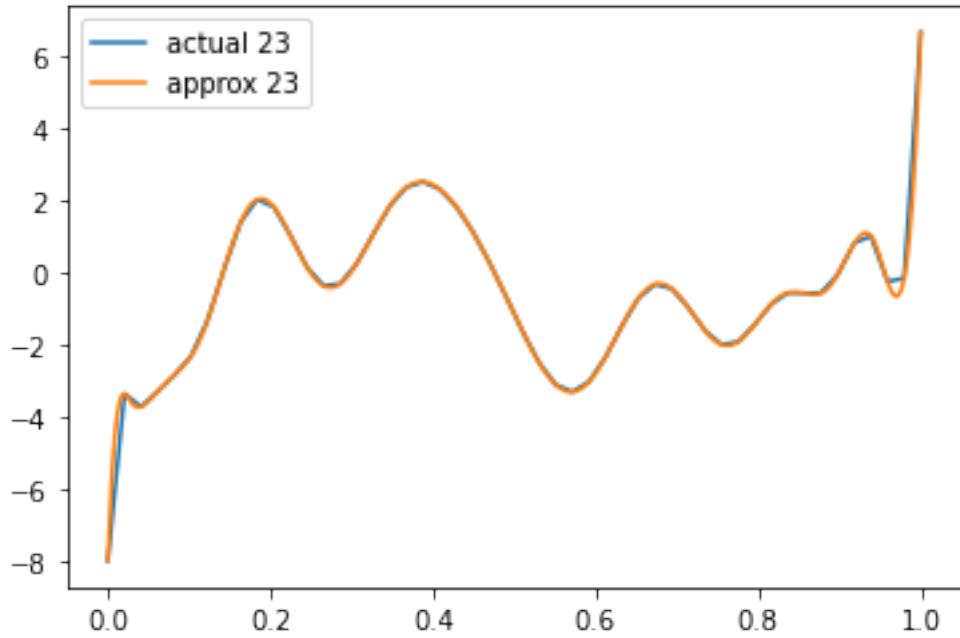


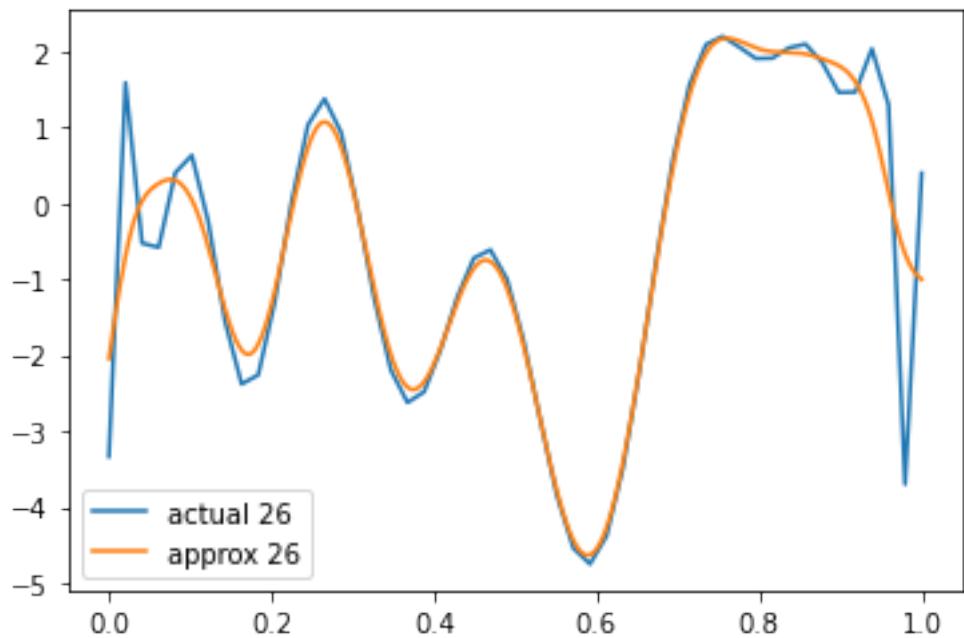
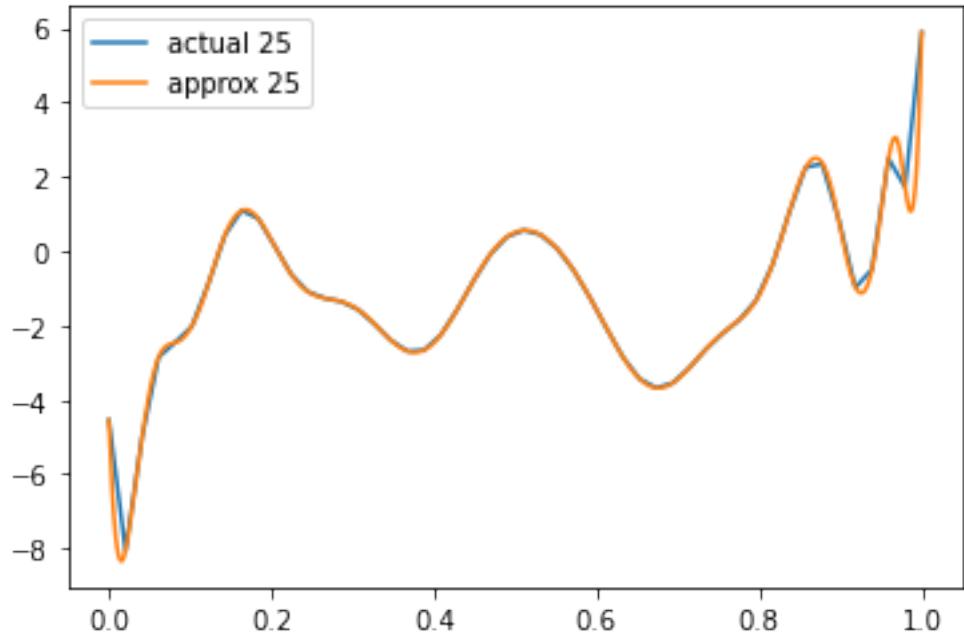


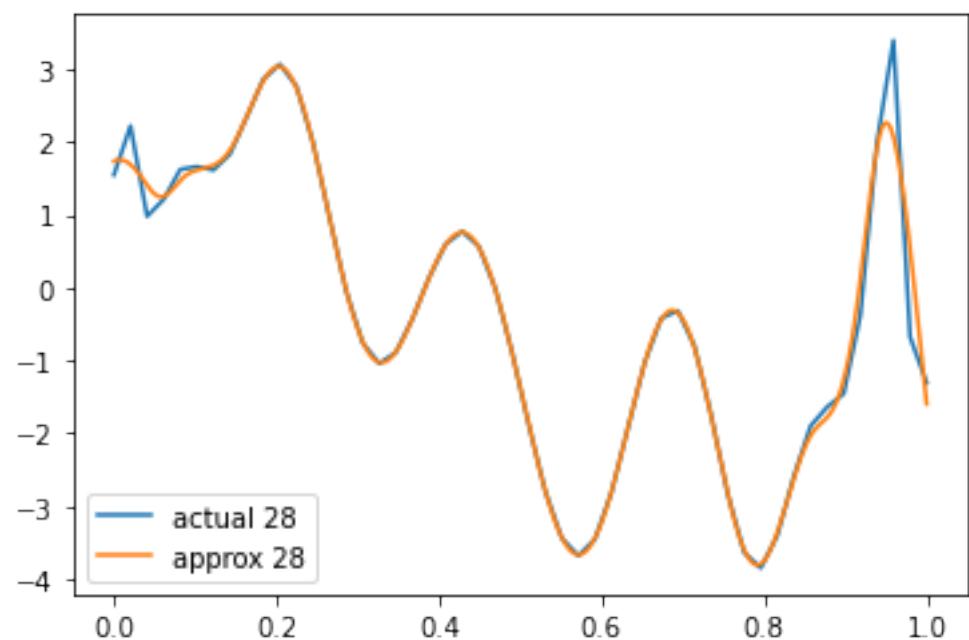
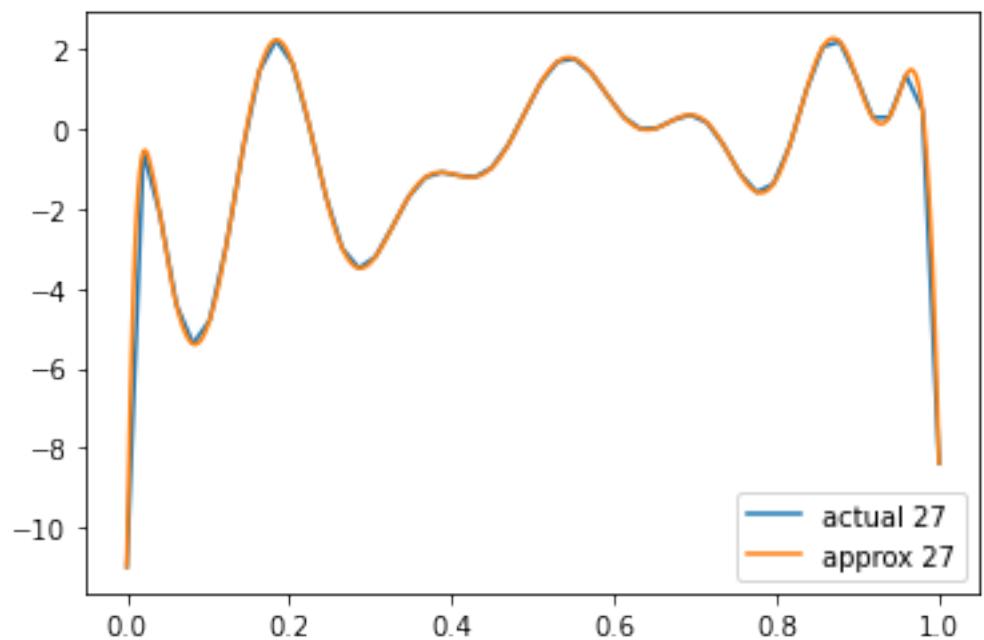


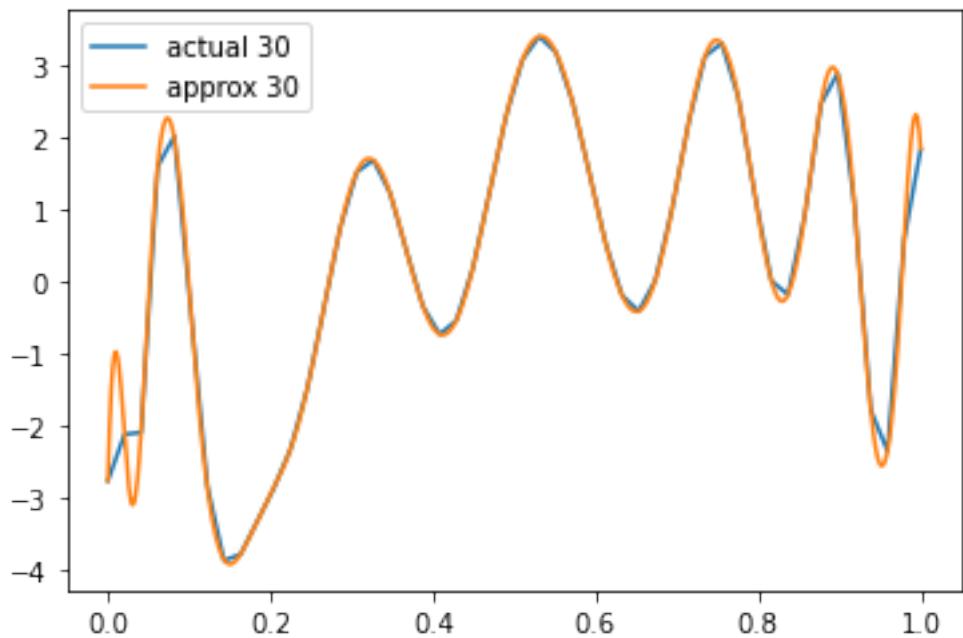
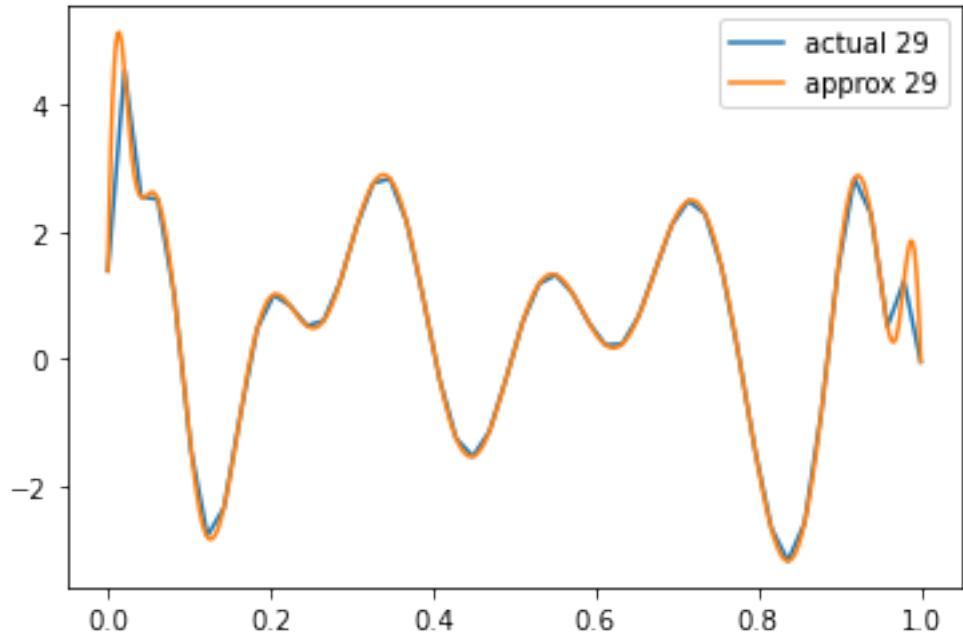


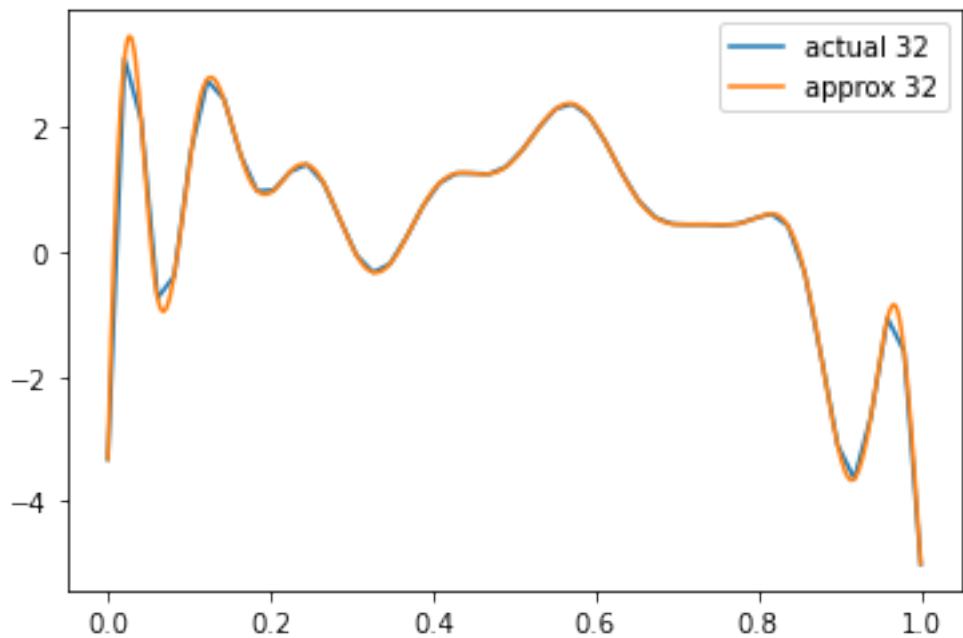
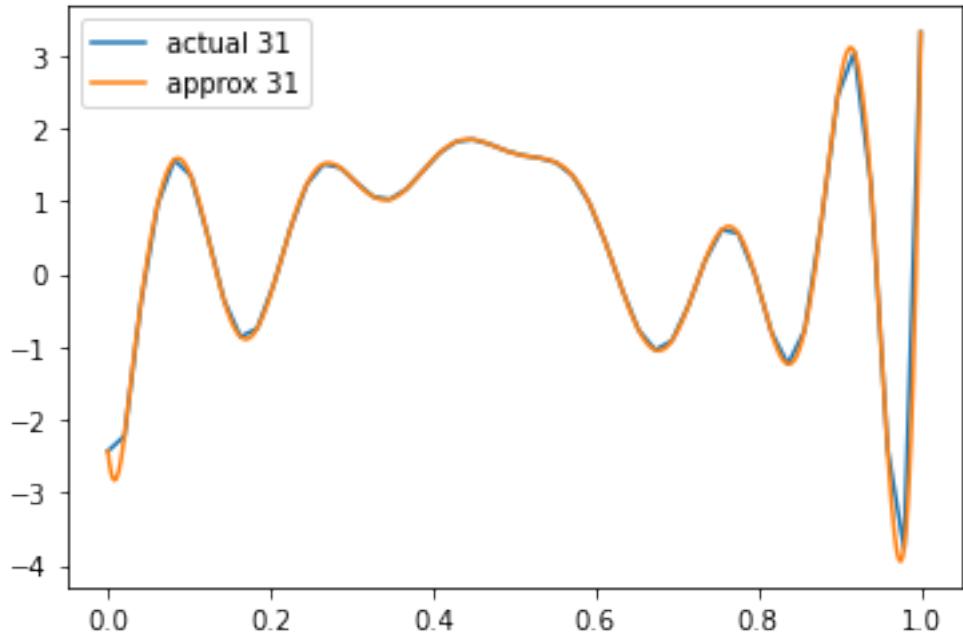


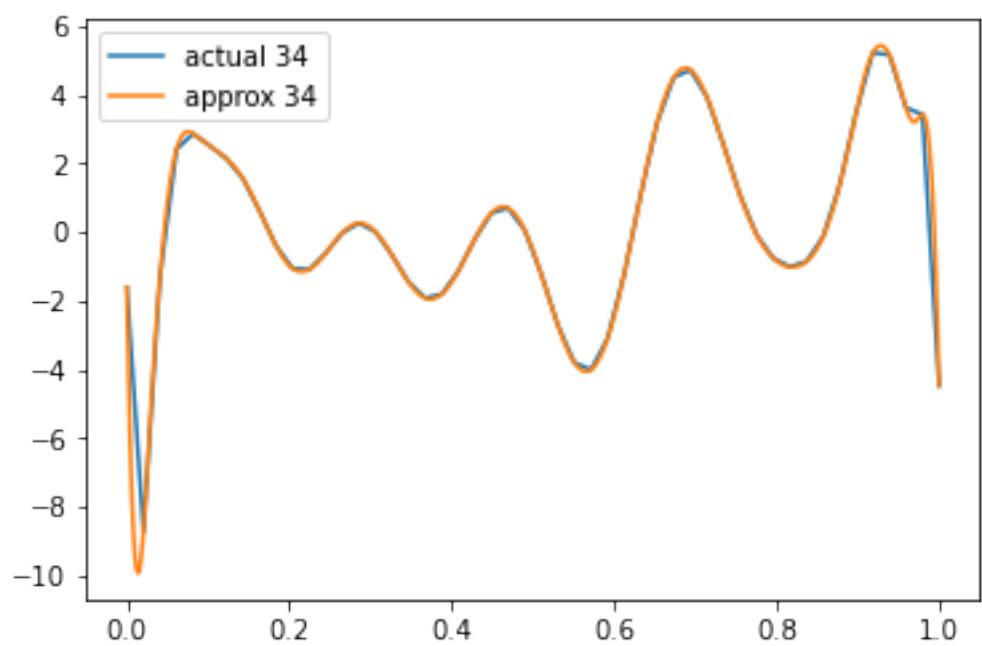
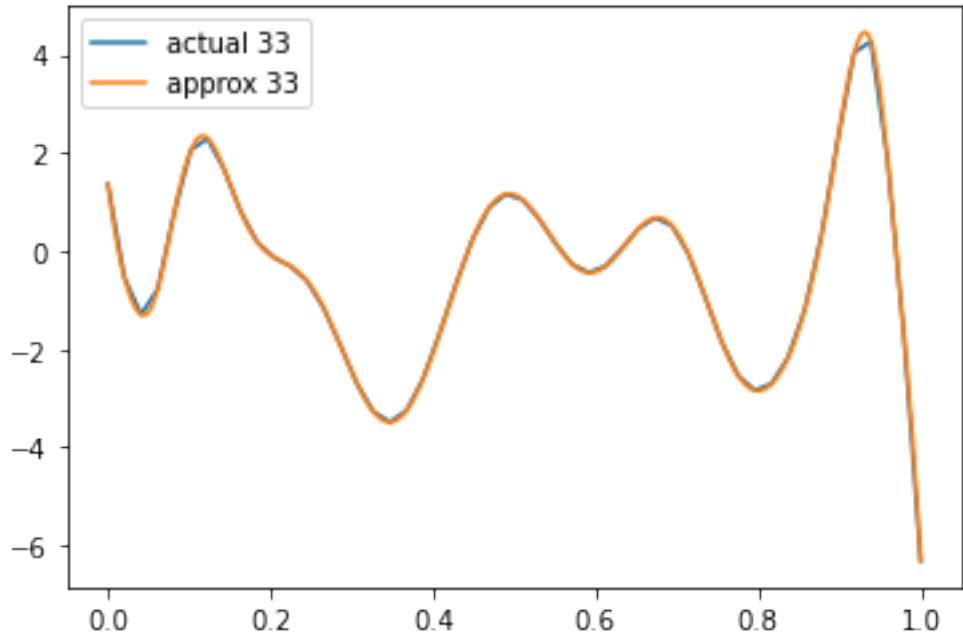


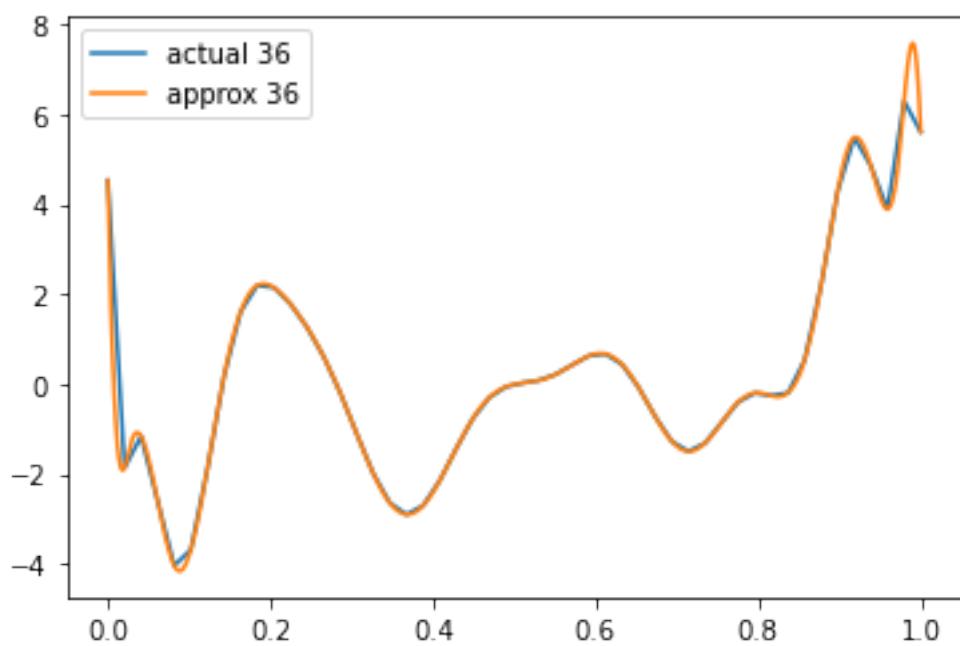
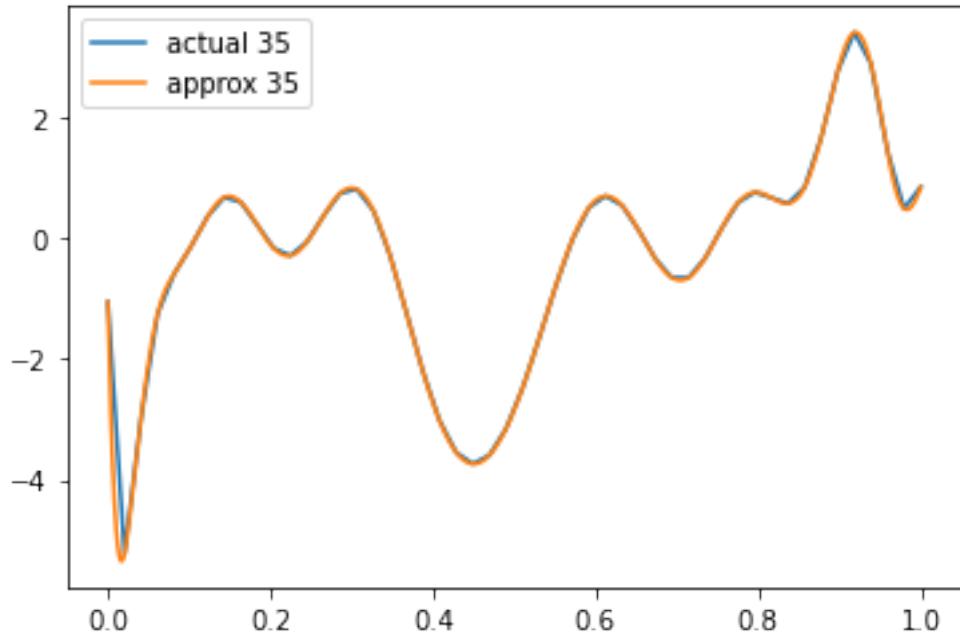


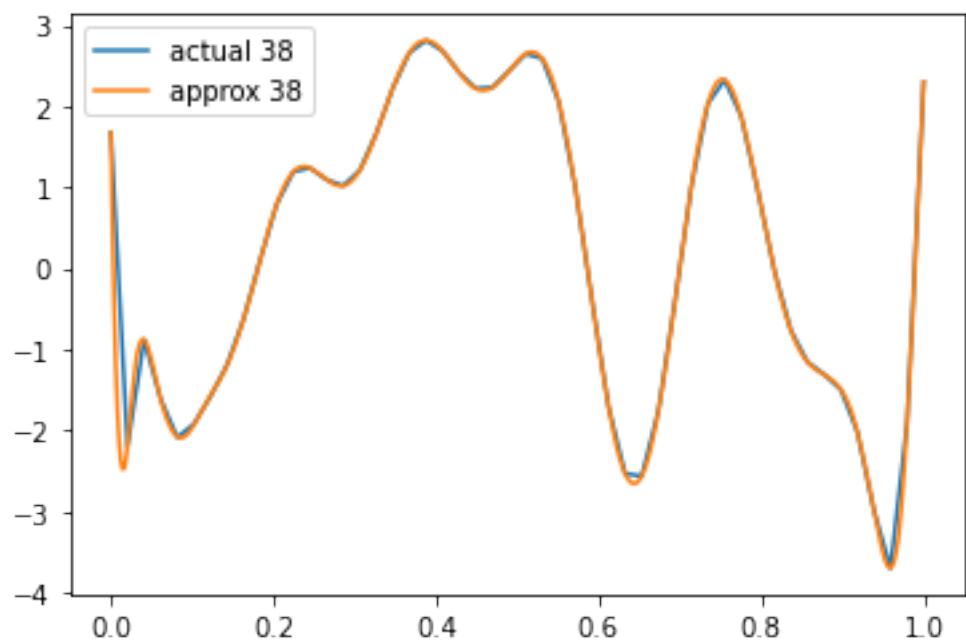
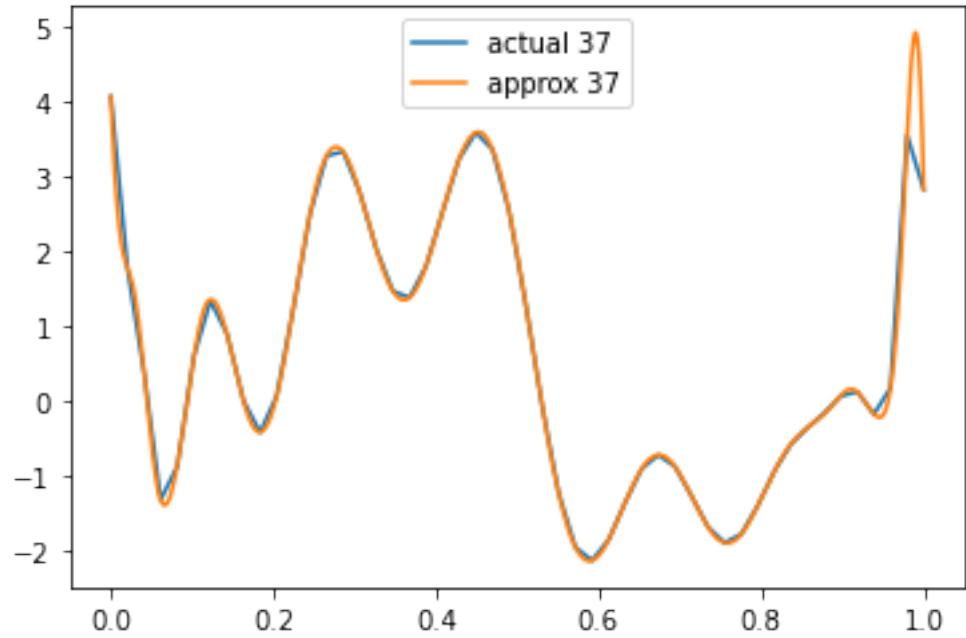


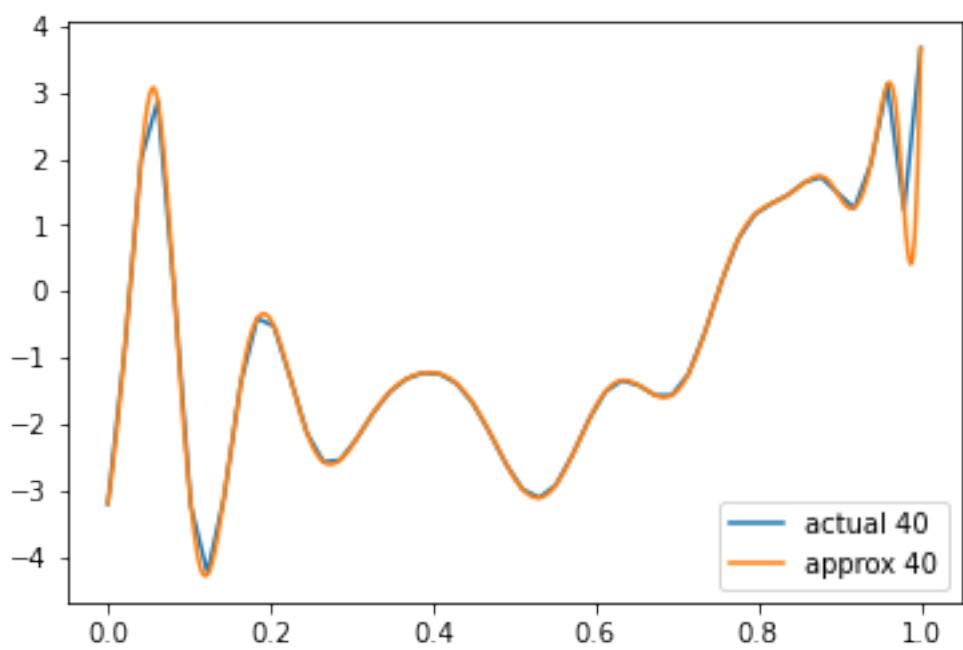
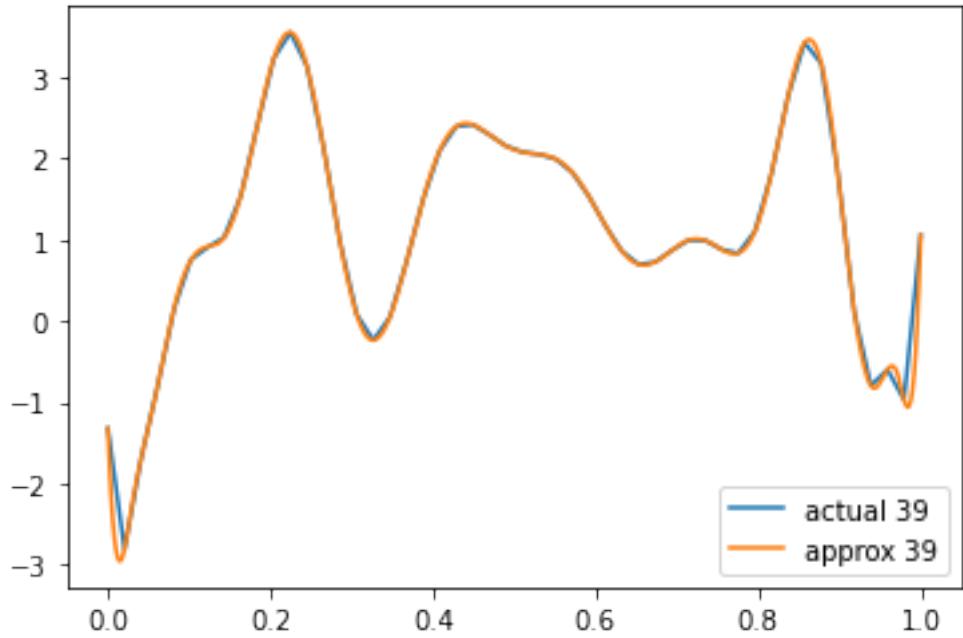


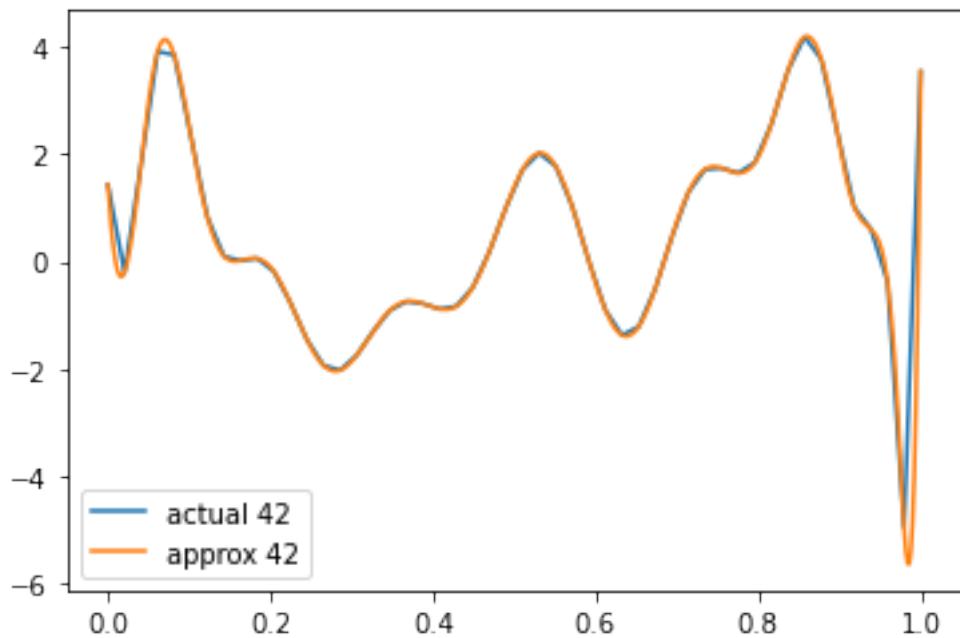
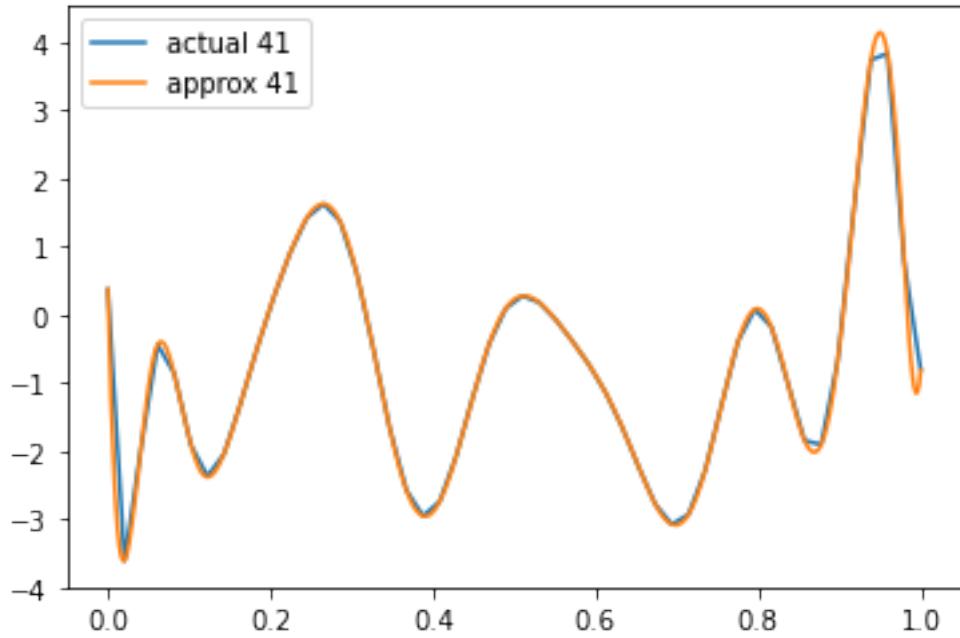


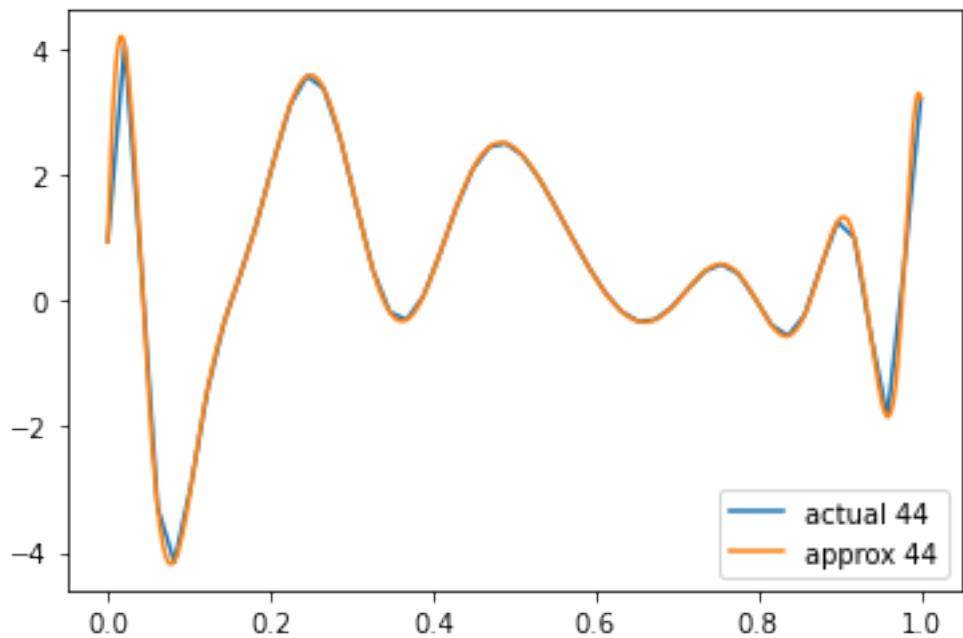
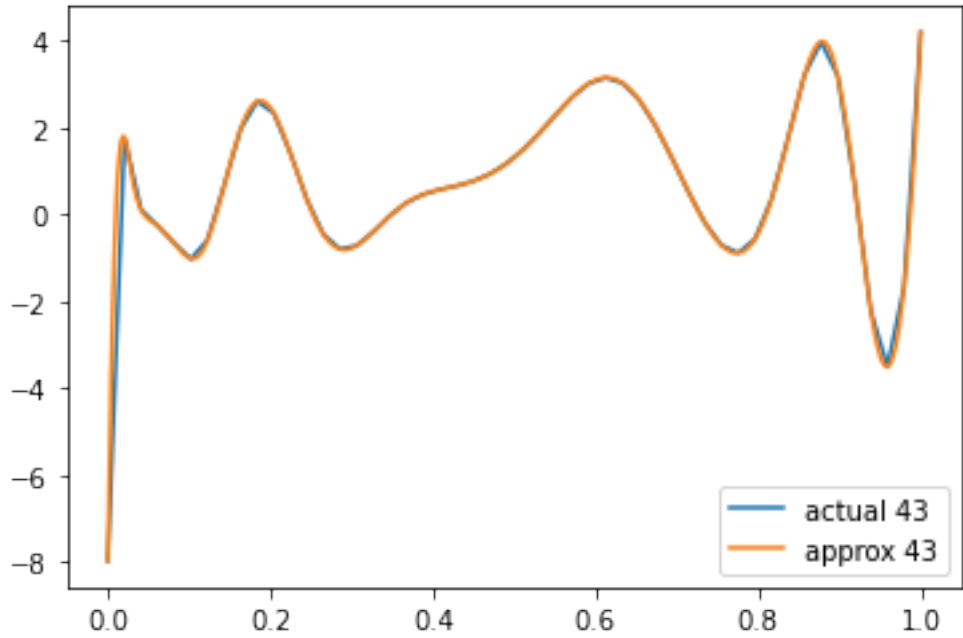


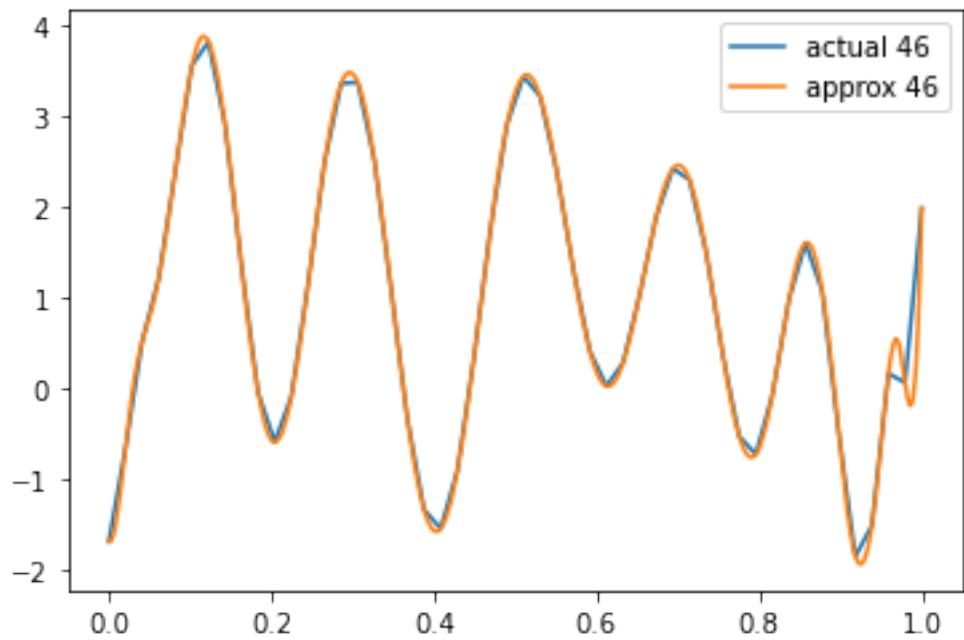
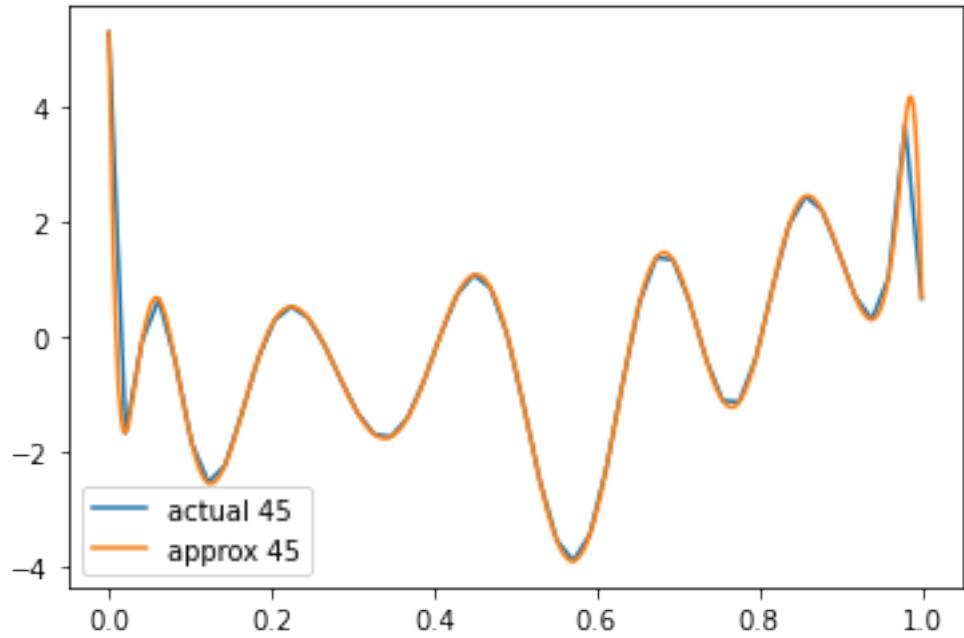


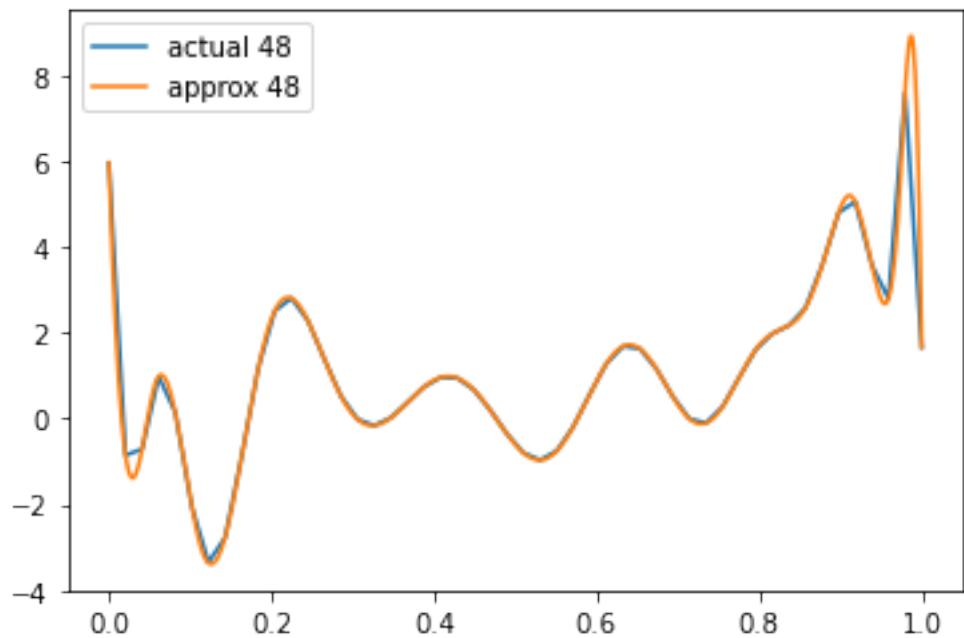
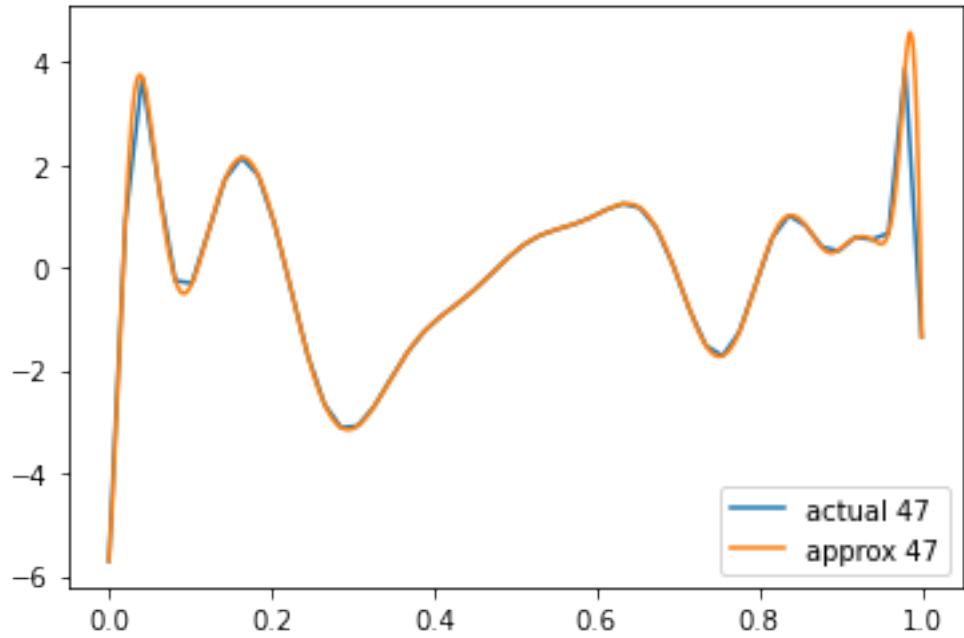


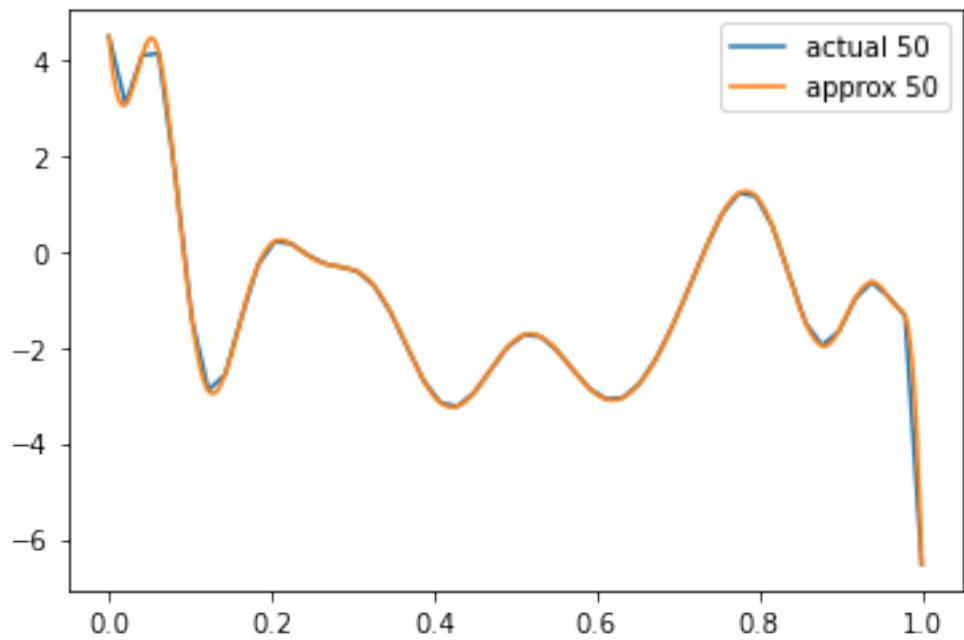
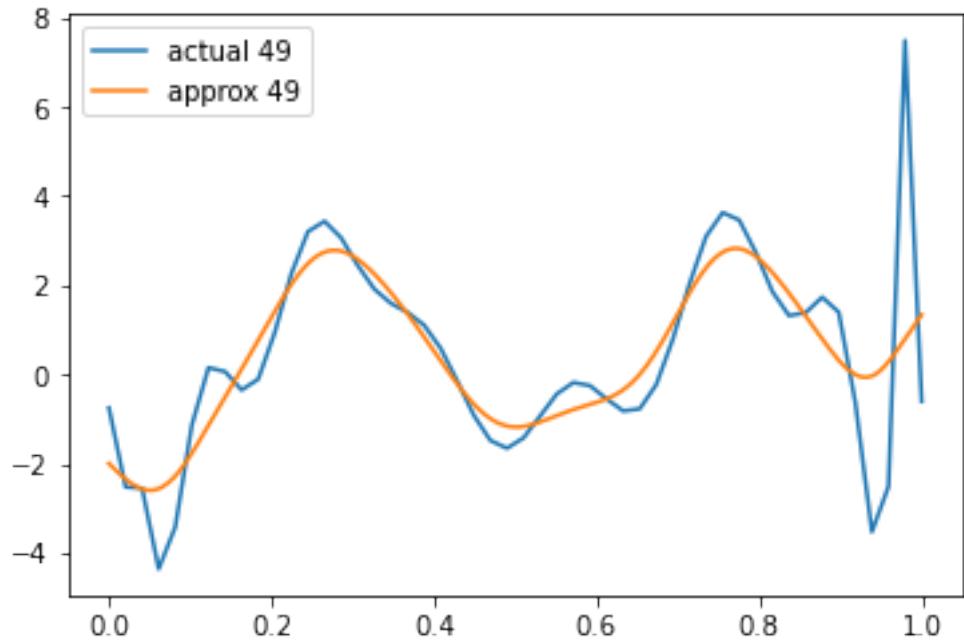


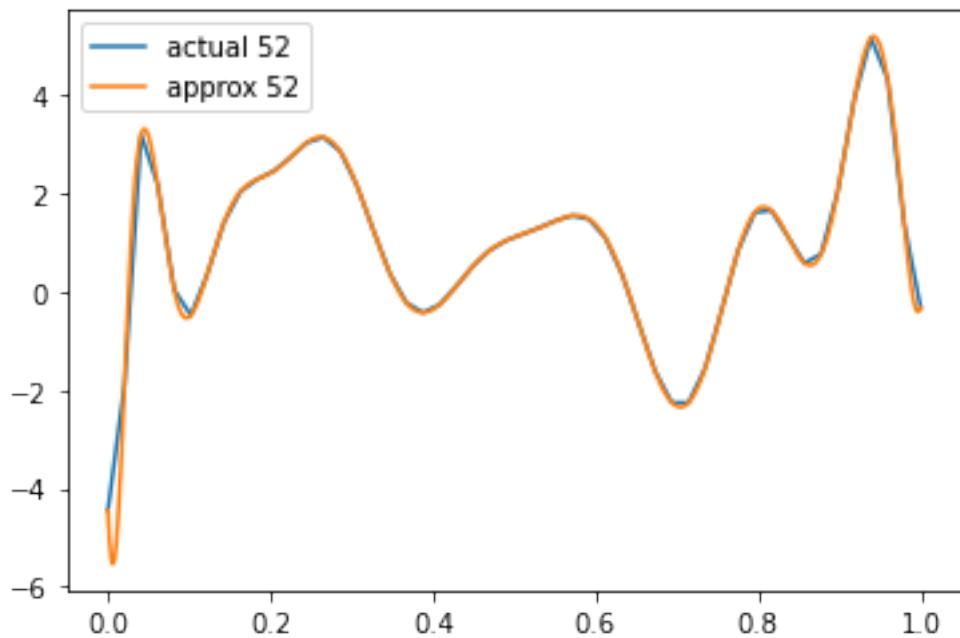
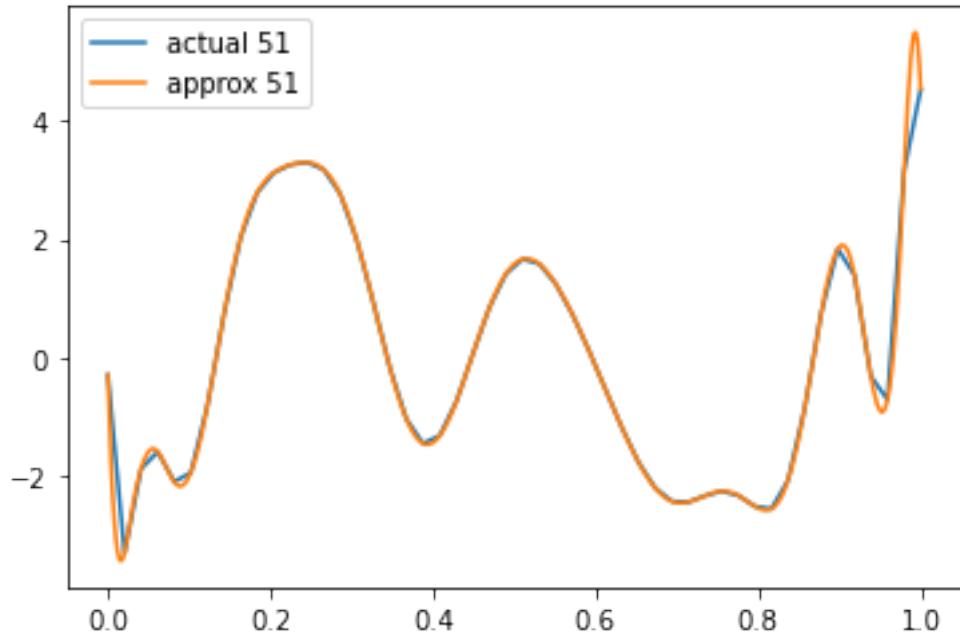


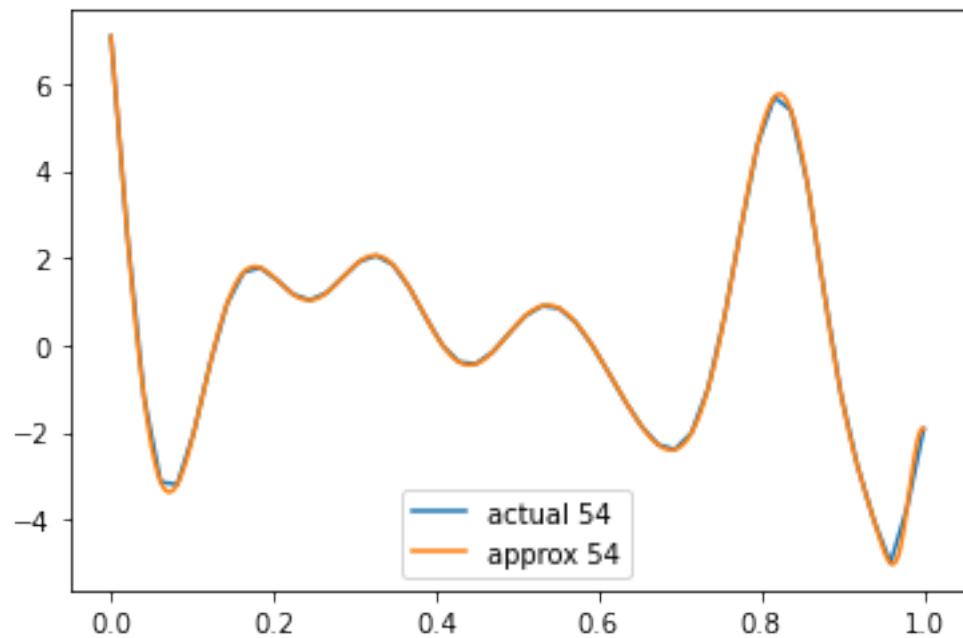
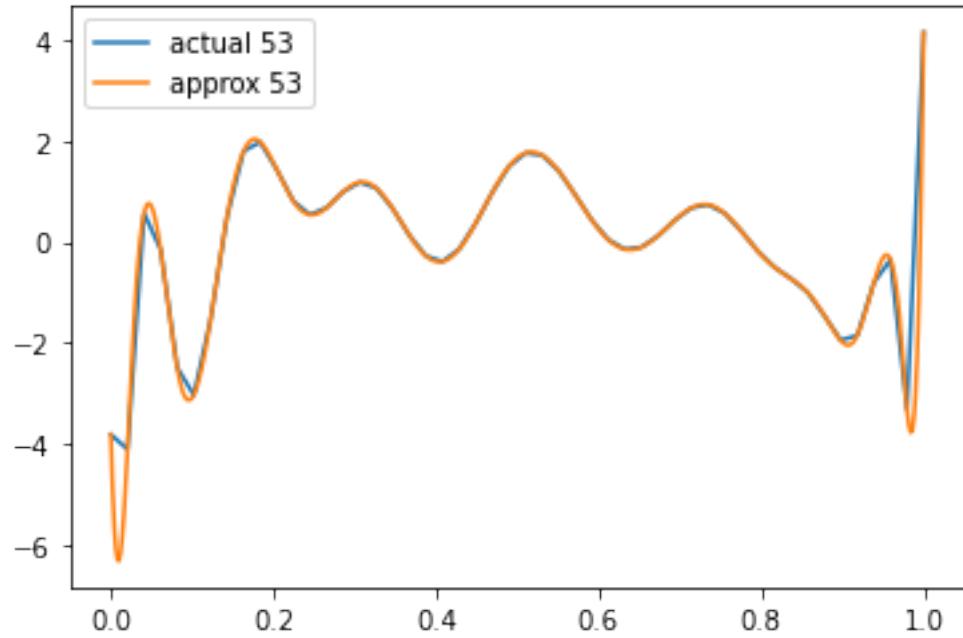


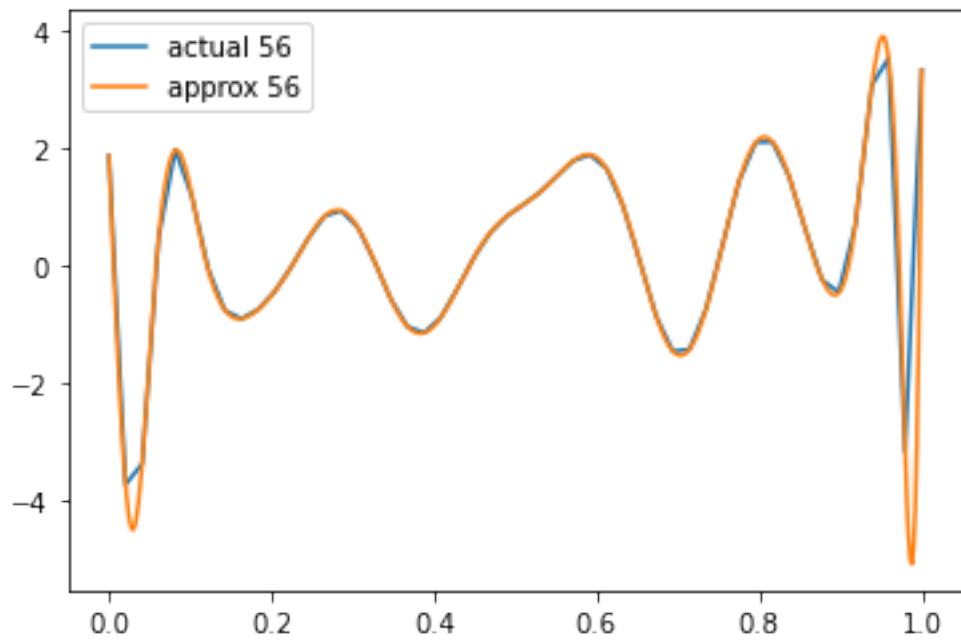
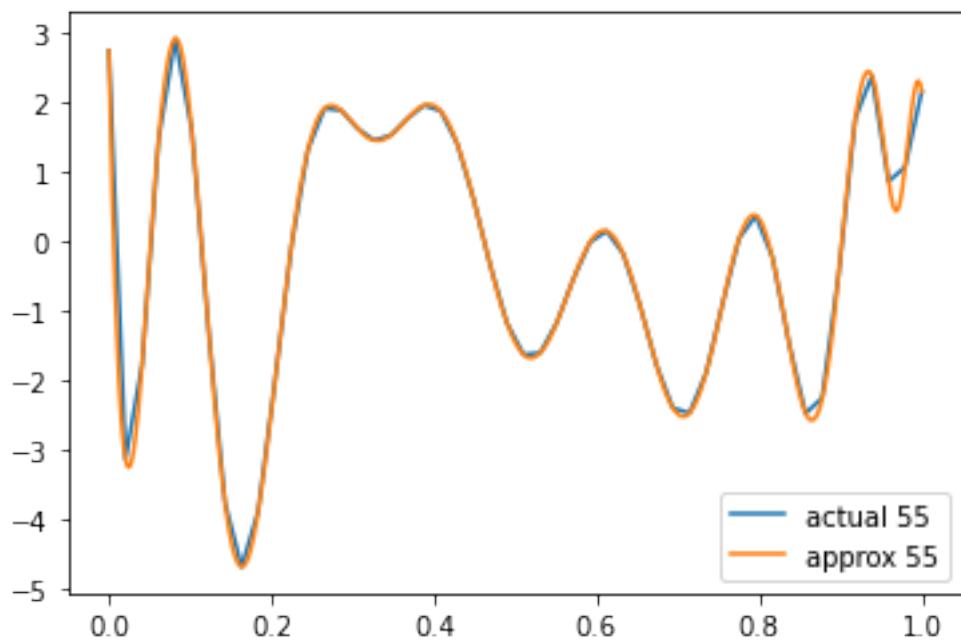


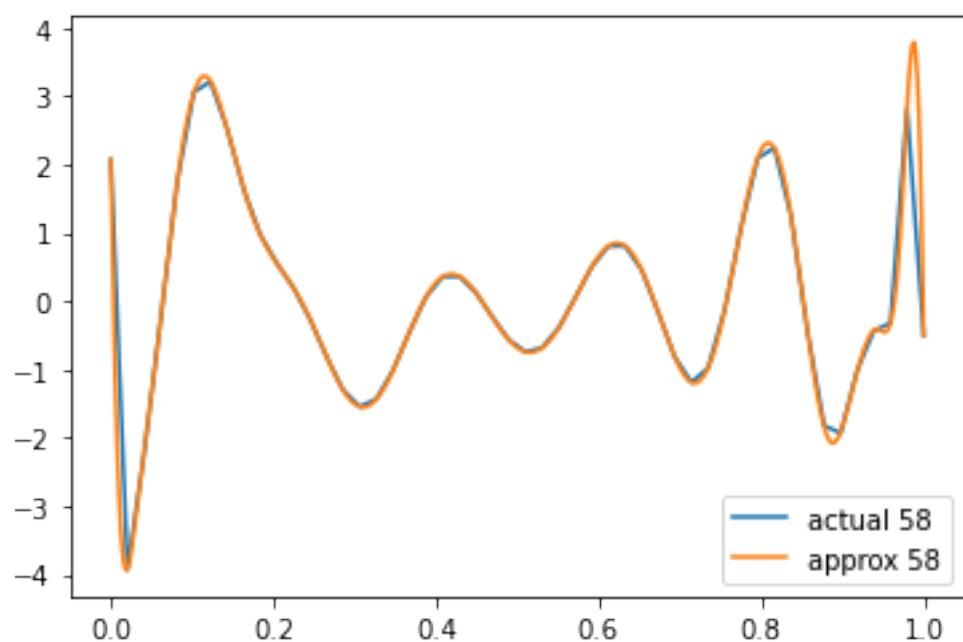
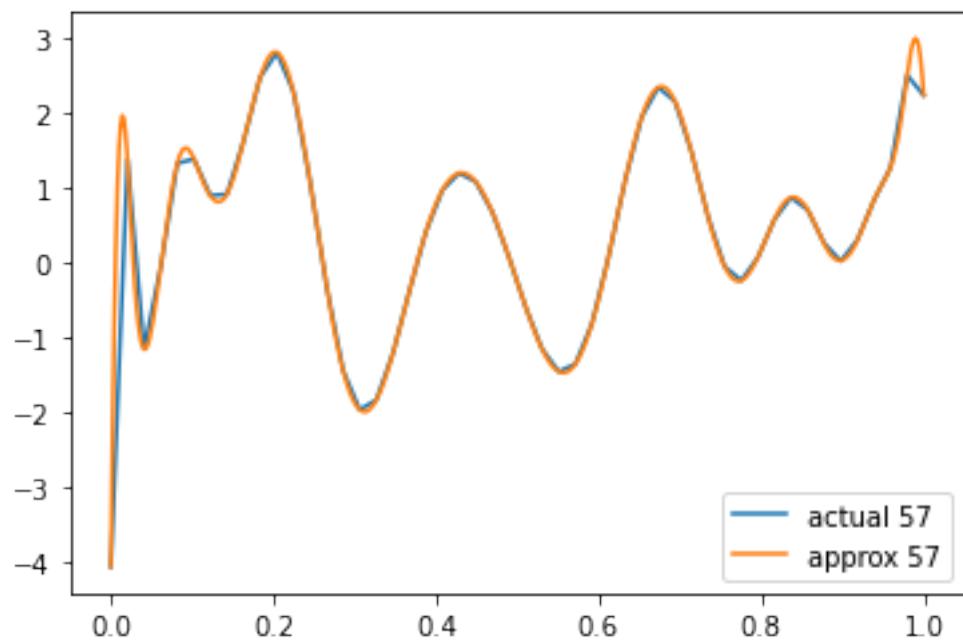


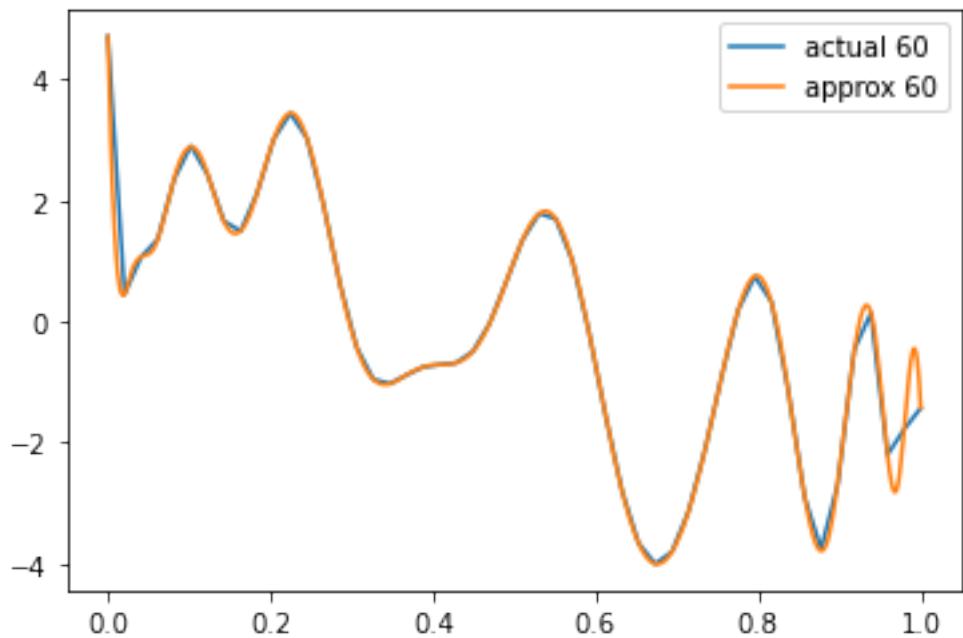
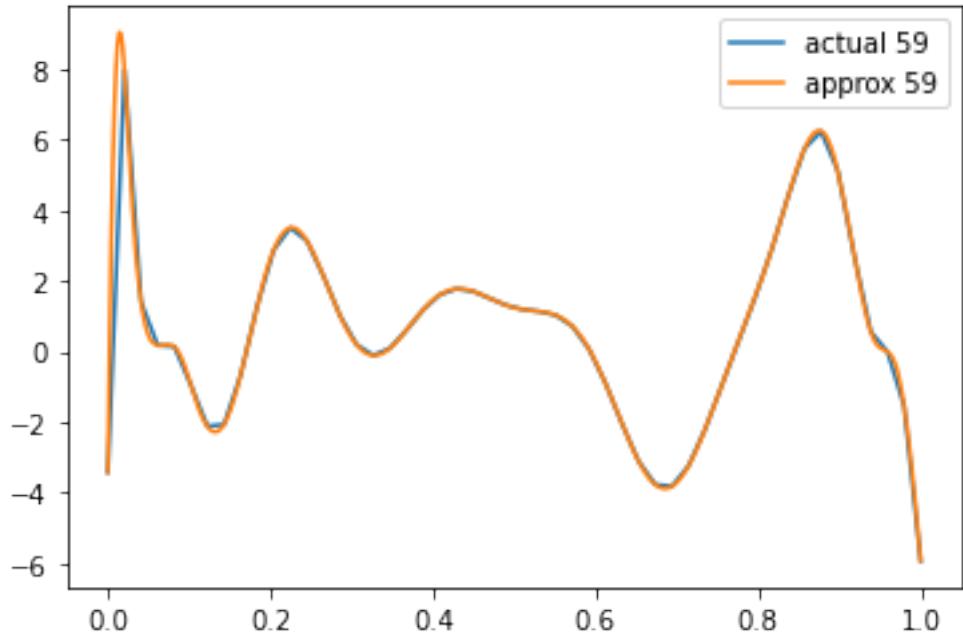


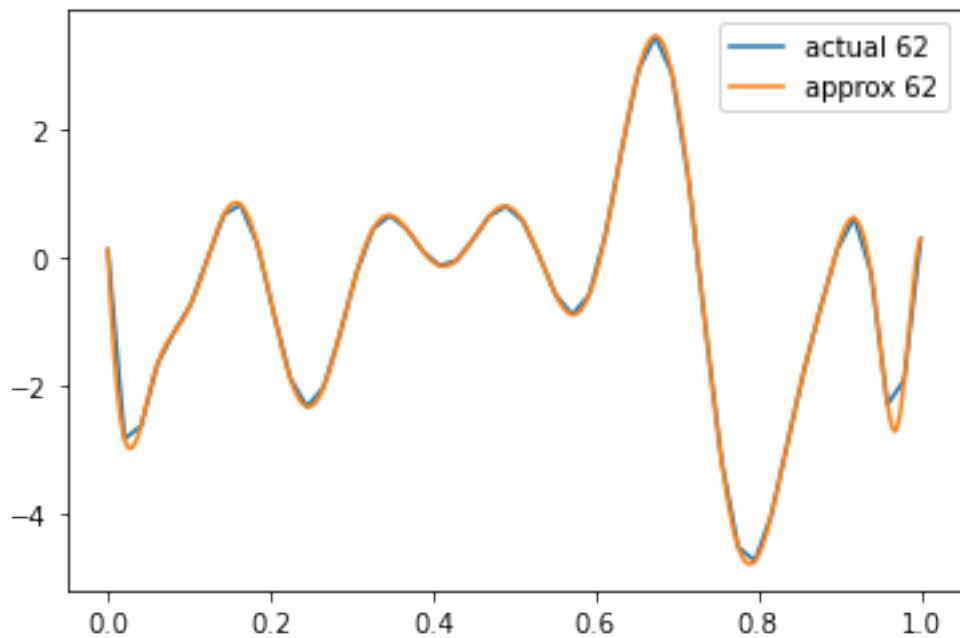
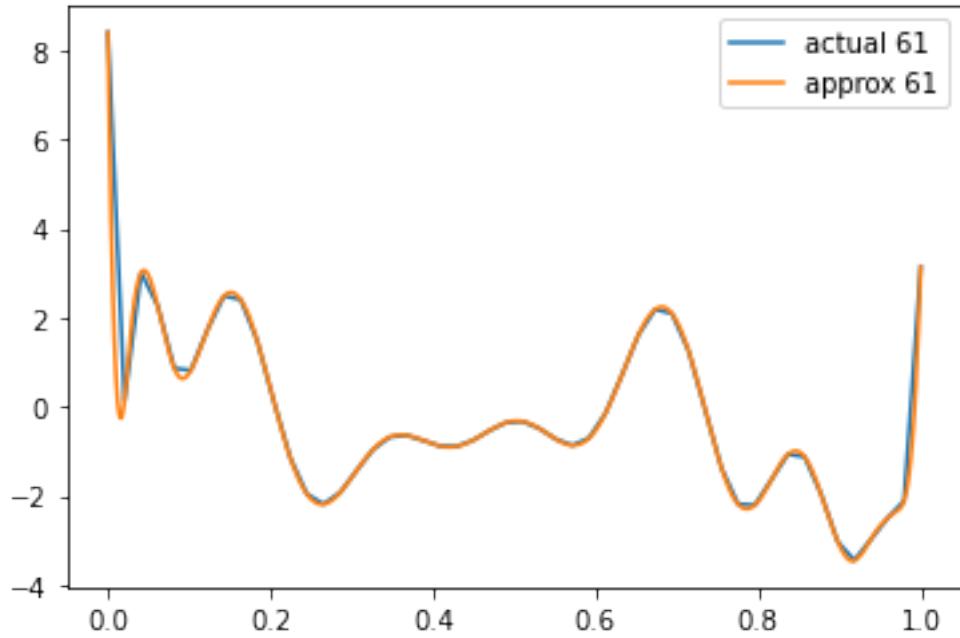


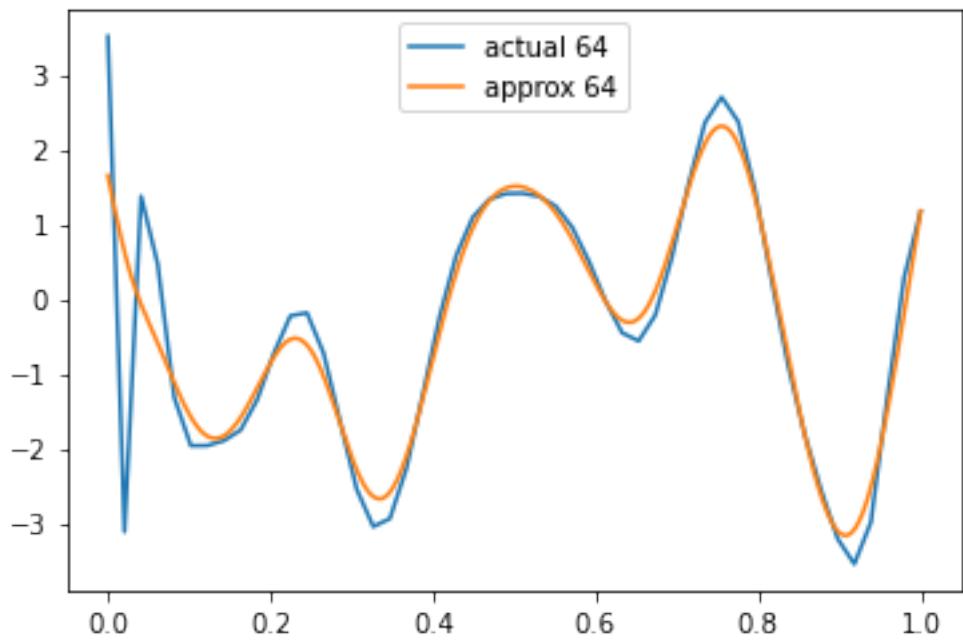
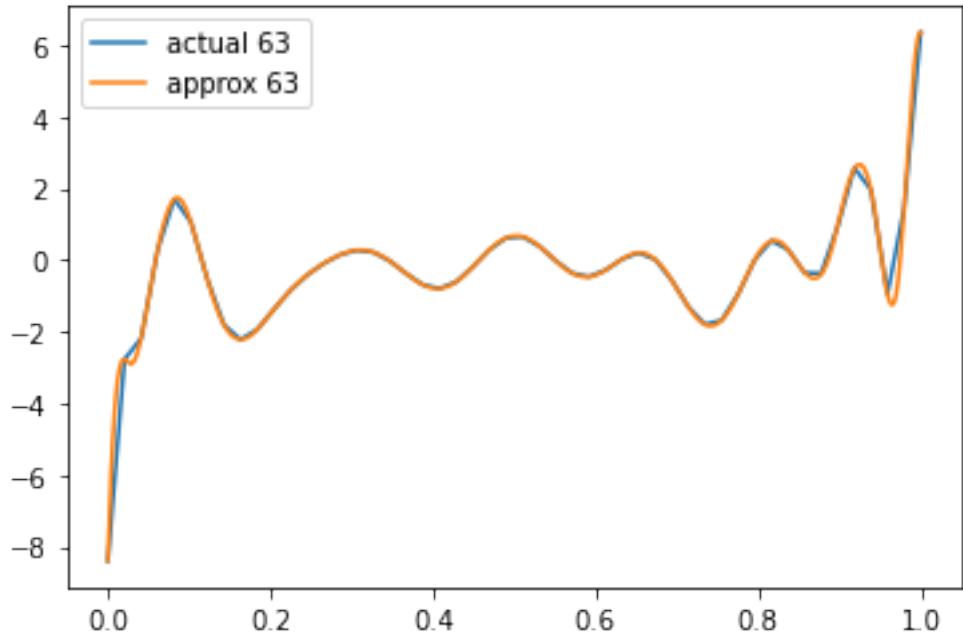


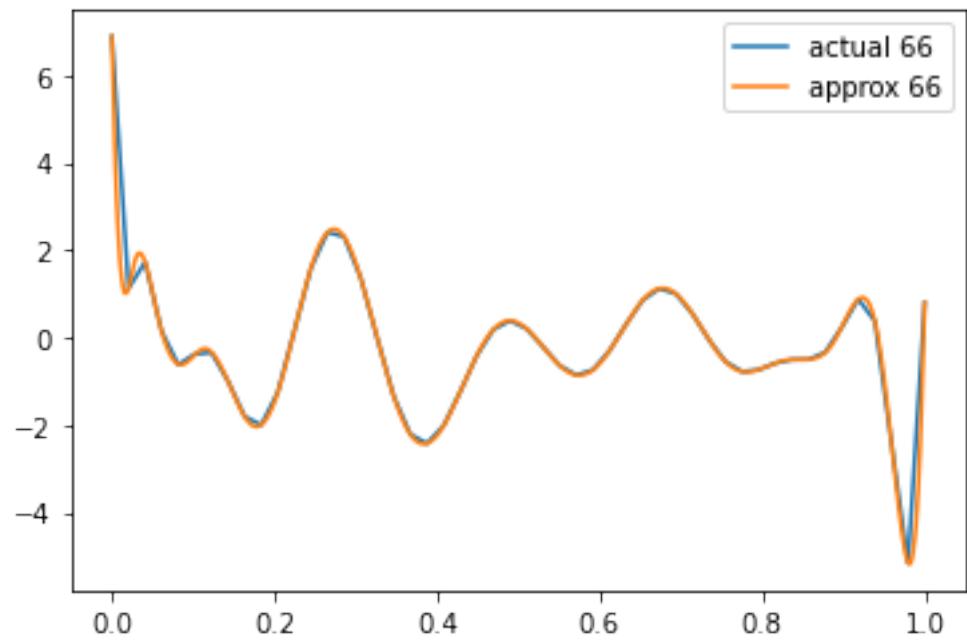
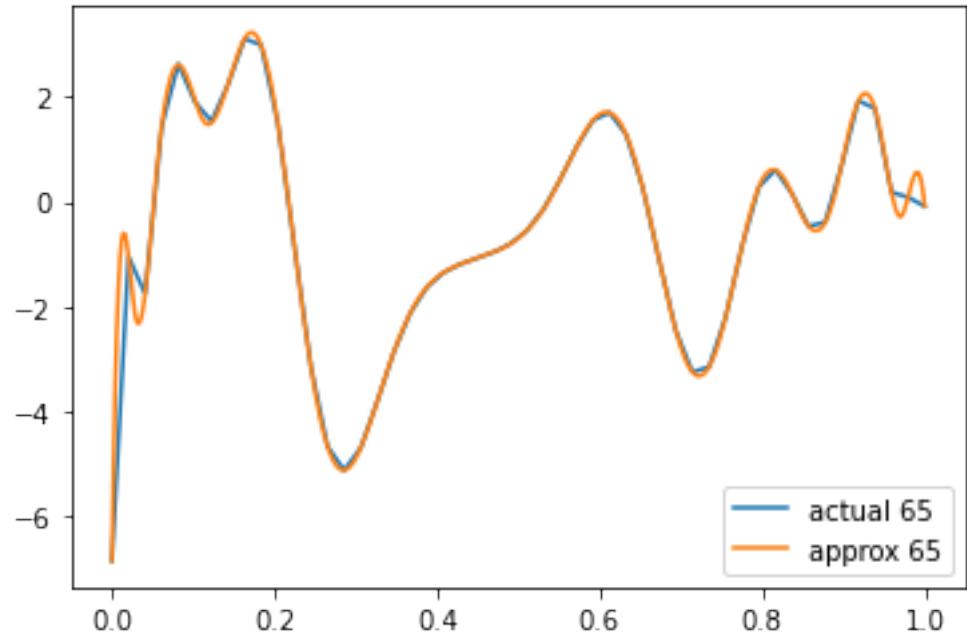


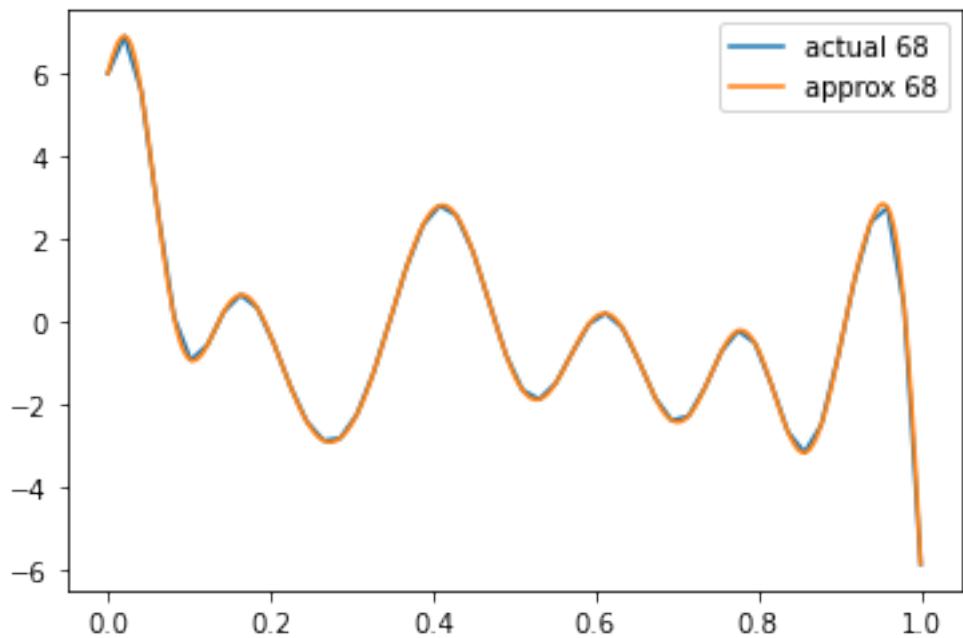
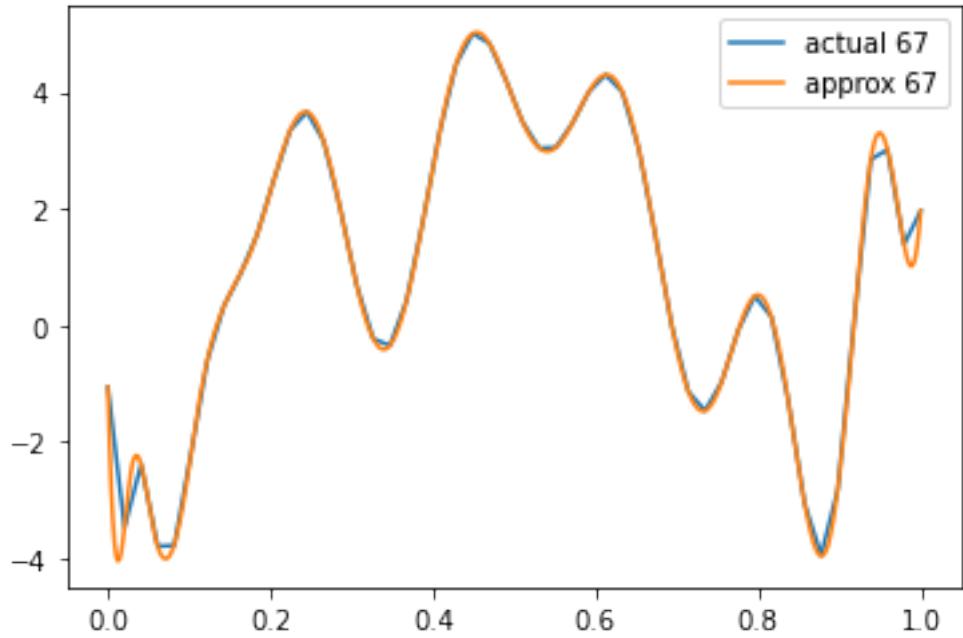


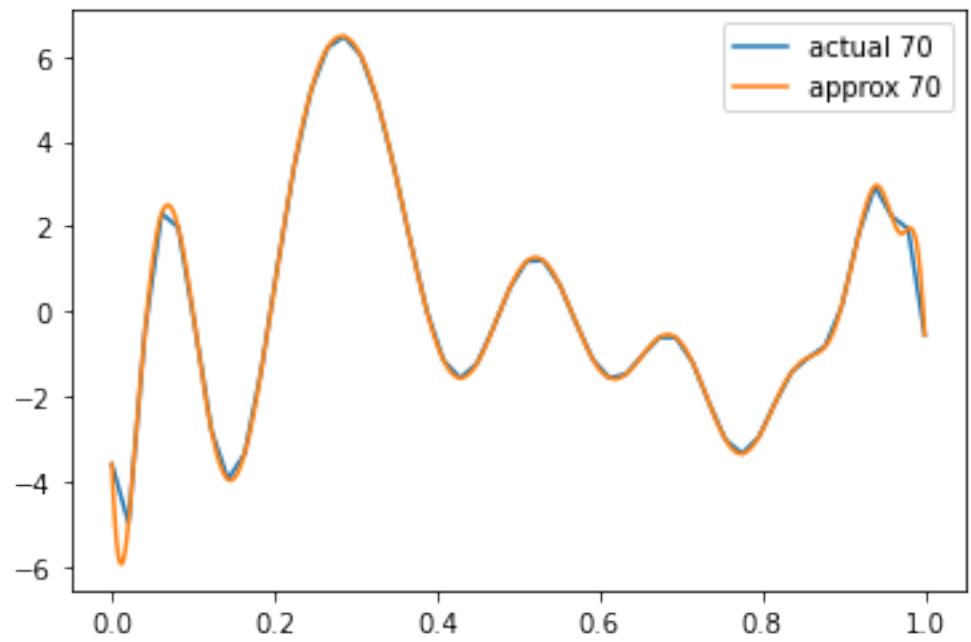
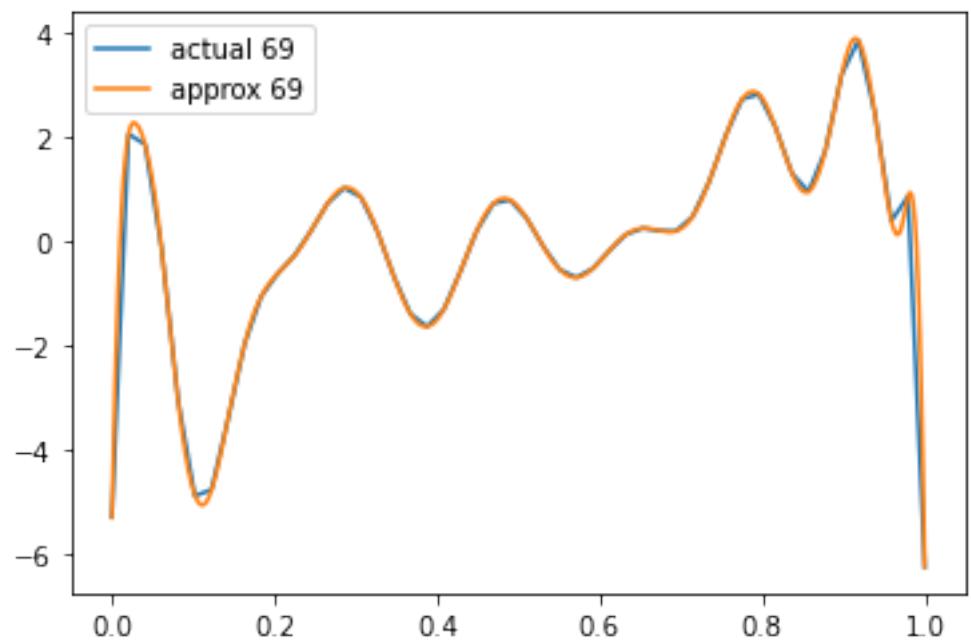


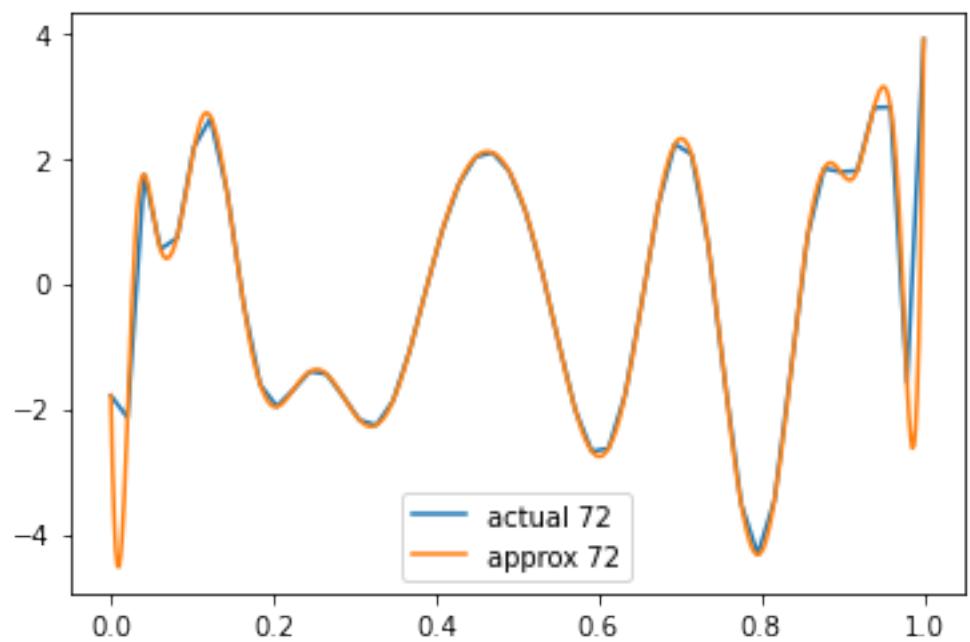
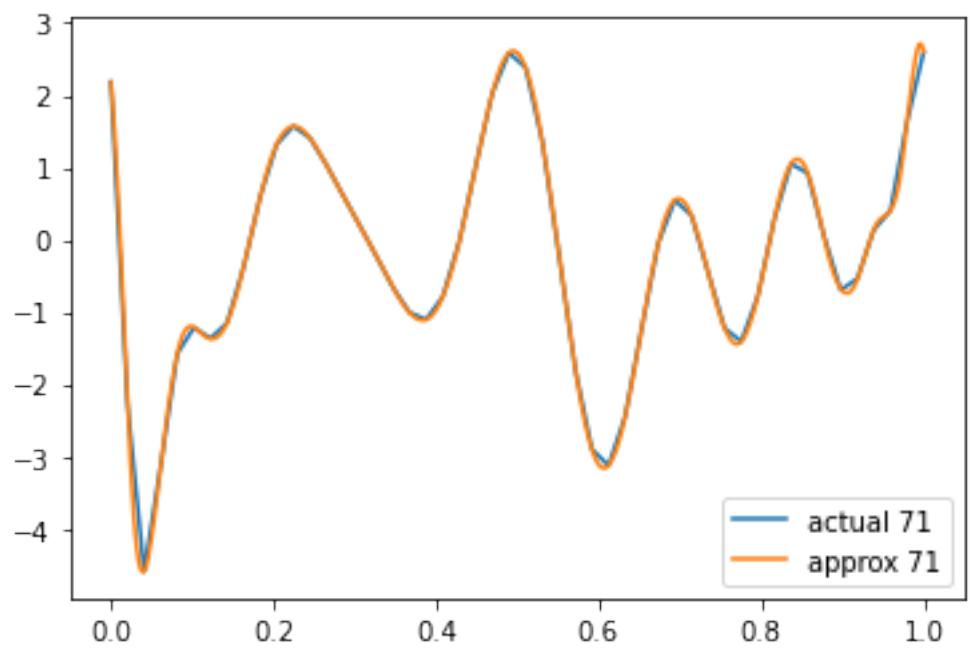


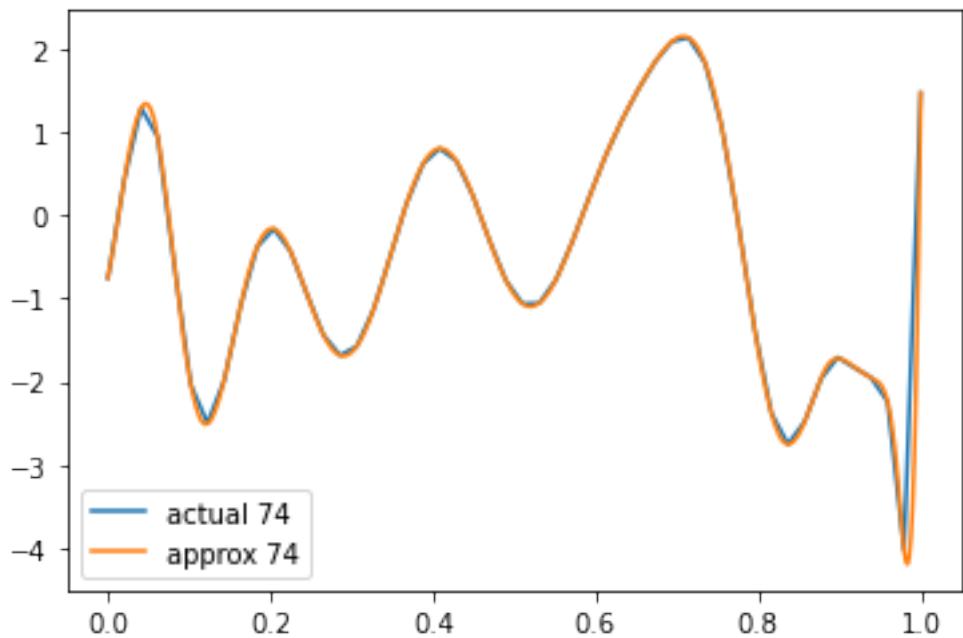
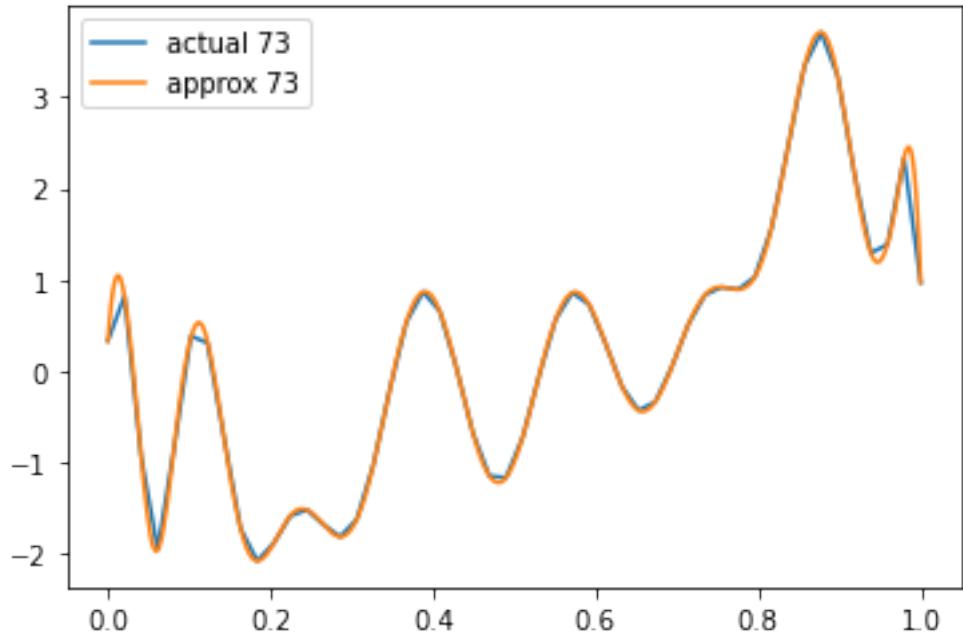


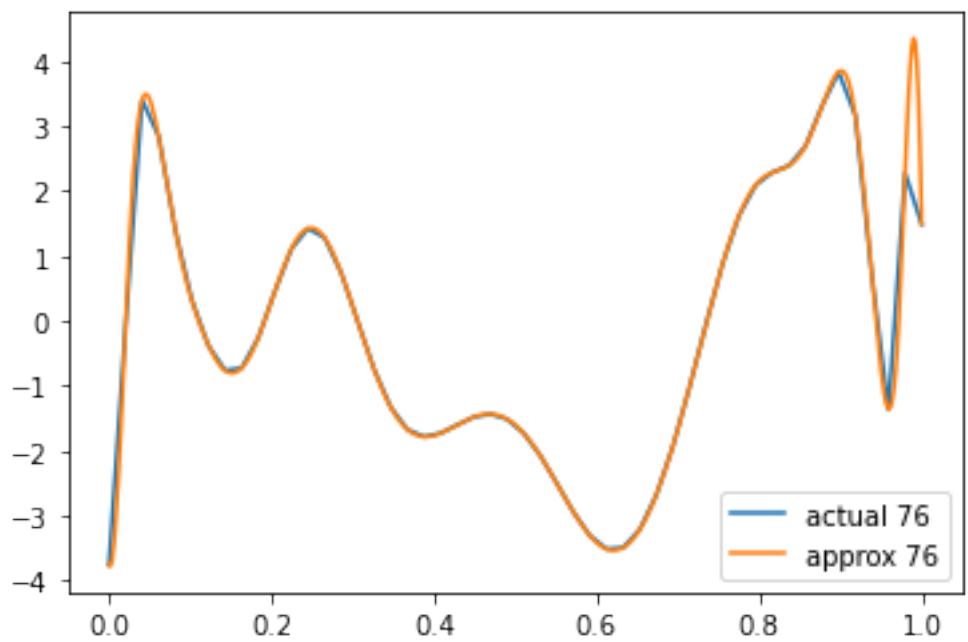
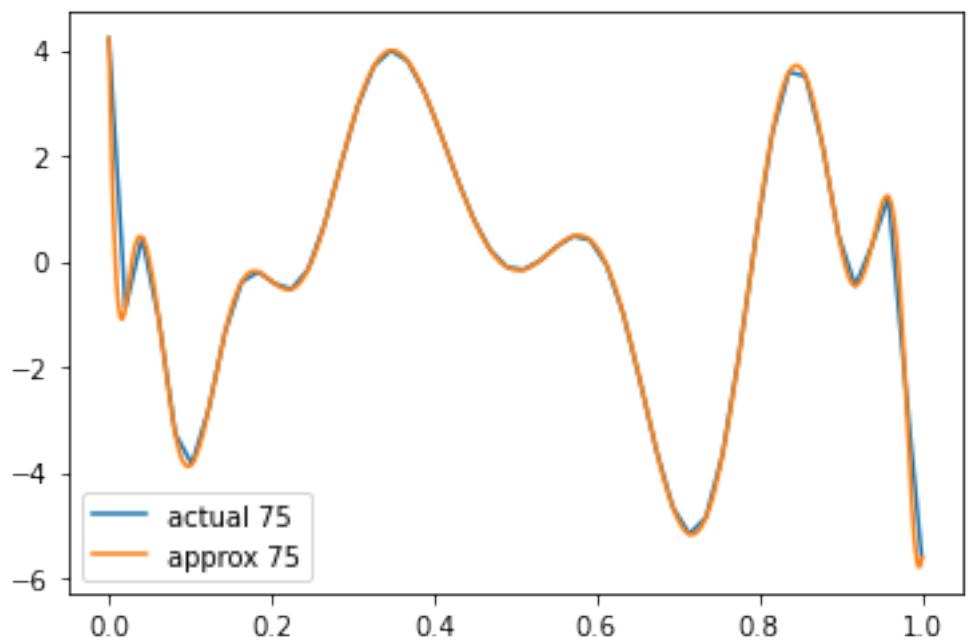


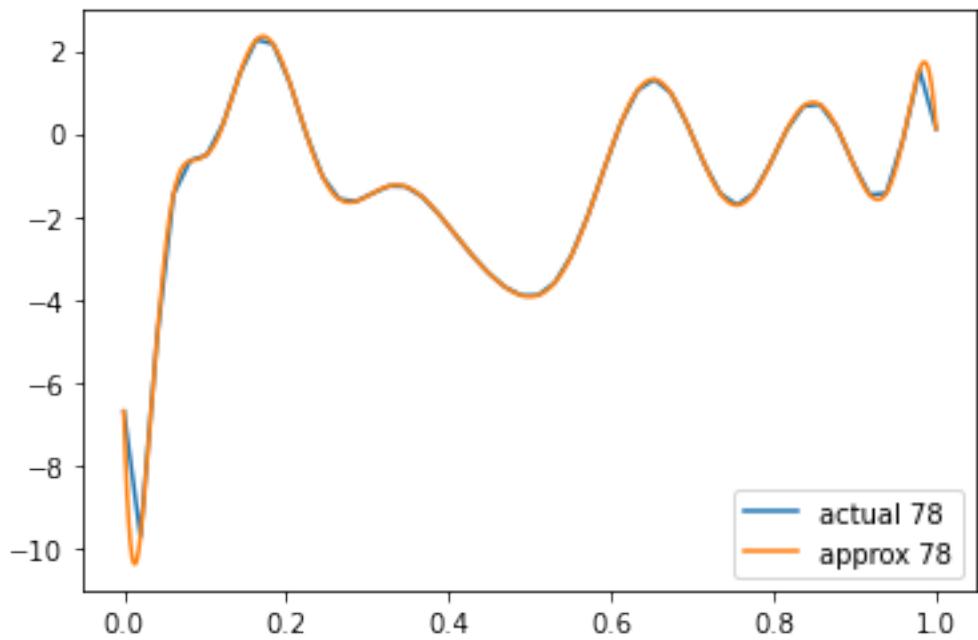
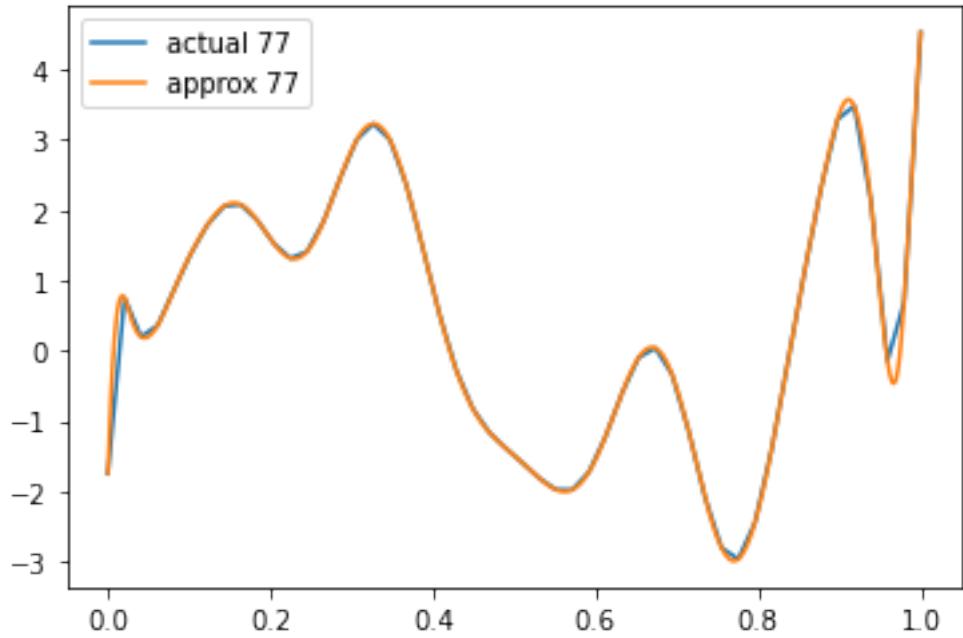


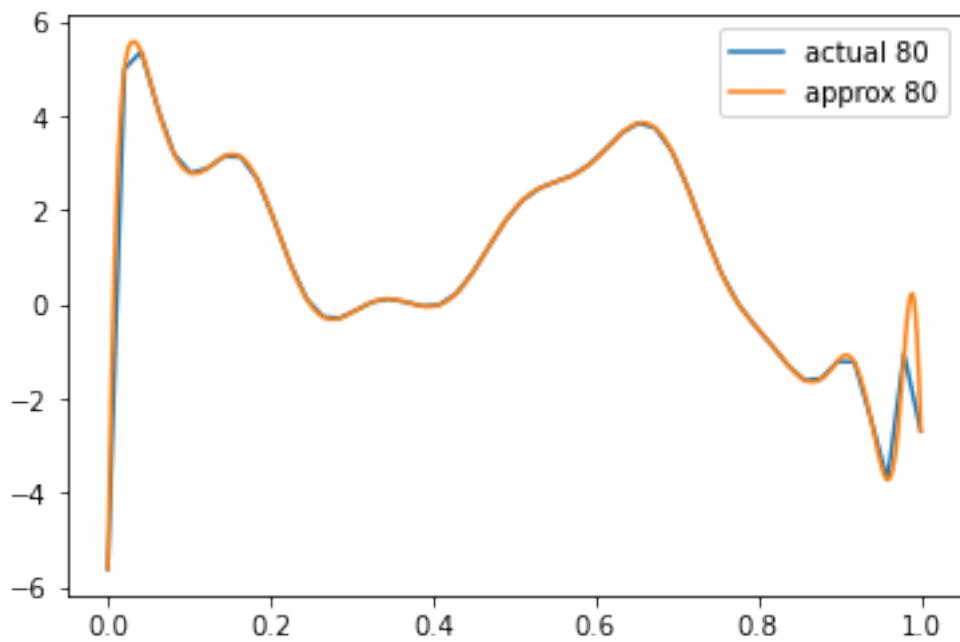
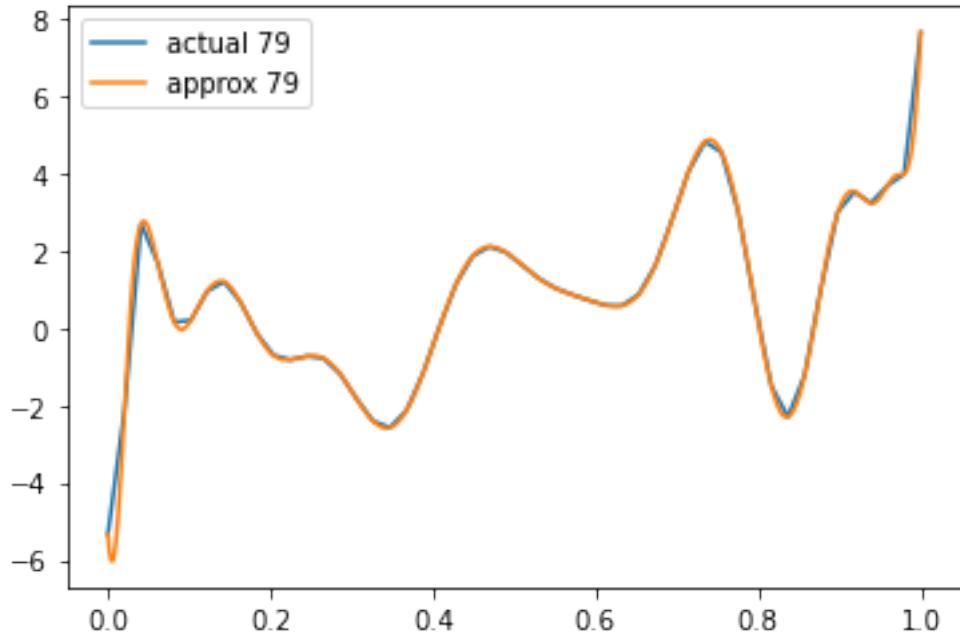


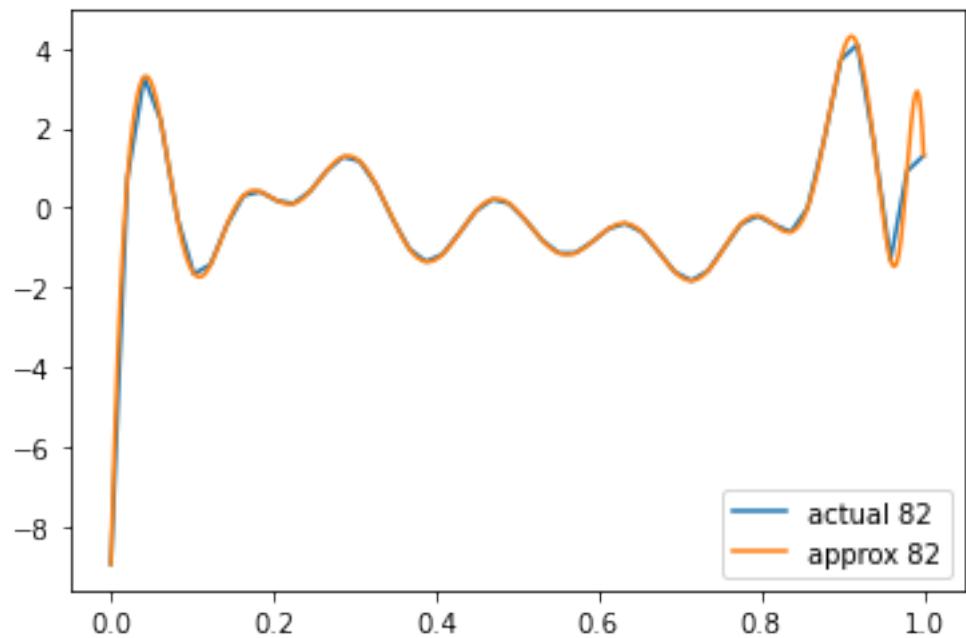
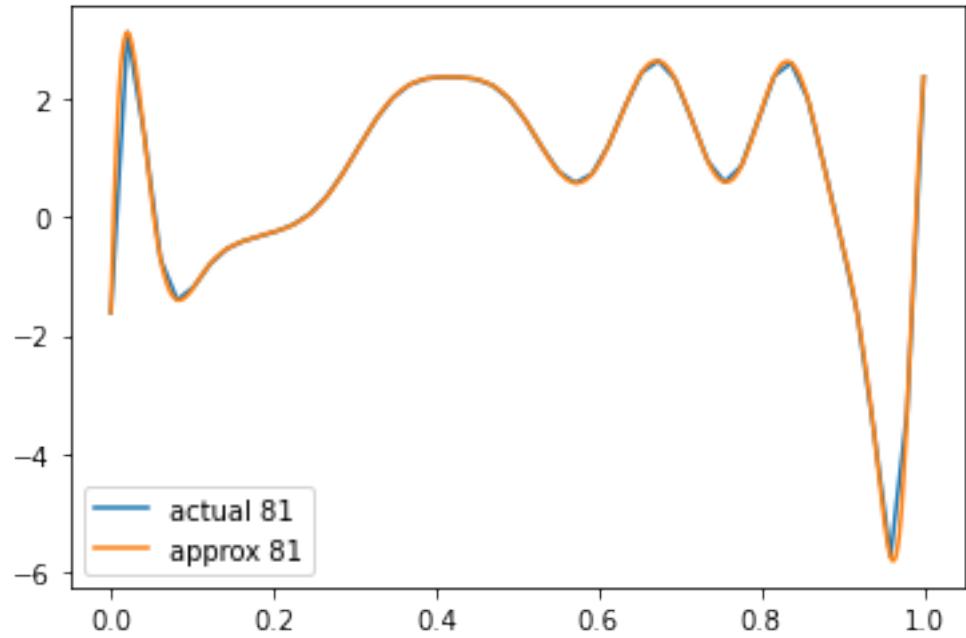


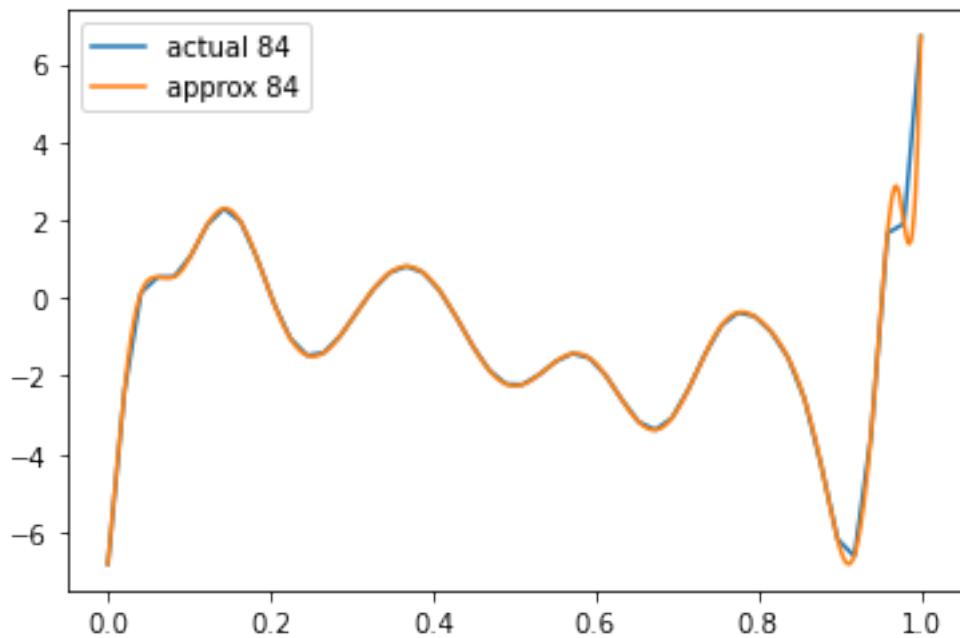
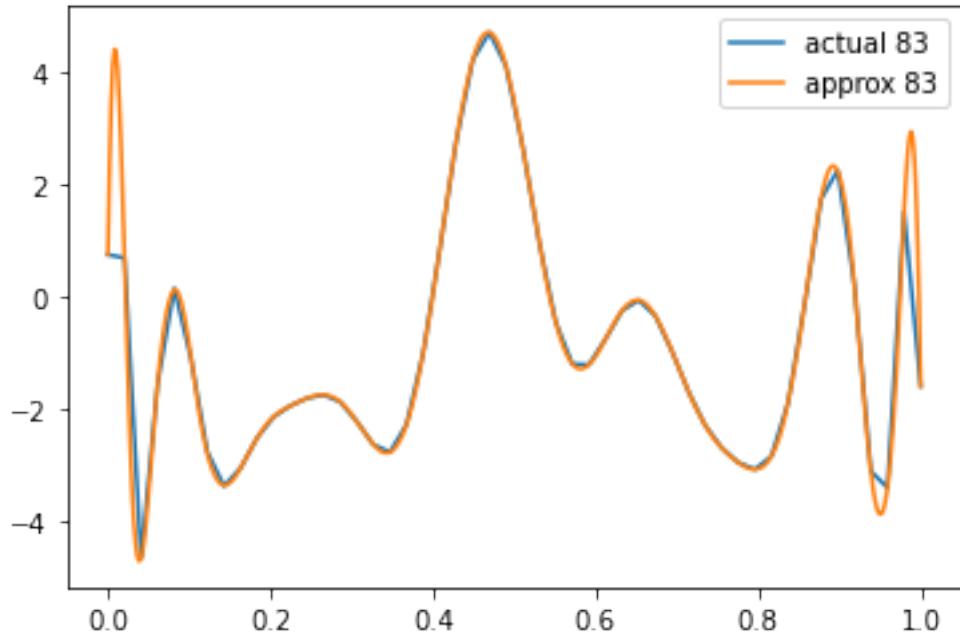


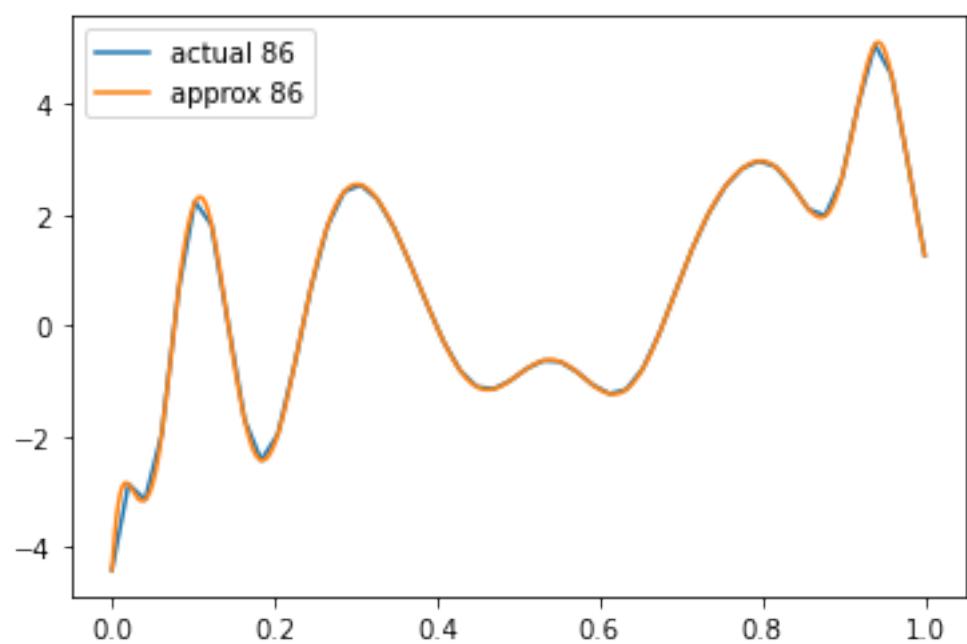
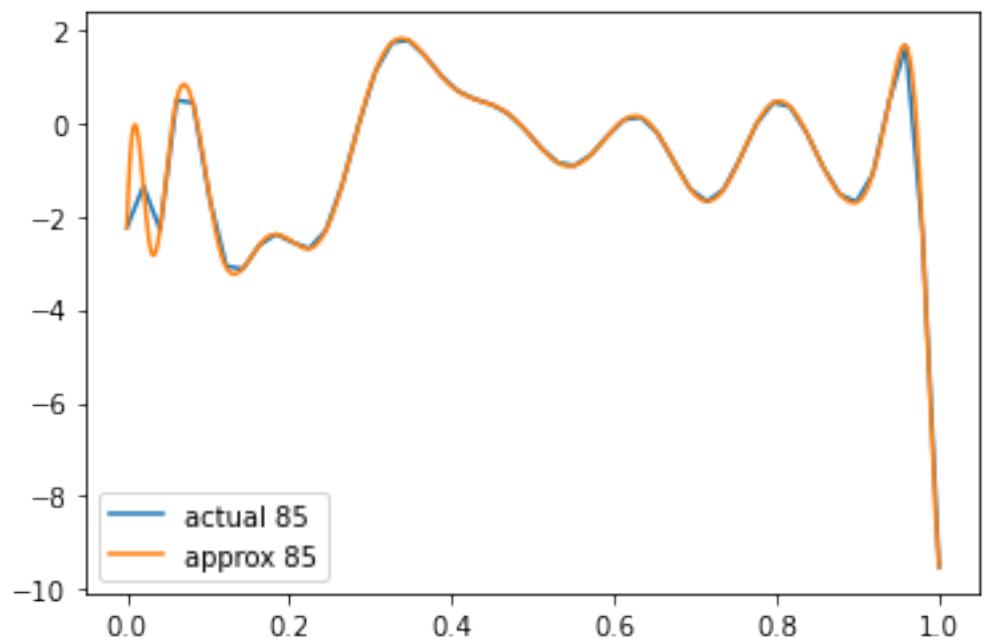


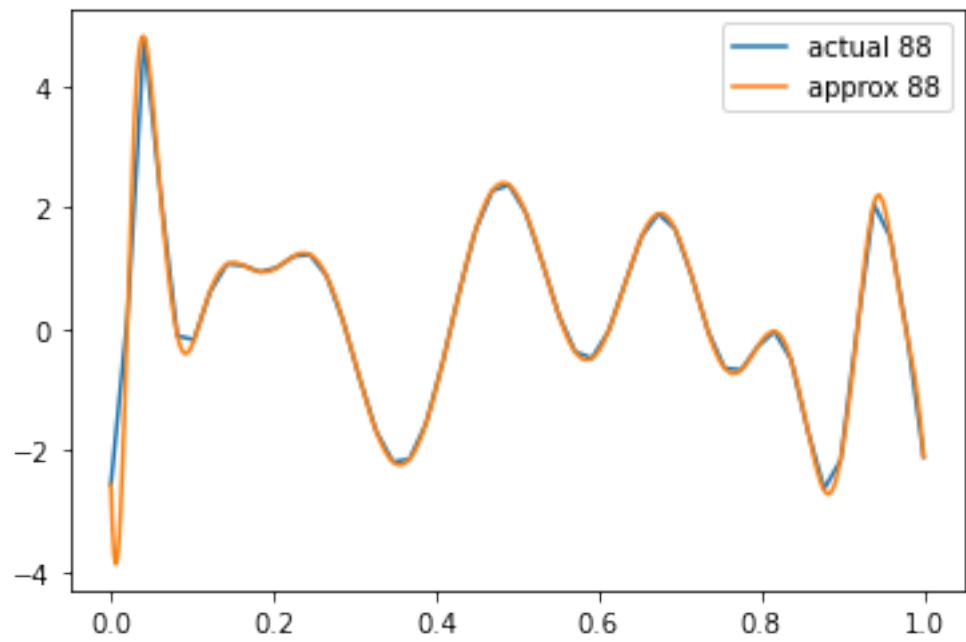
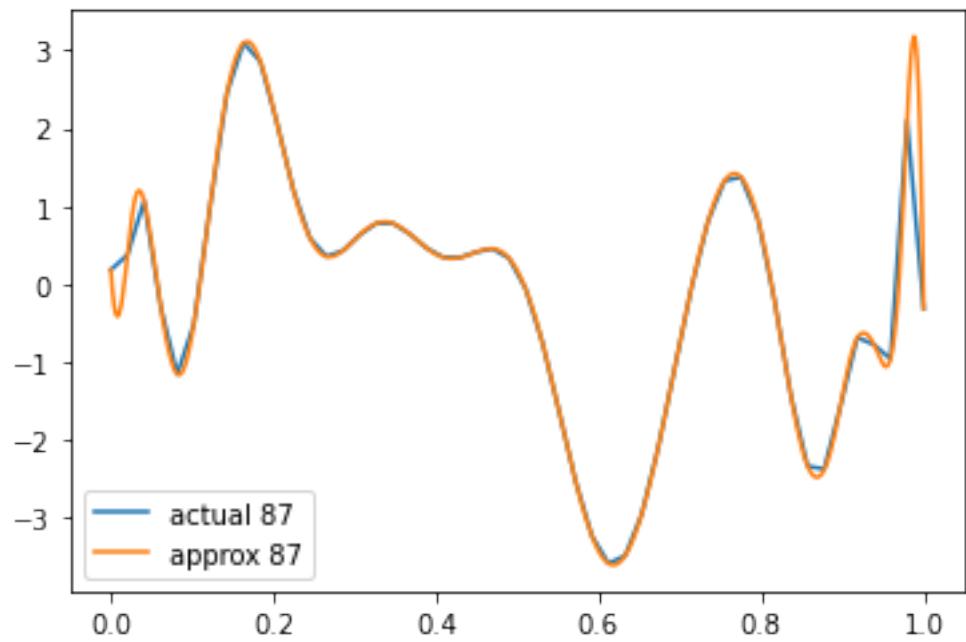


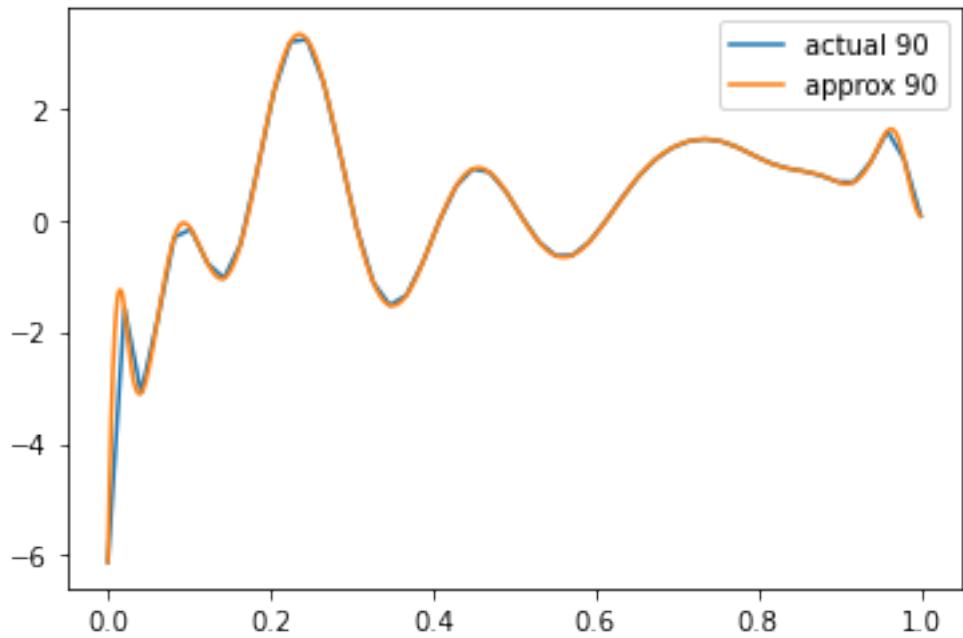
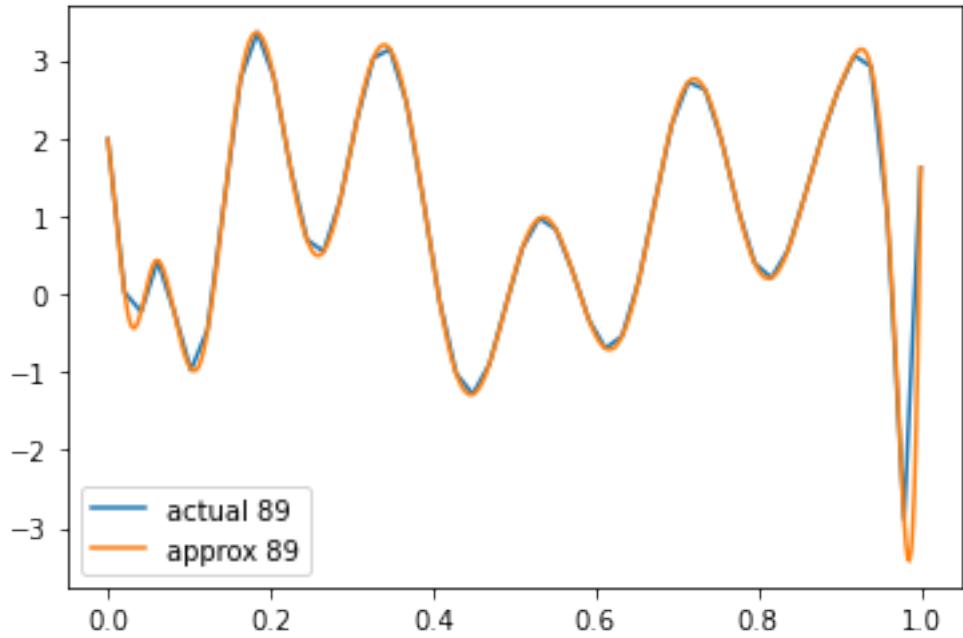


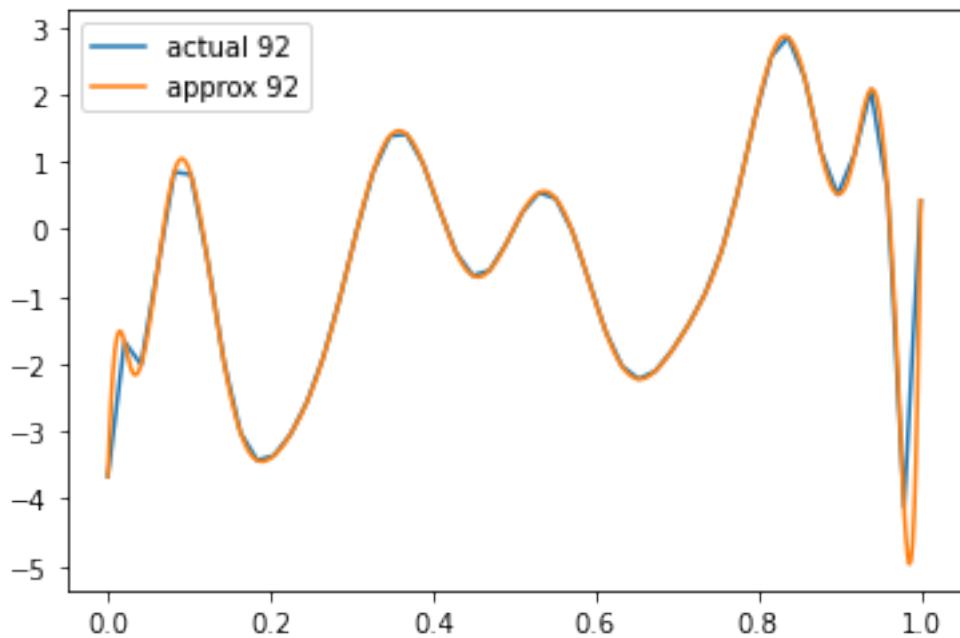
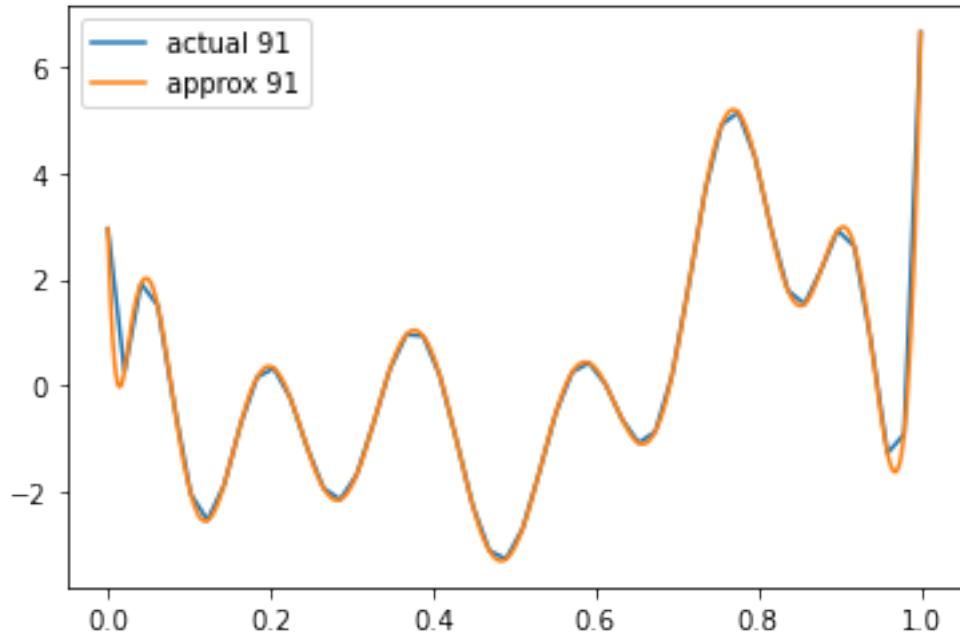


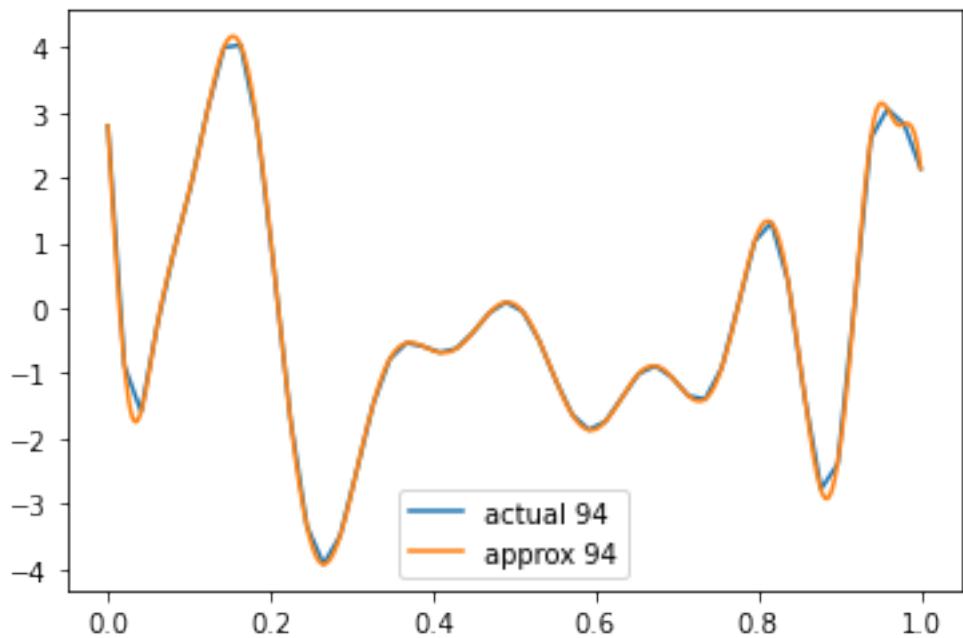
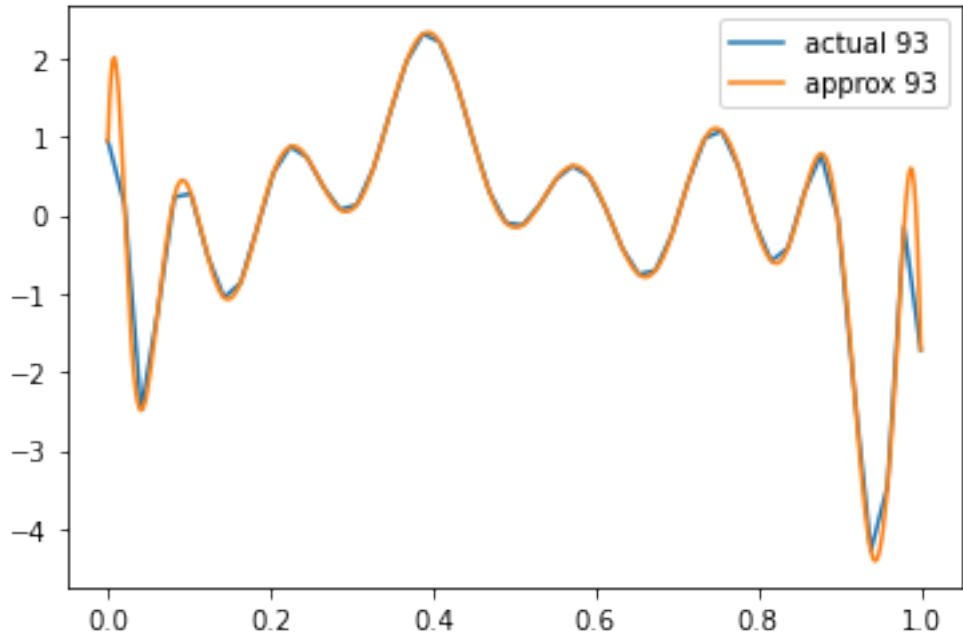


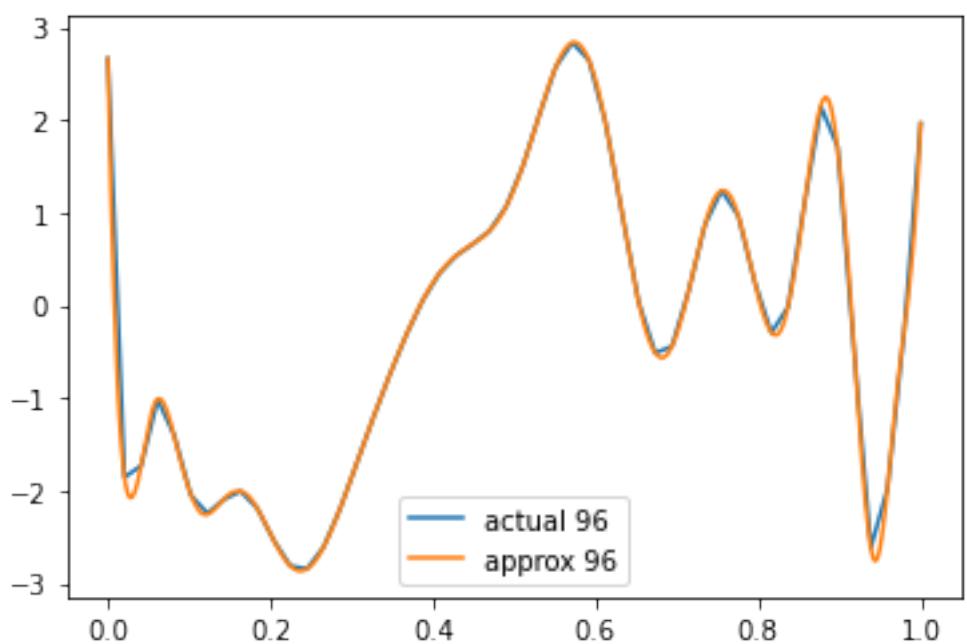
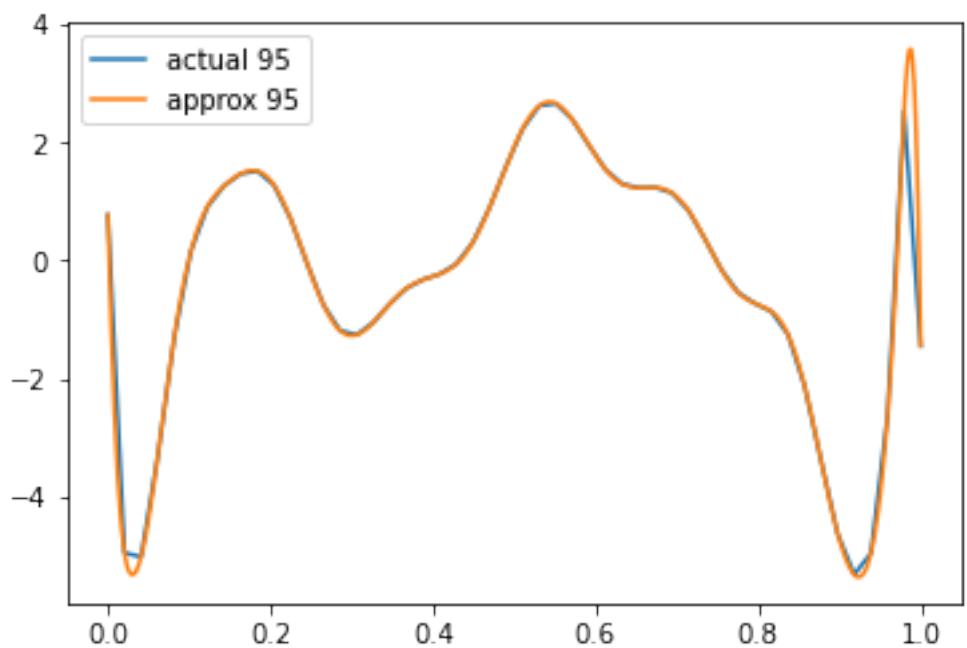


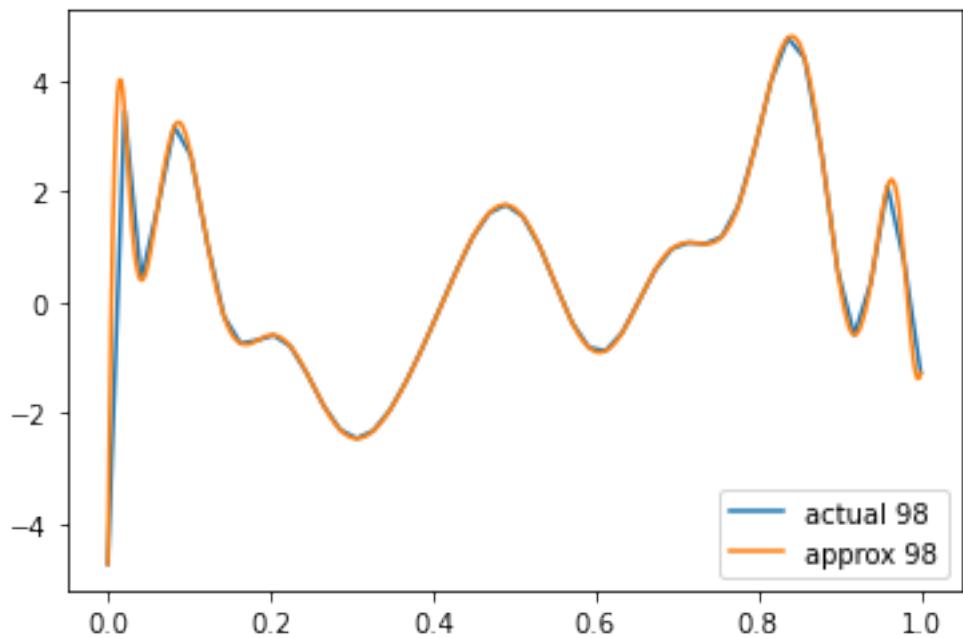
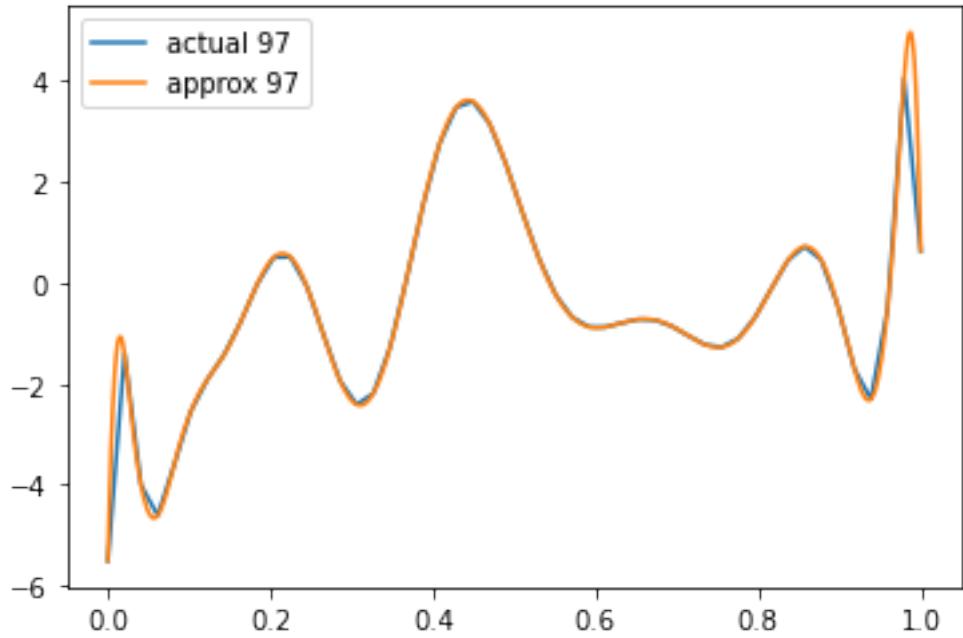


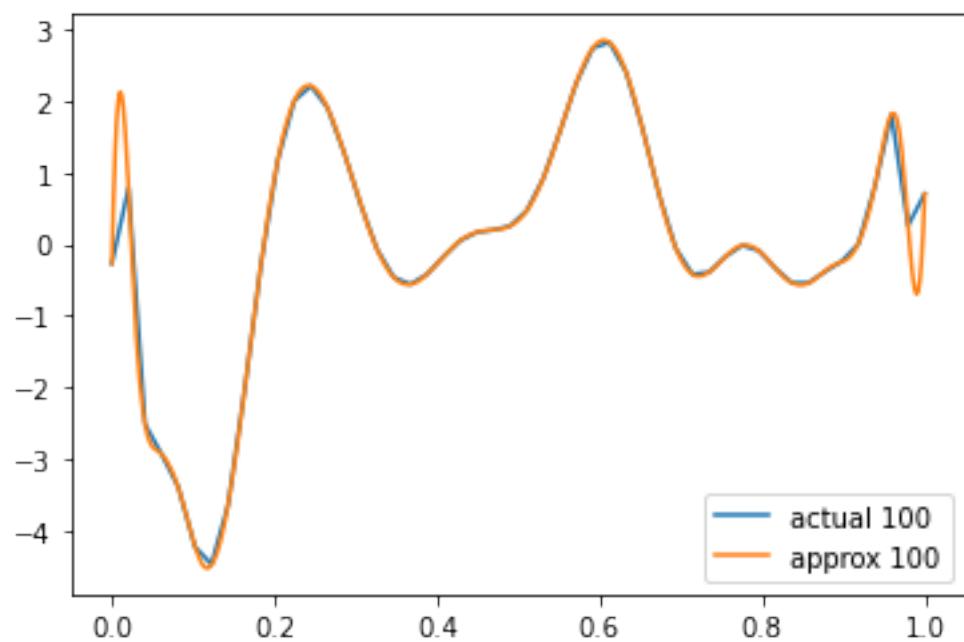
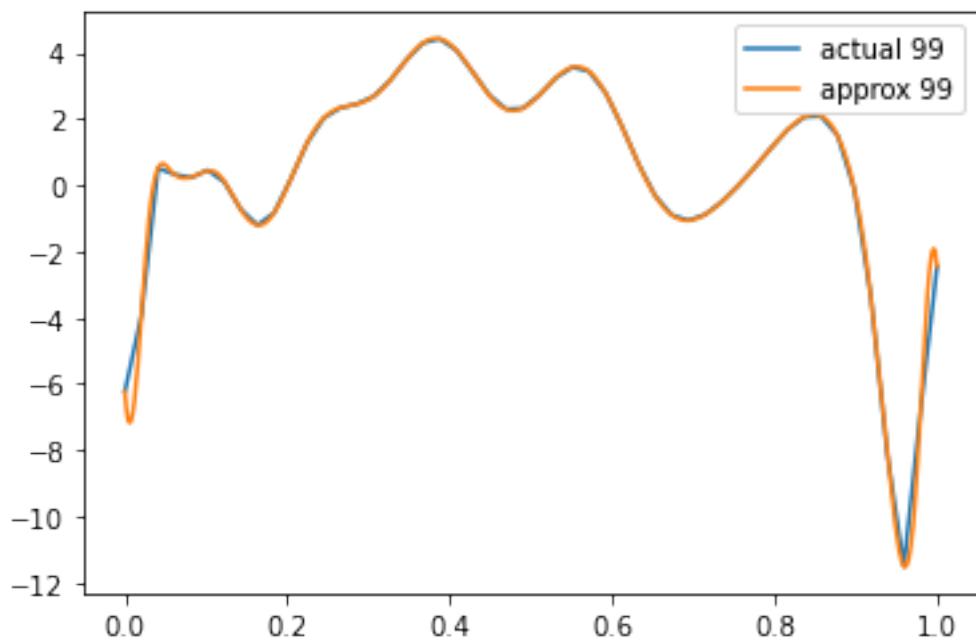


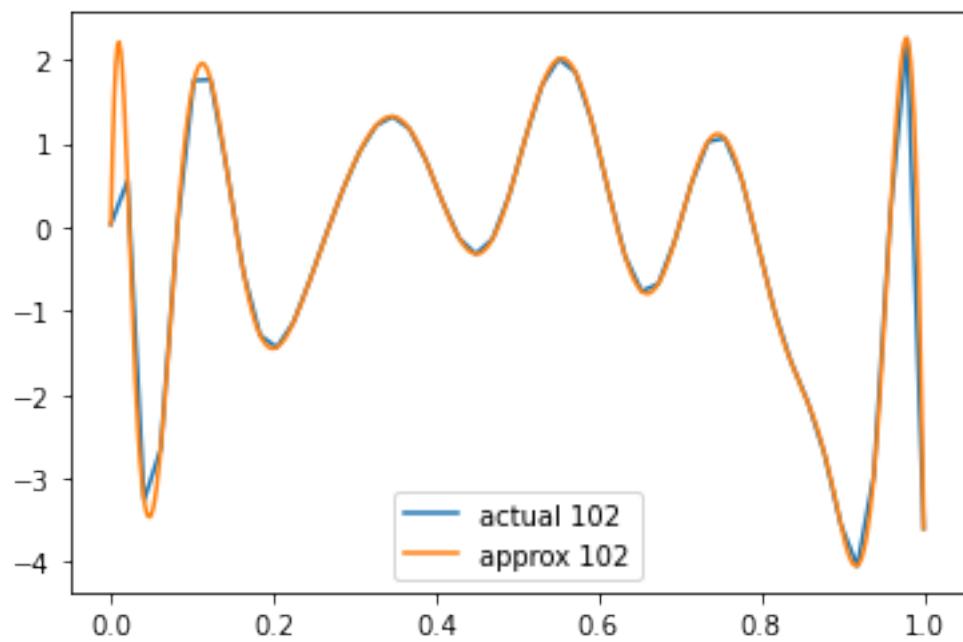
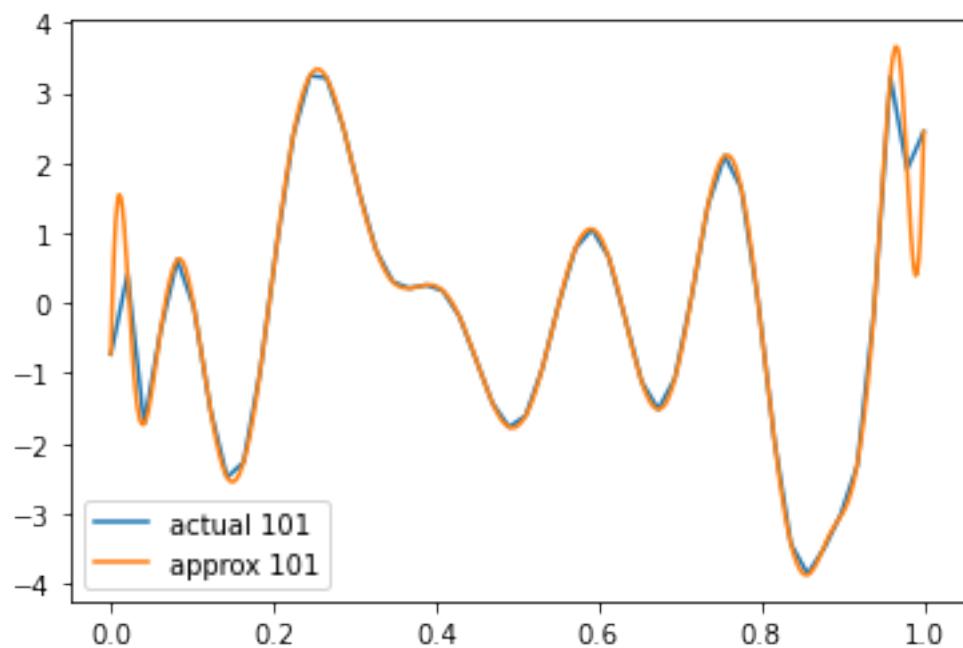


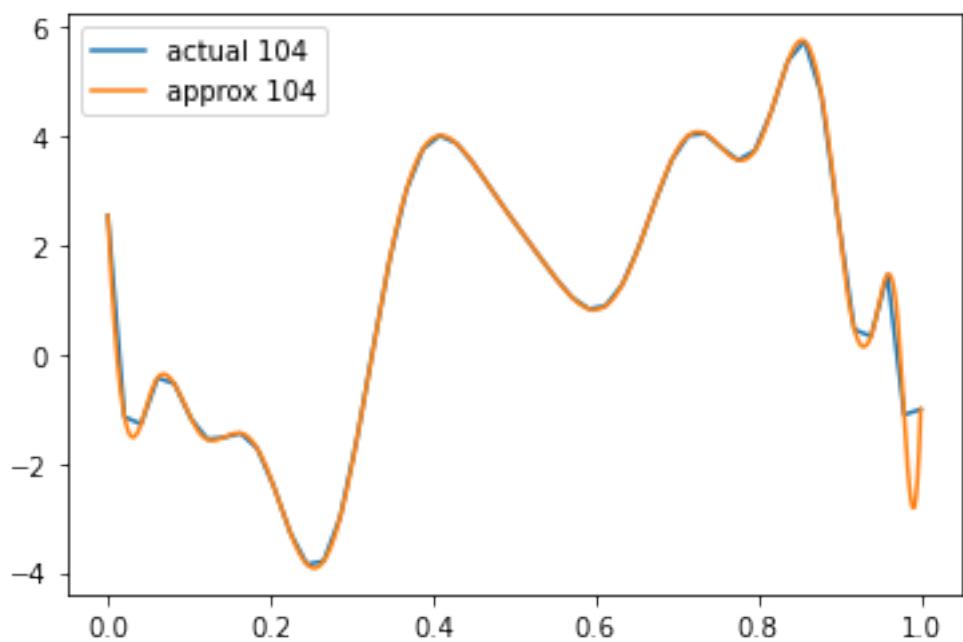
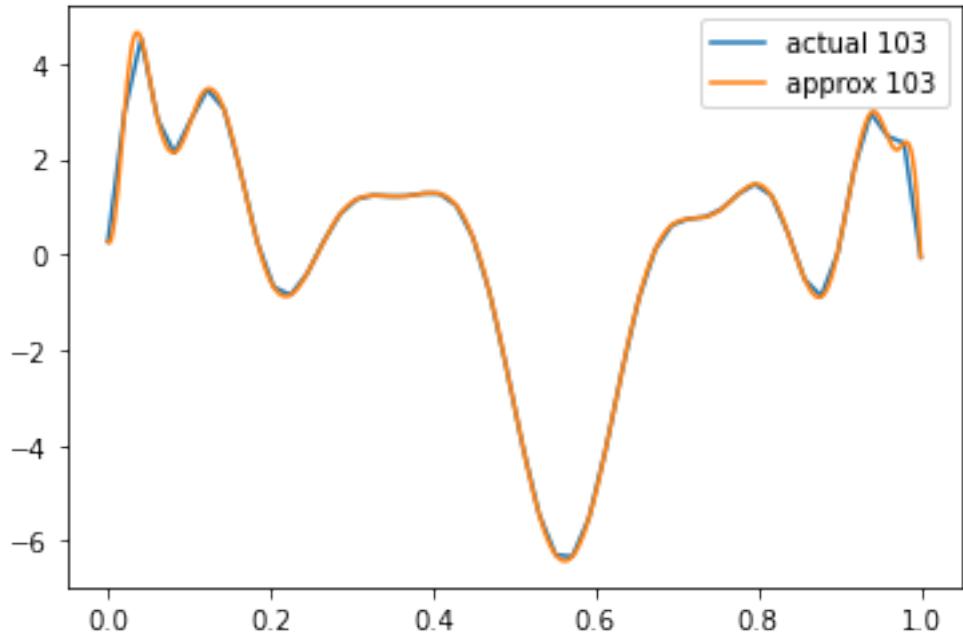


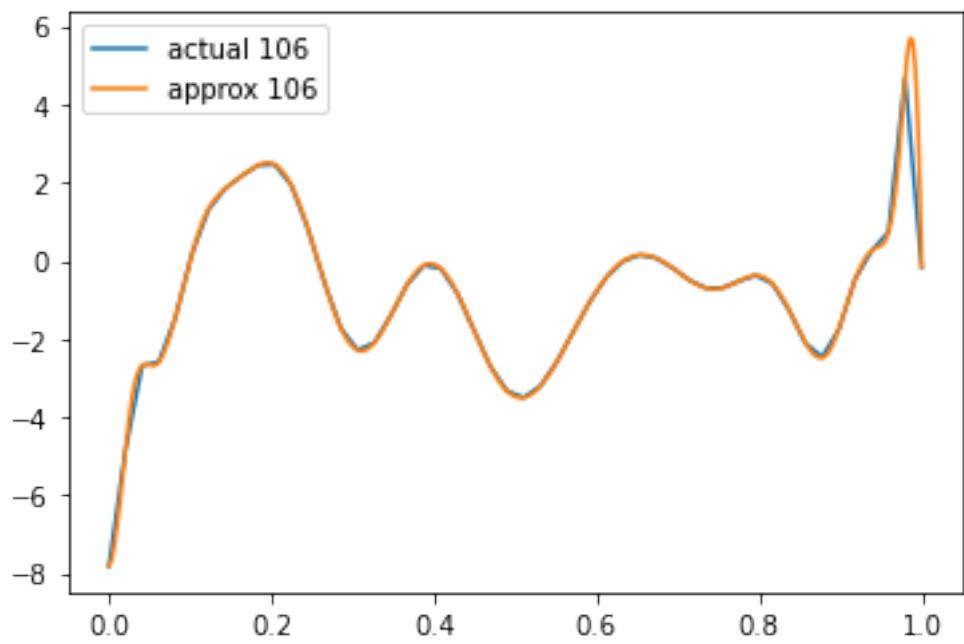
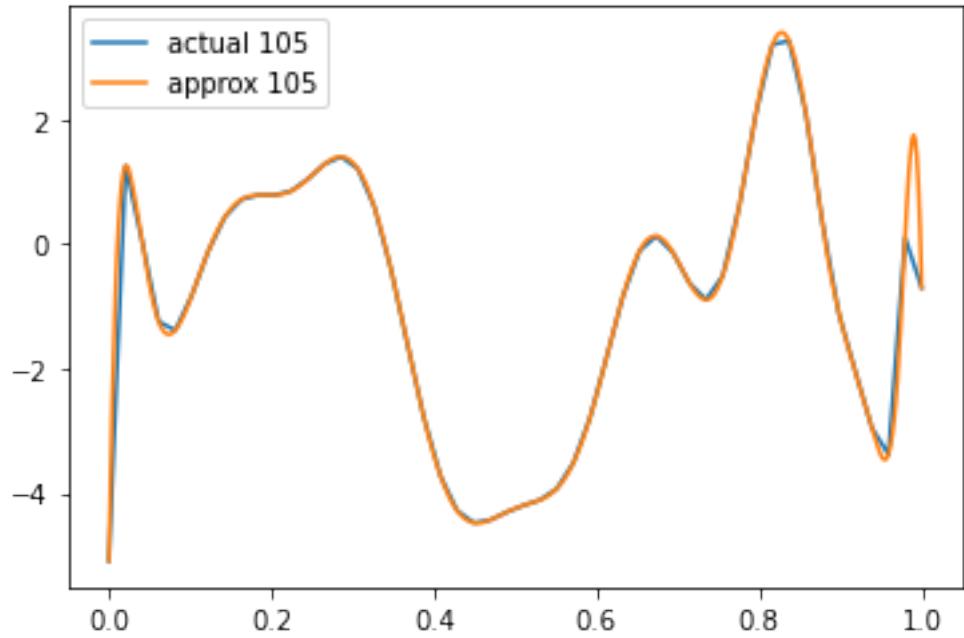


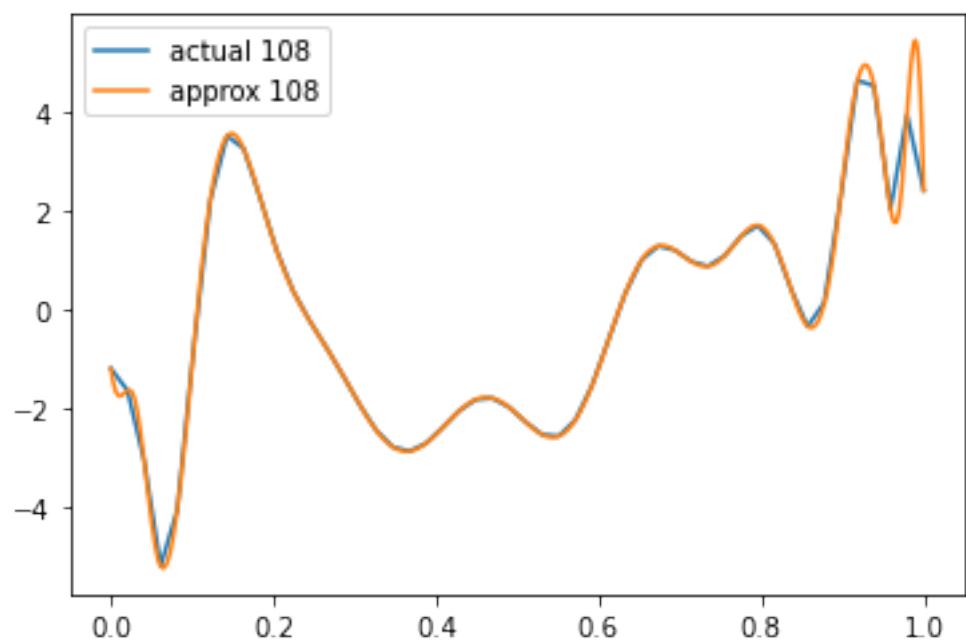
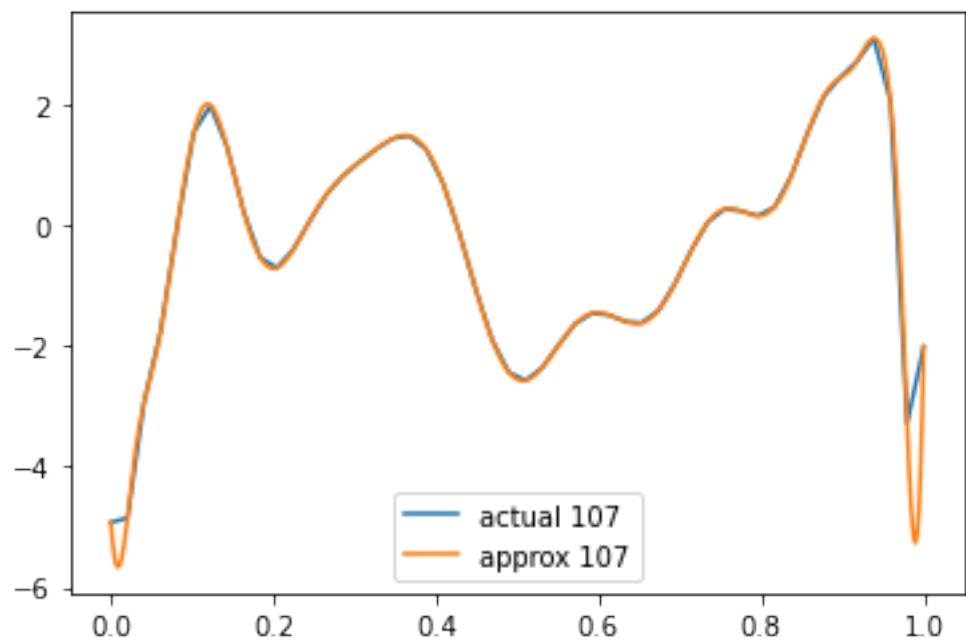


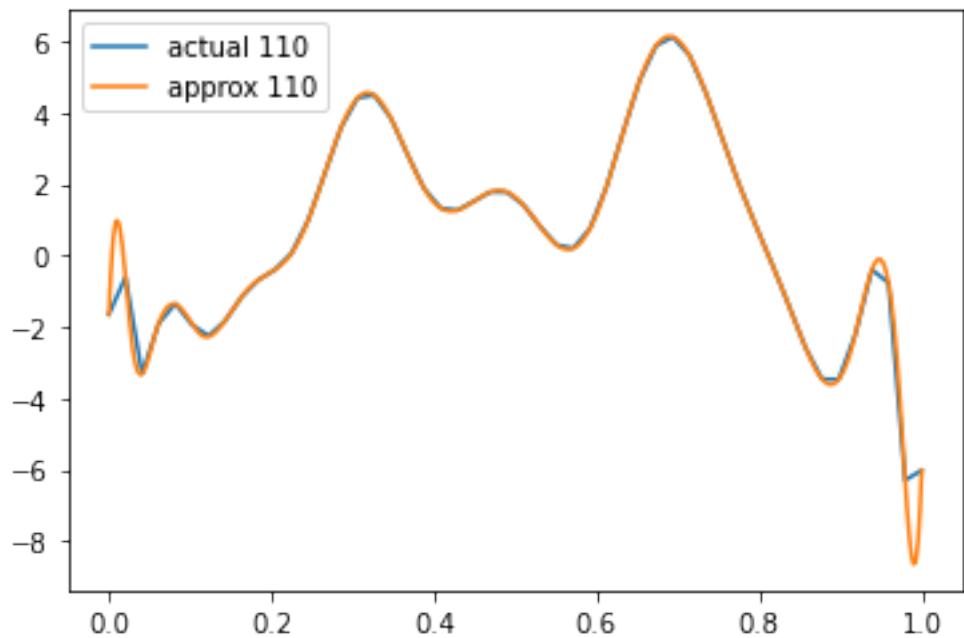
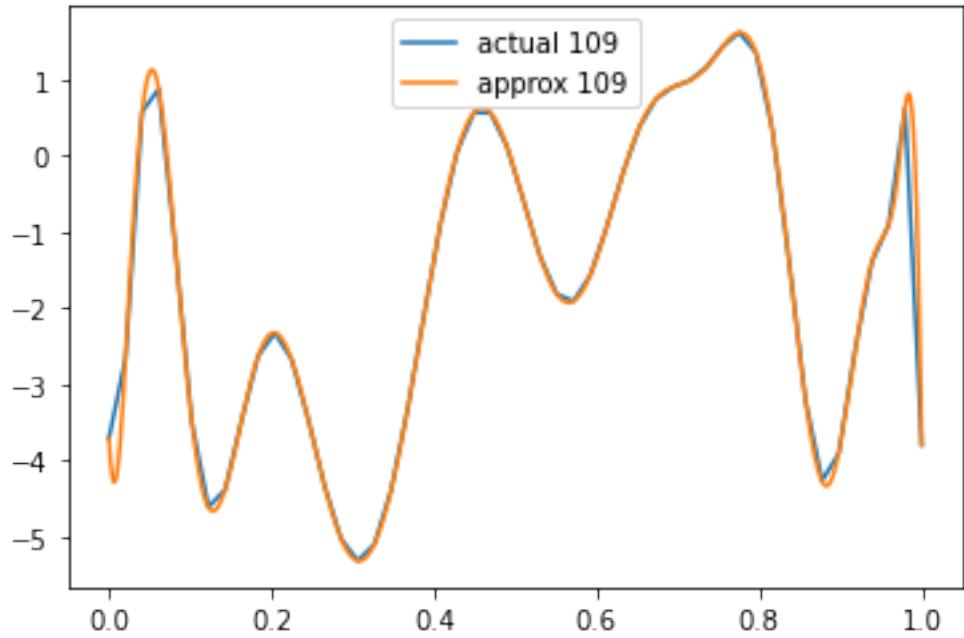


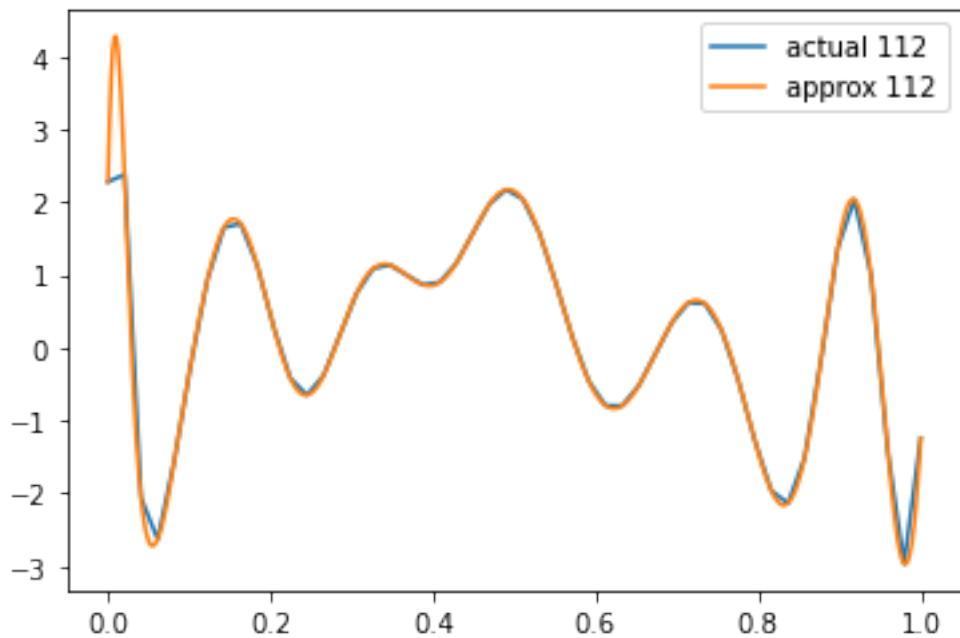
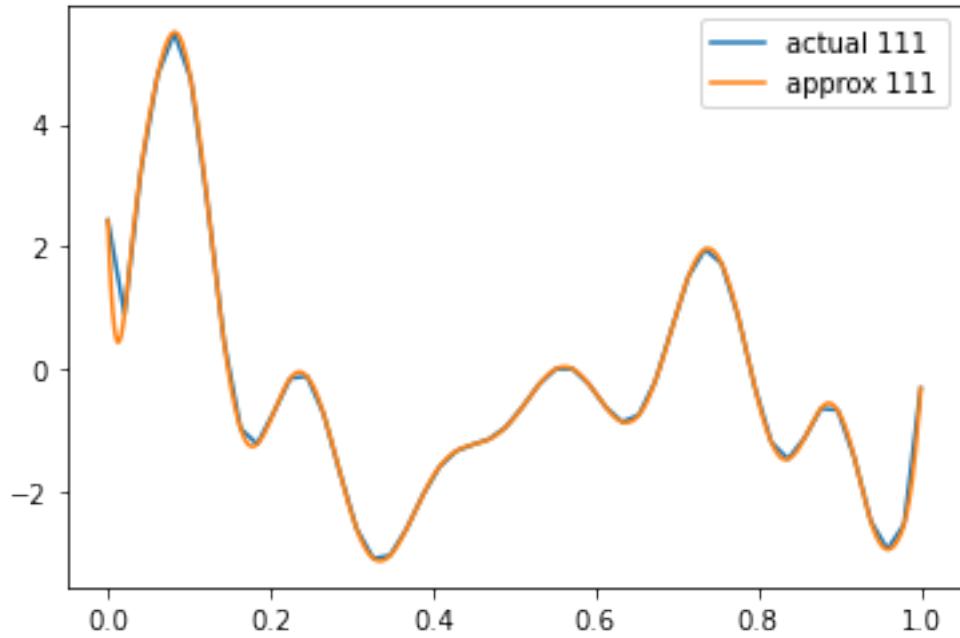




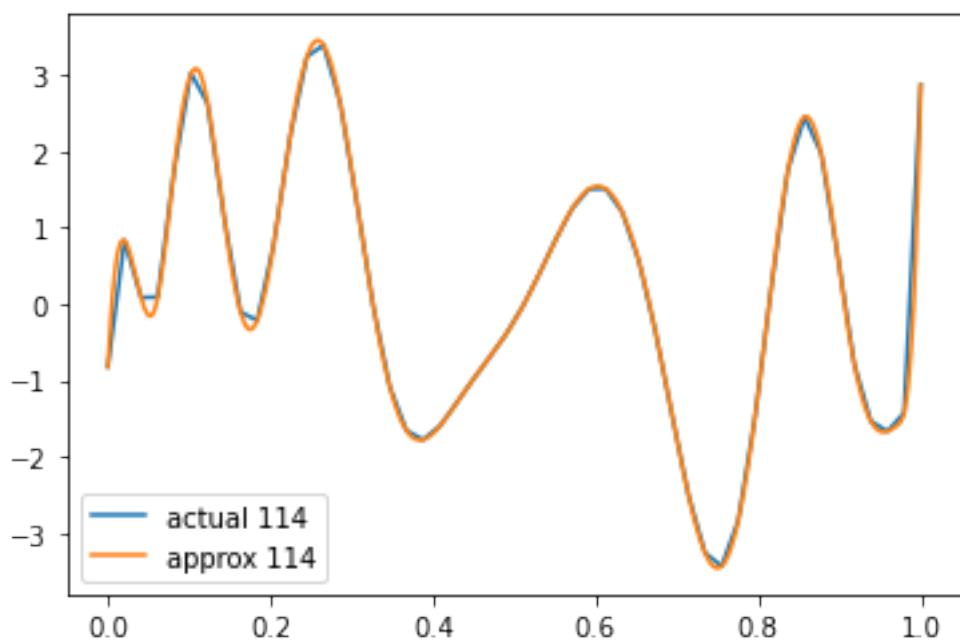
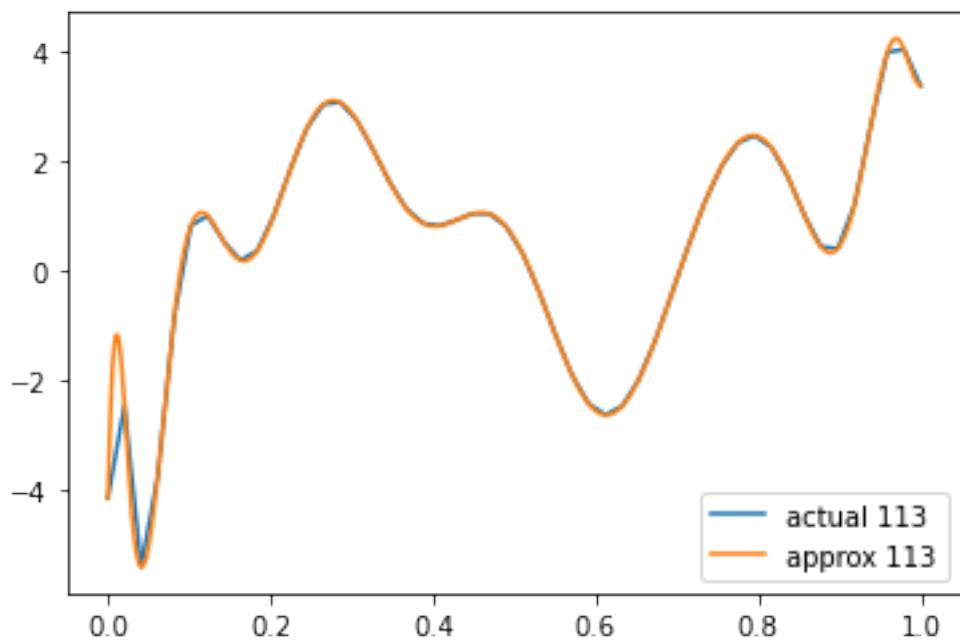


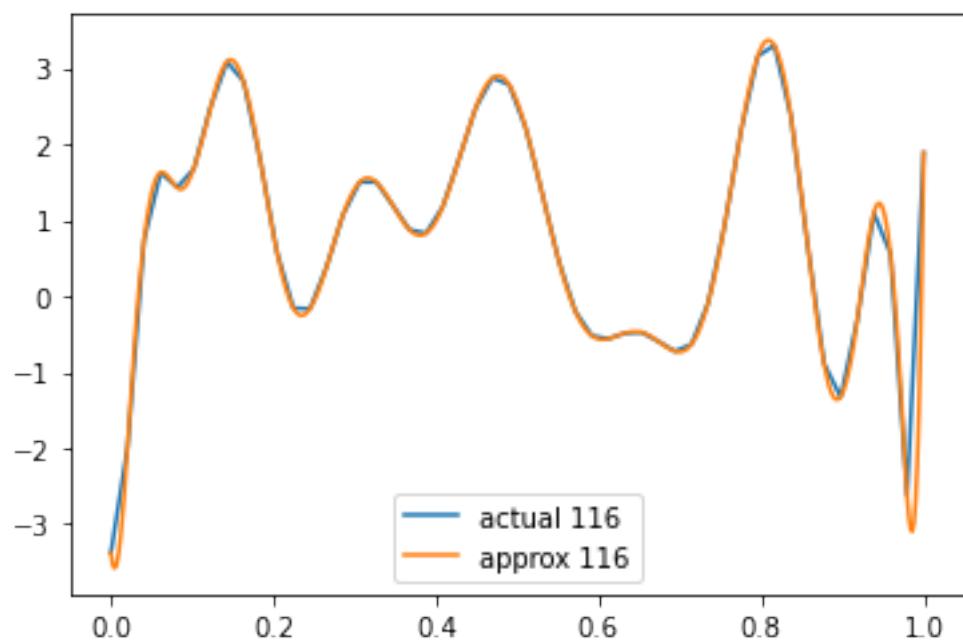
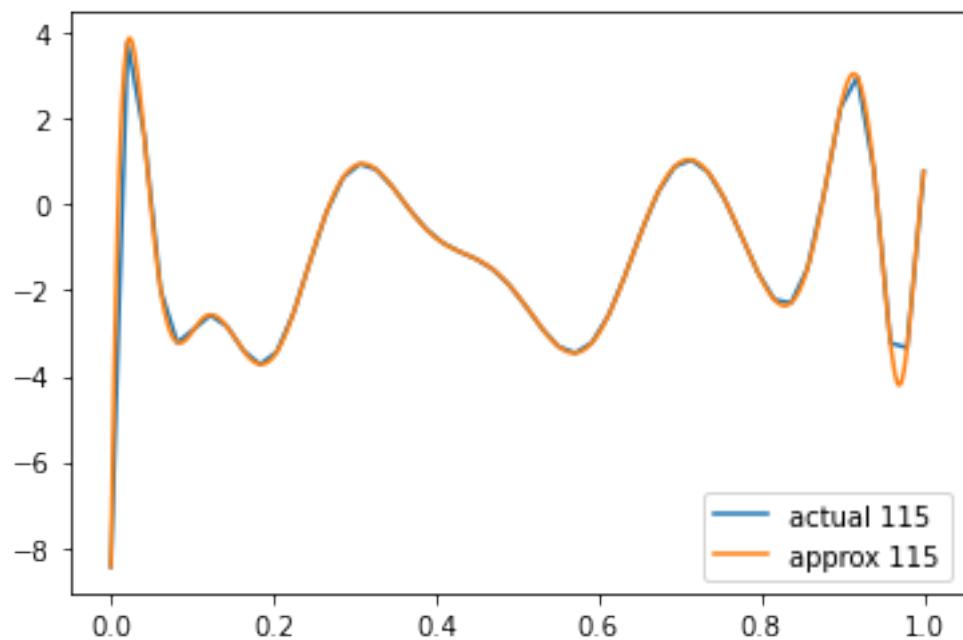


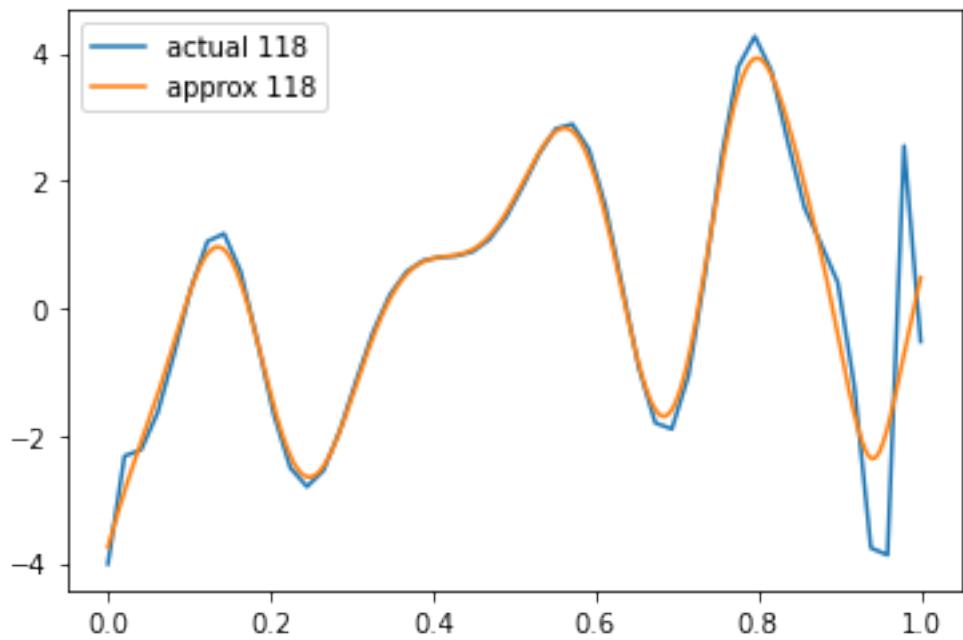
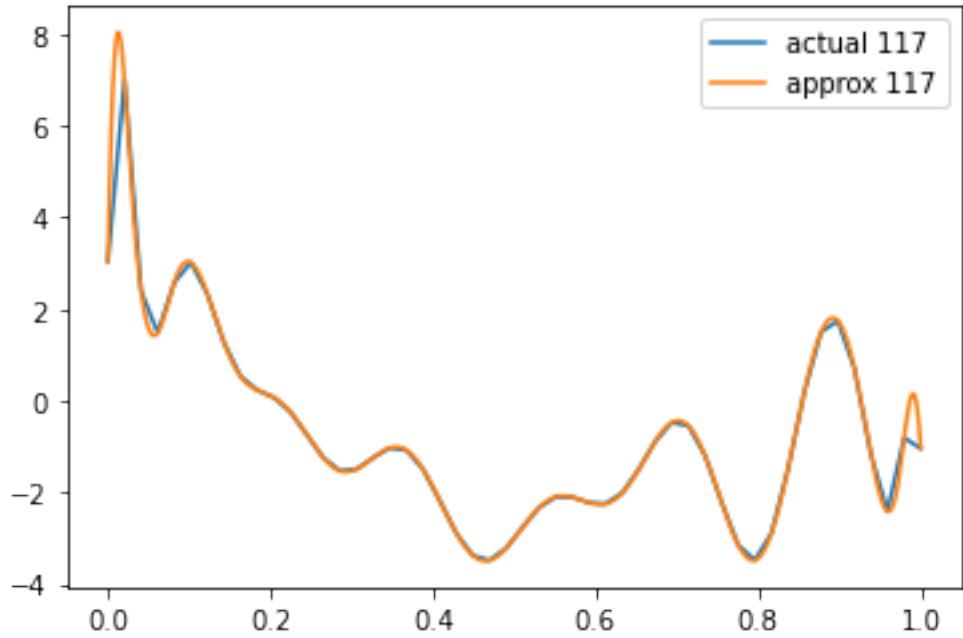


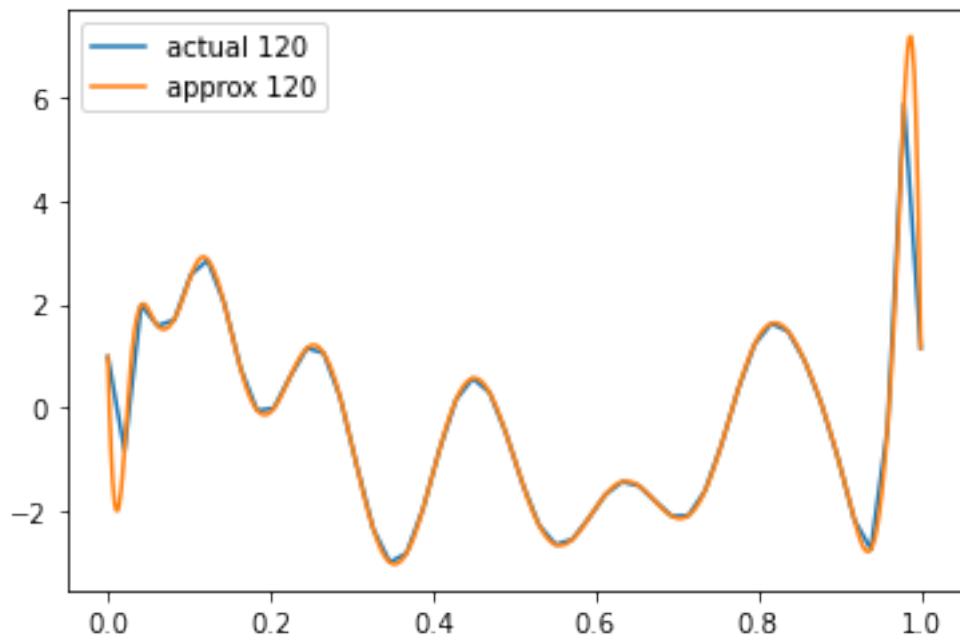
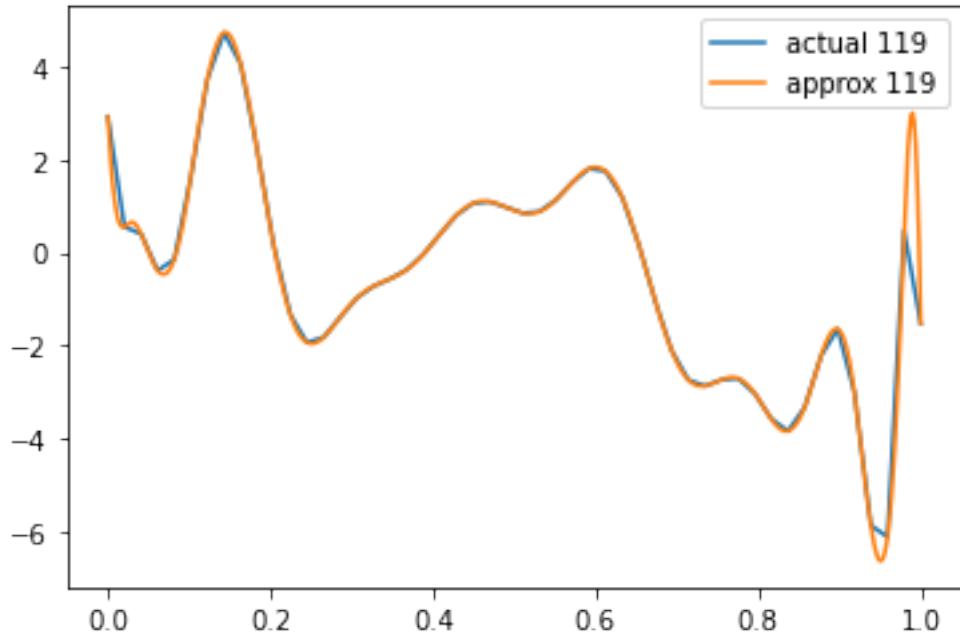


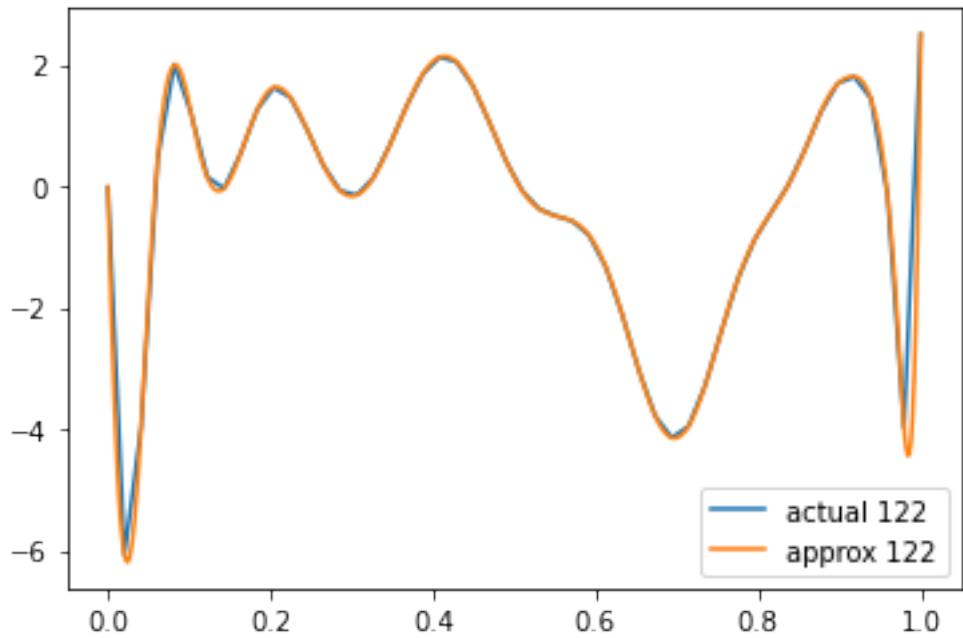
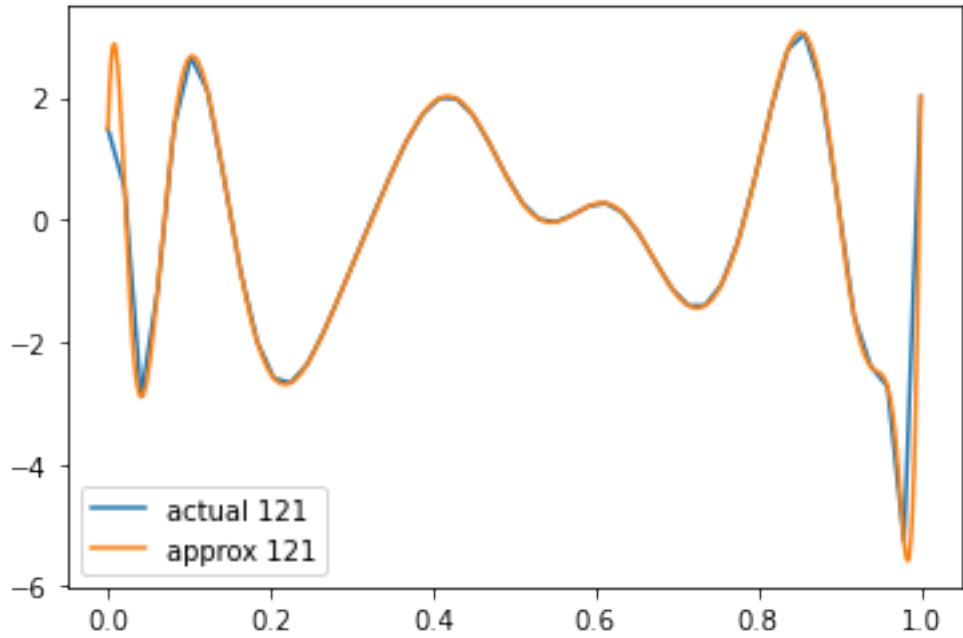
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to bounds  
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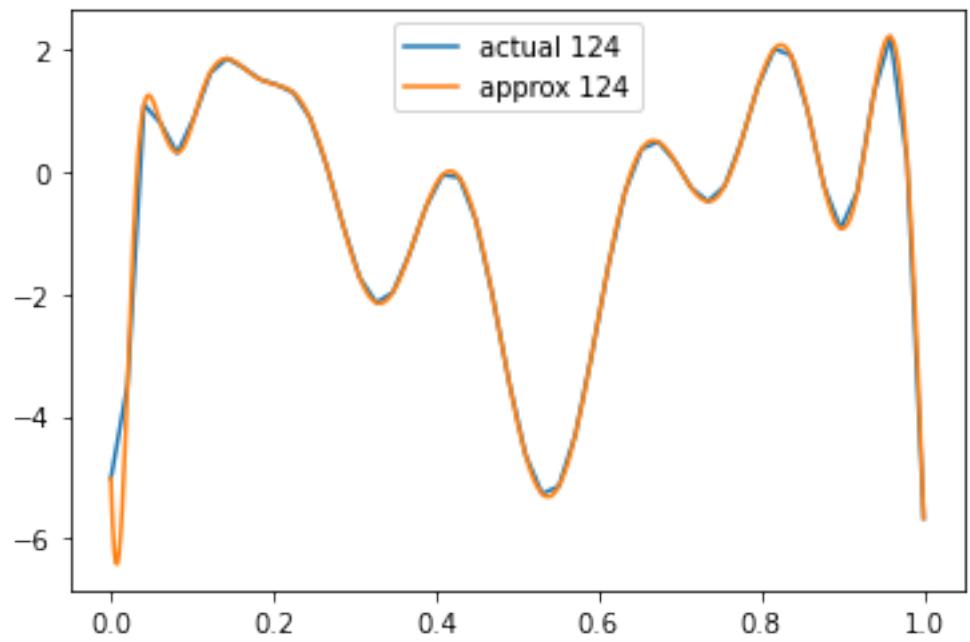
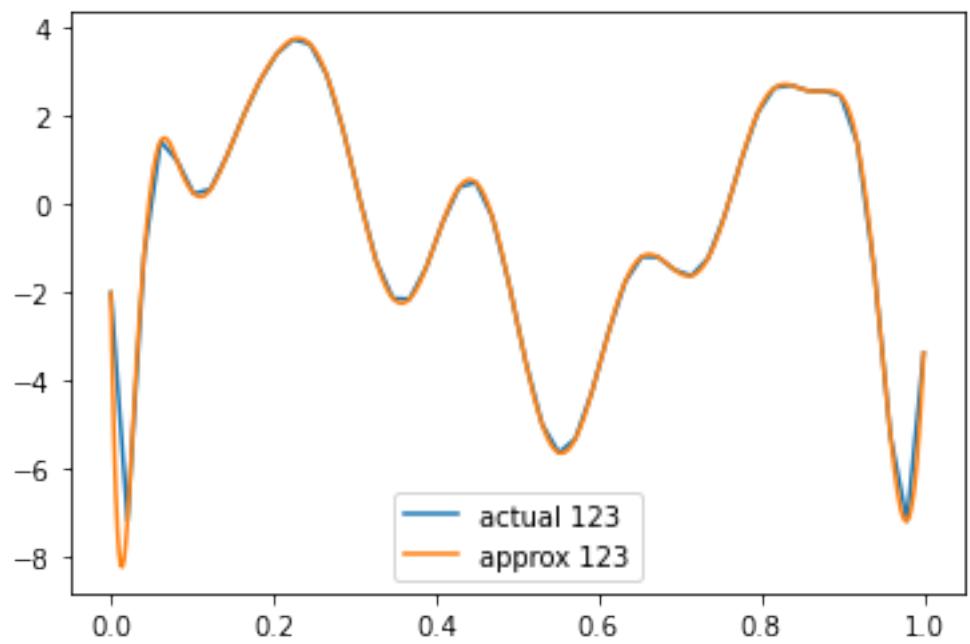


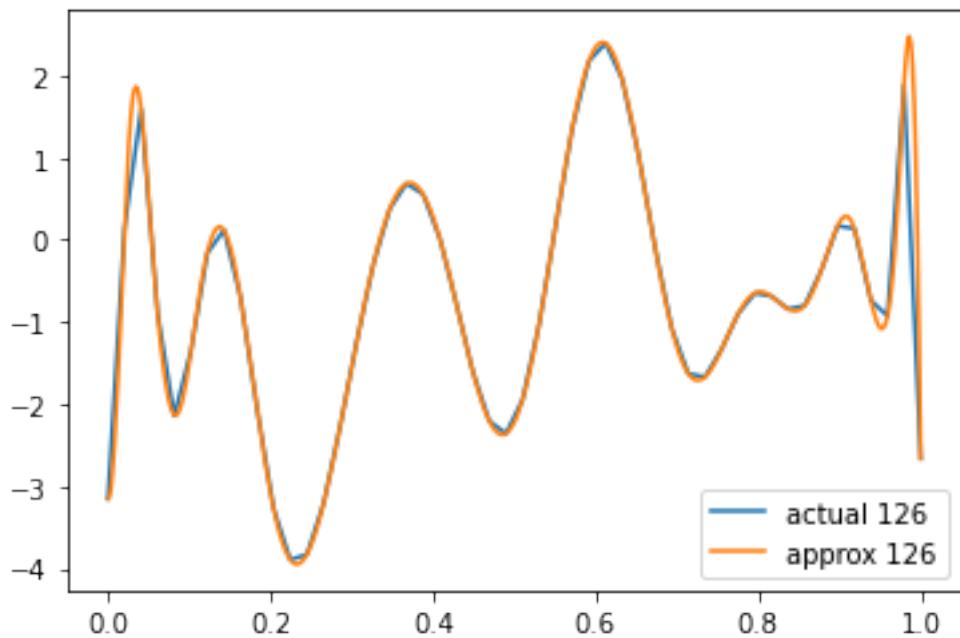
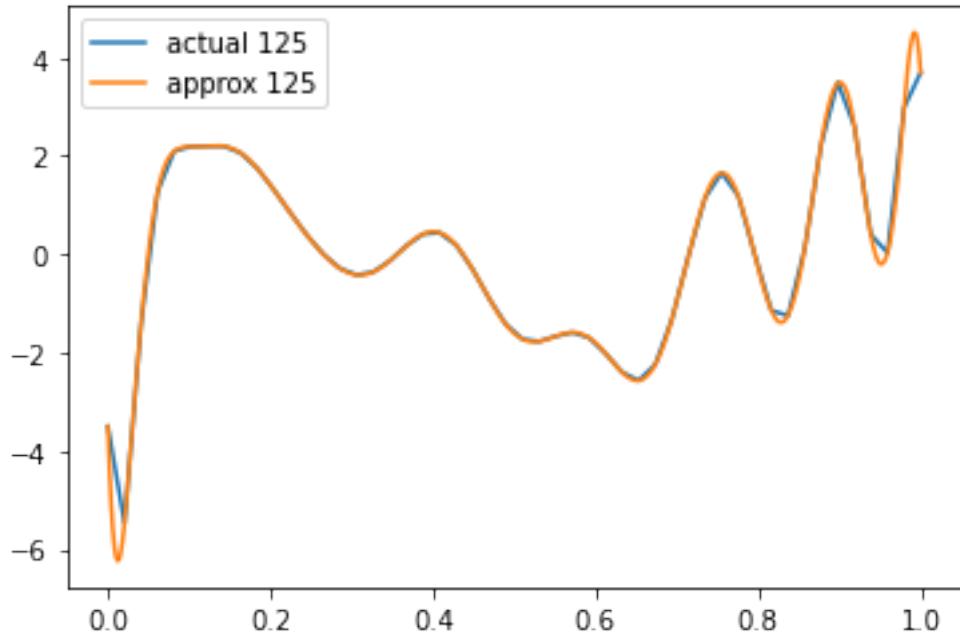


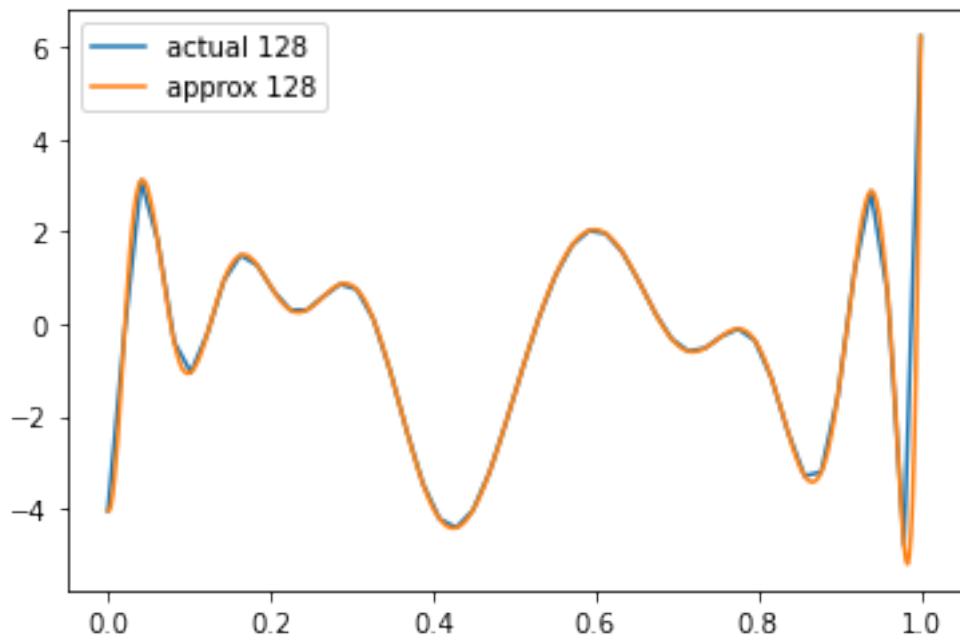
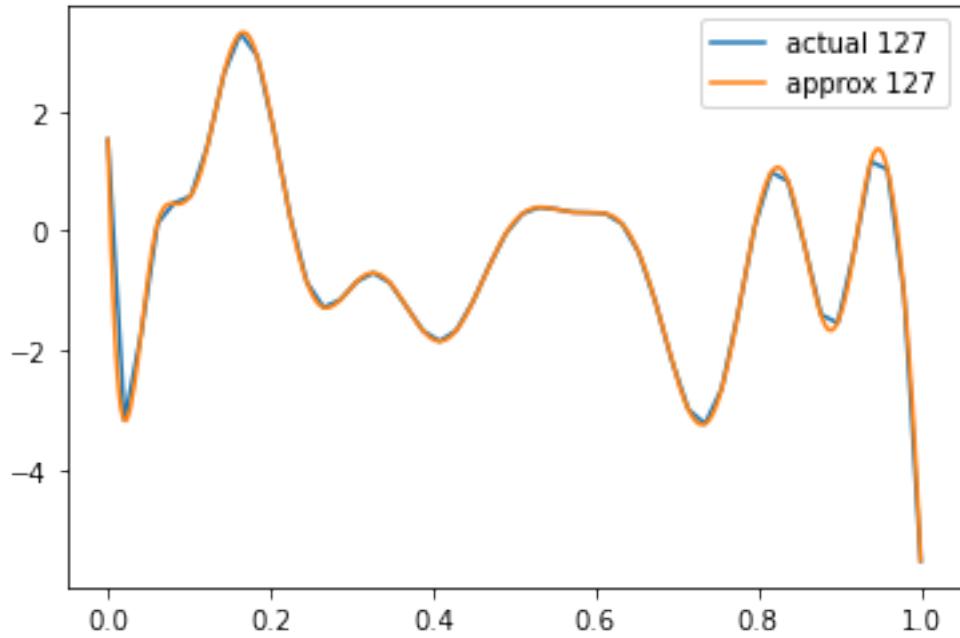


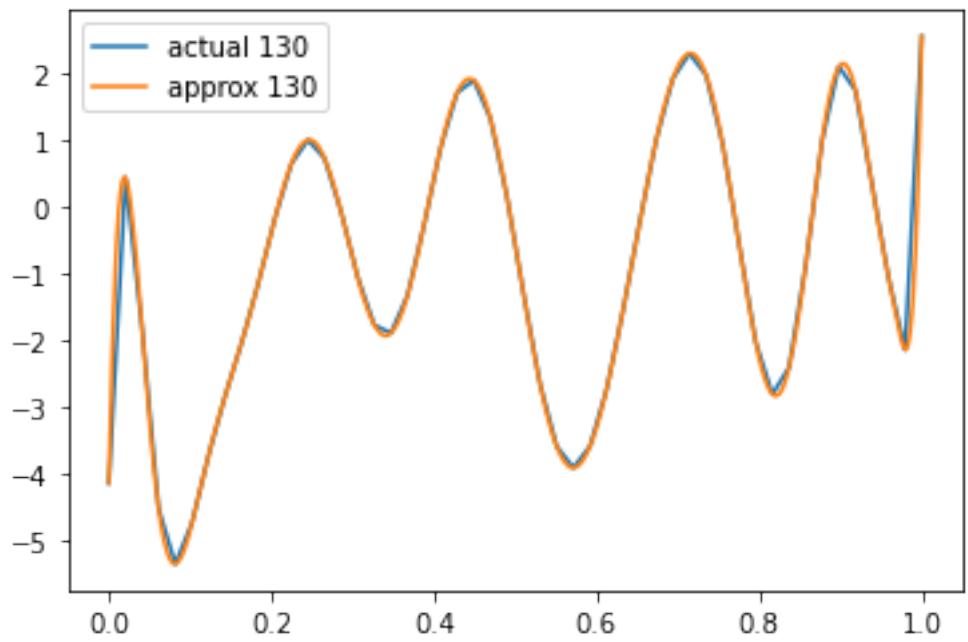
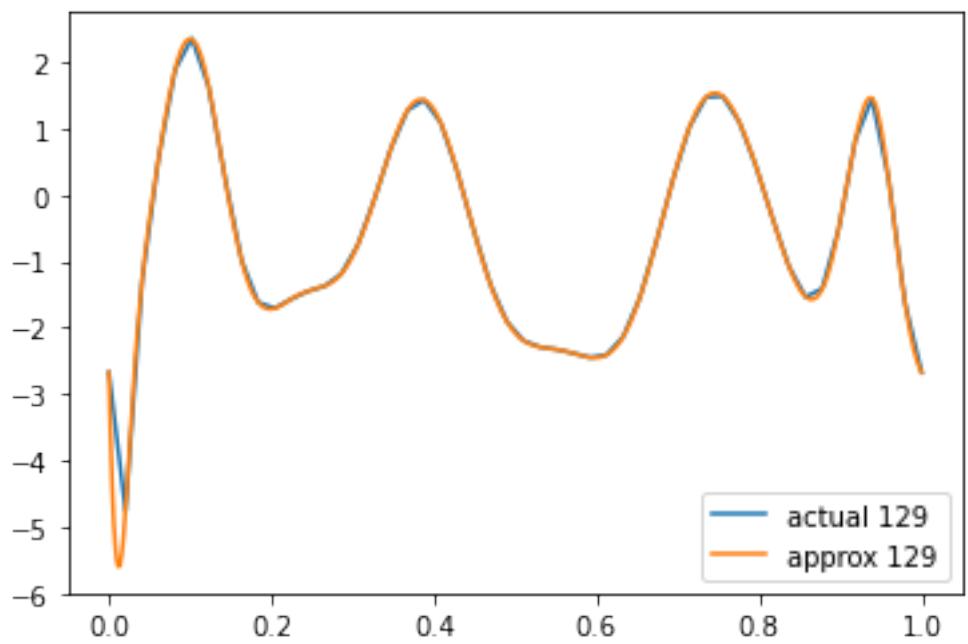


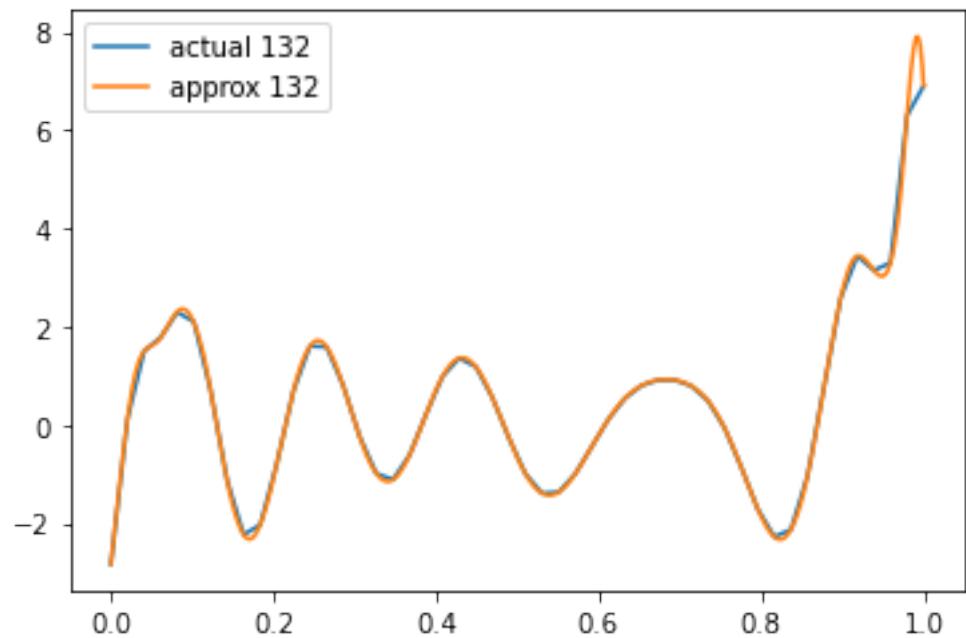
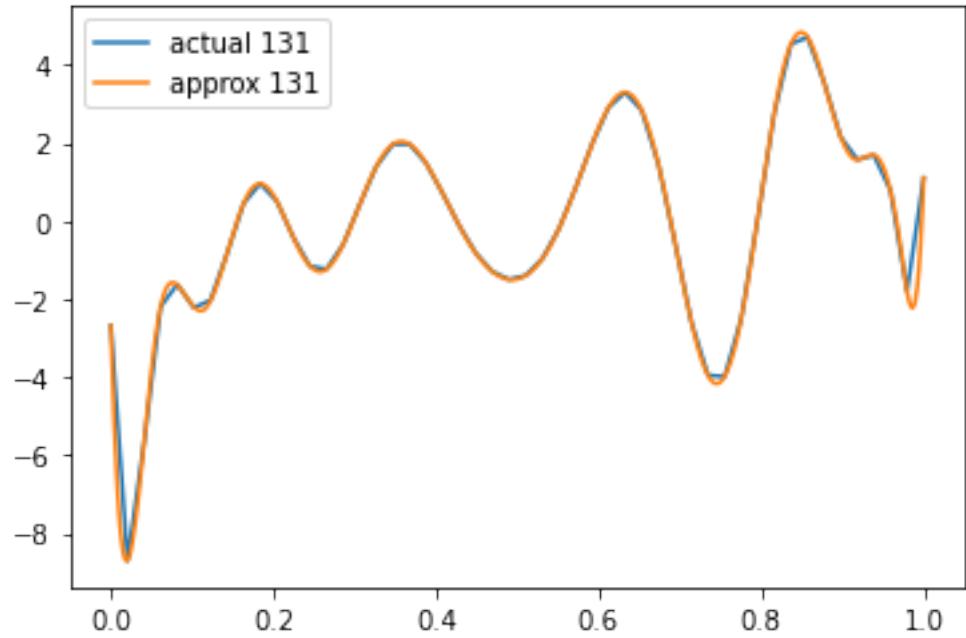


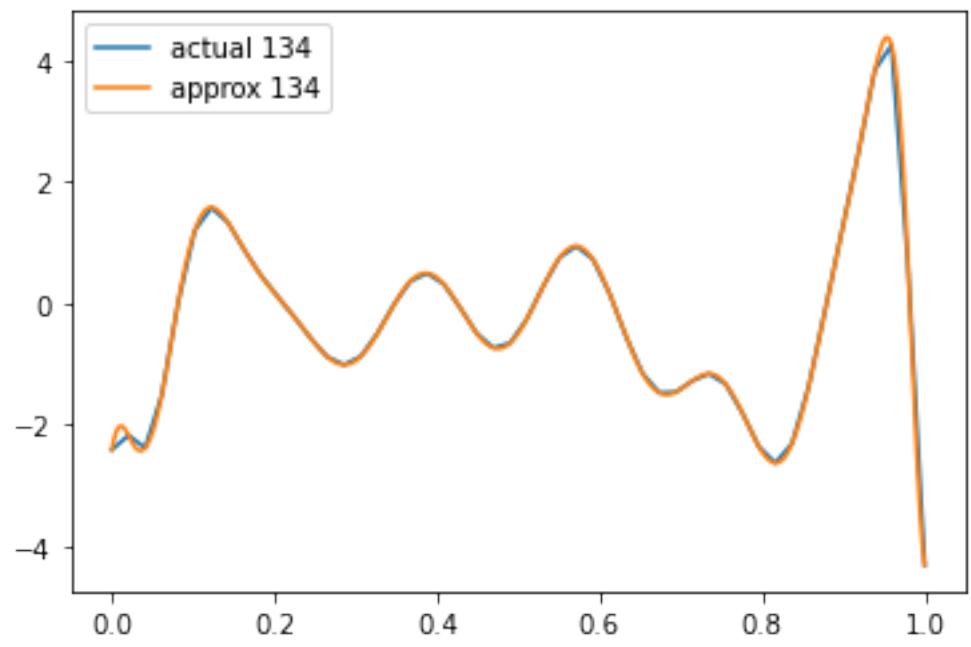
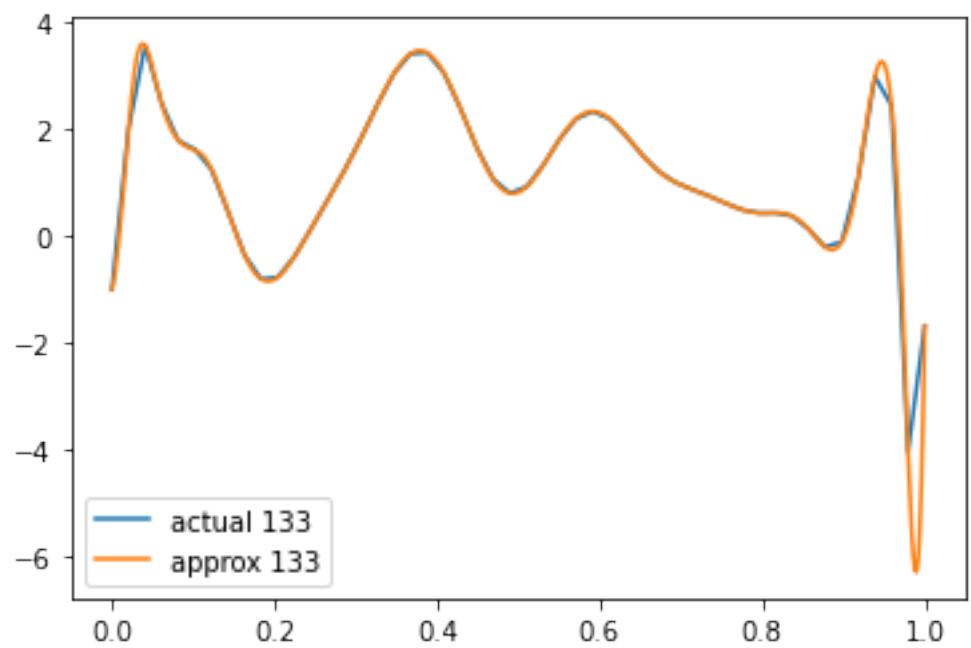


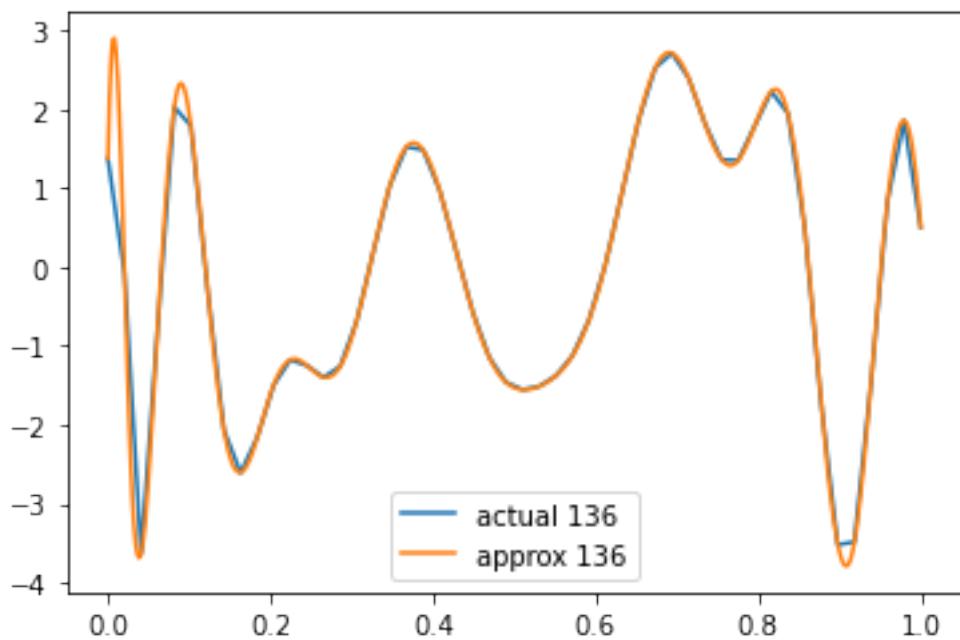
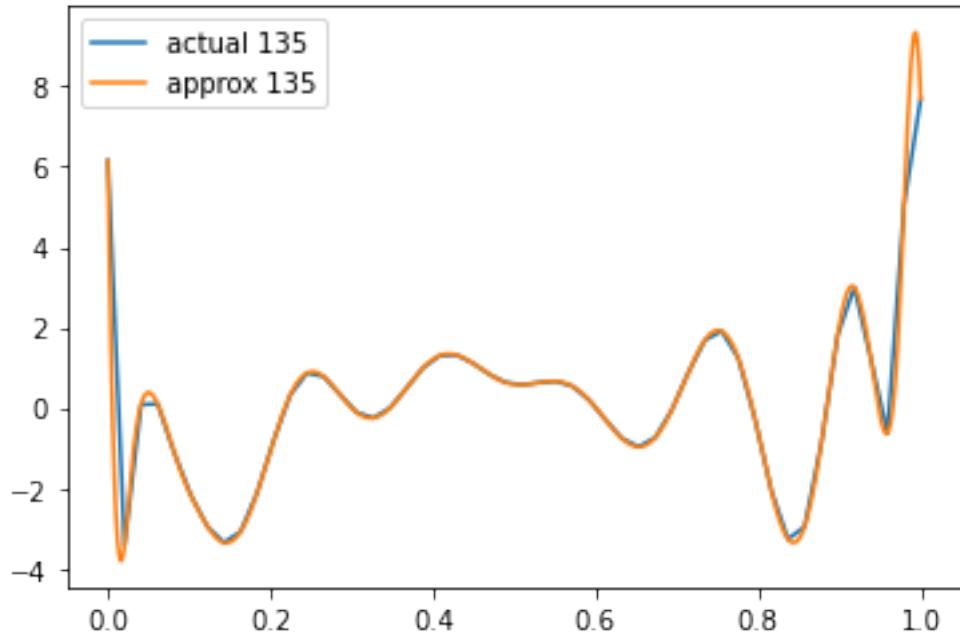


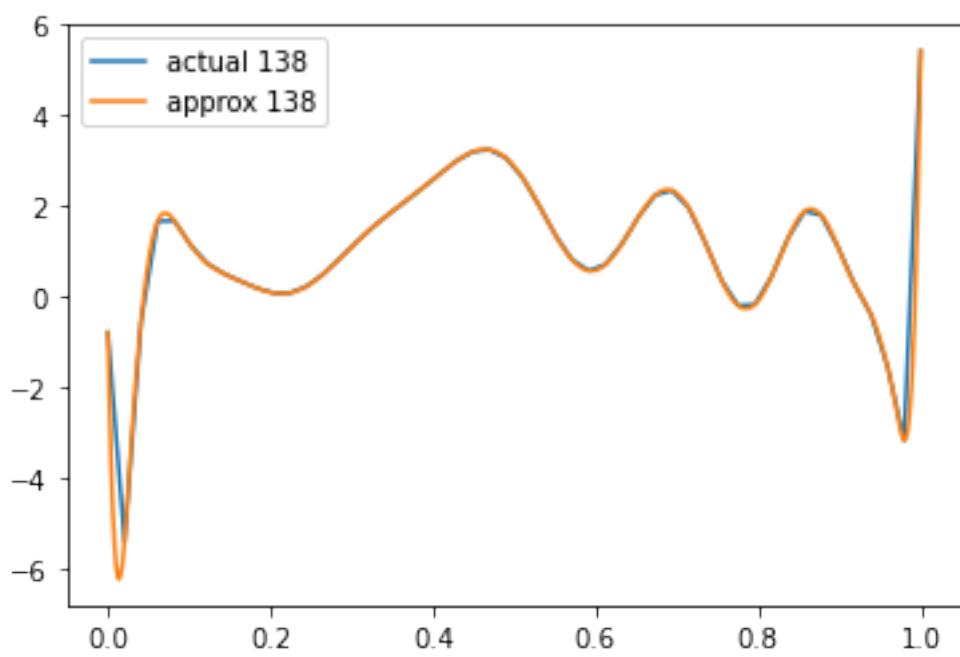
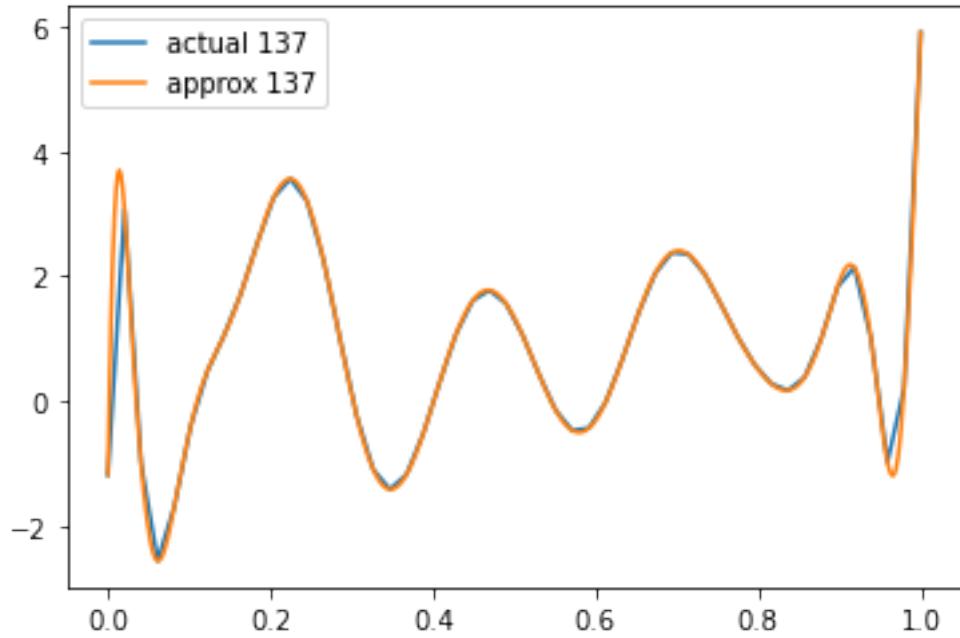


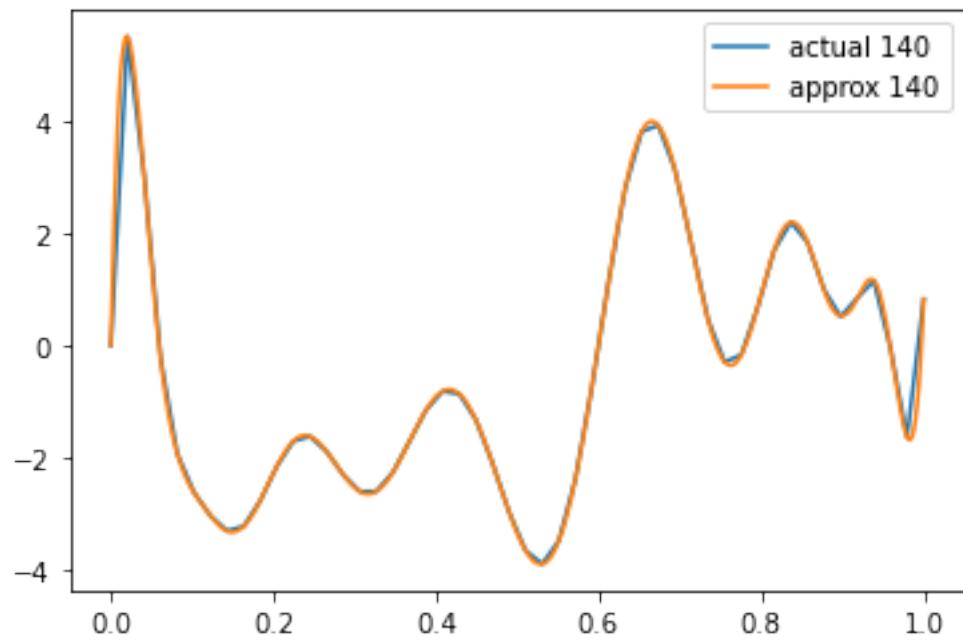
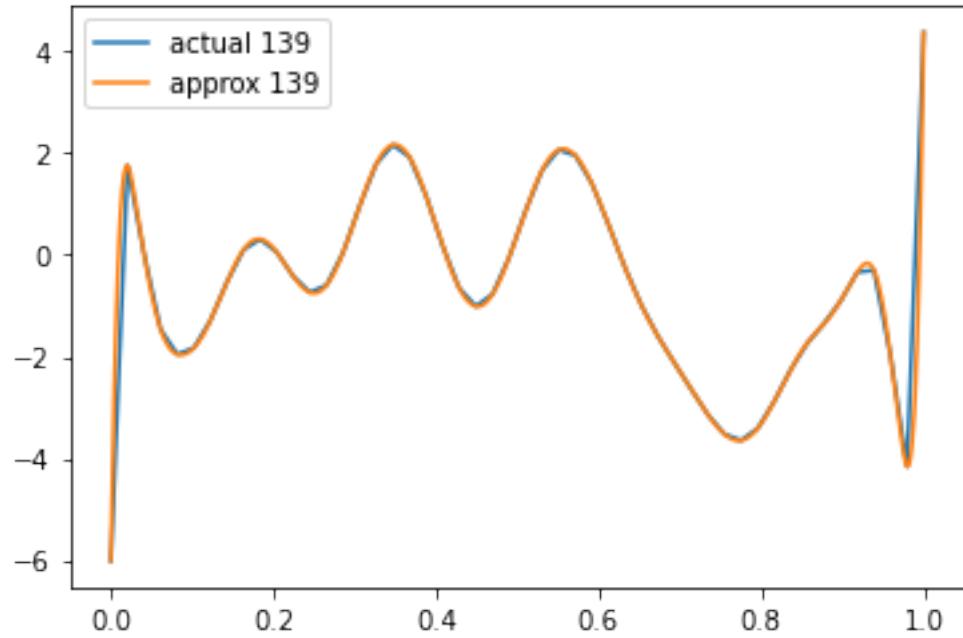


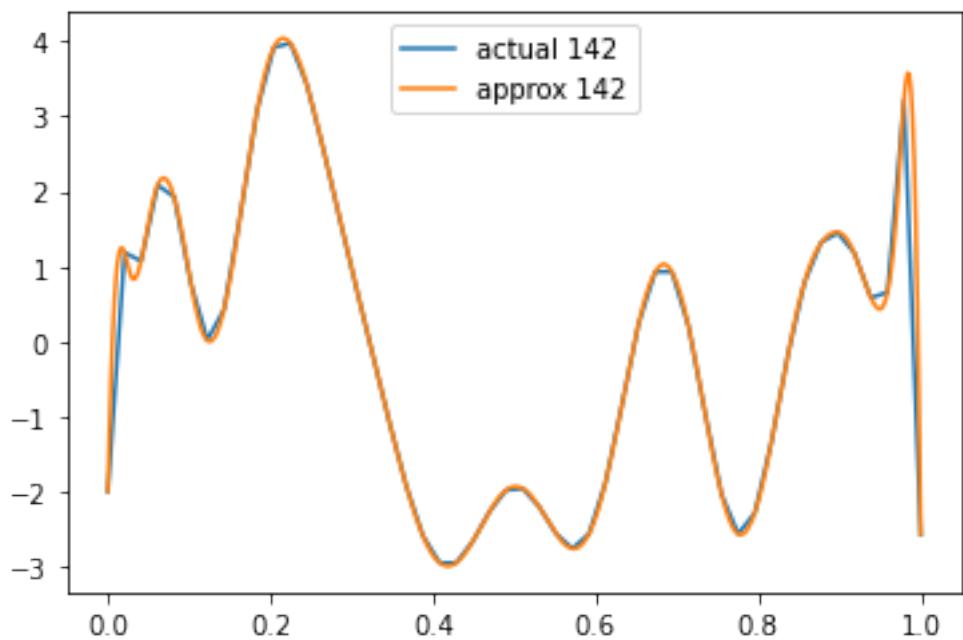
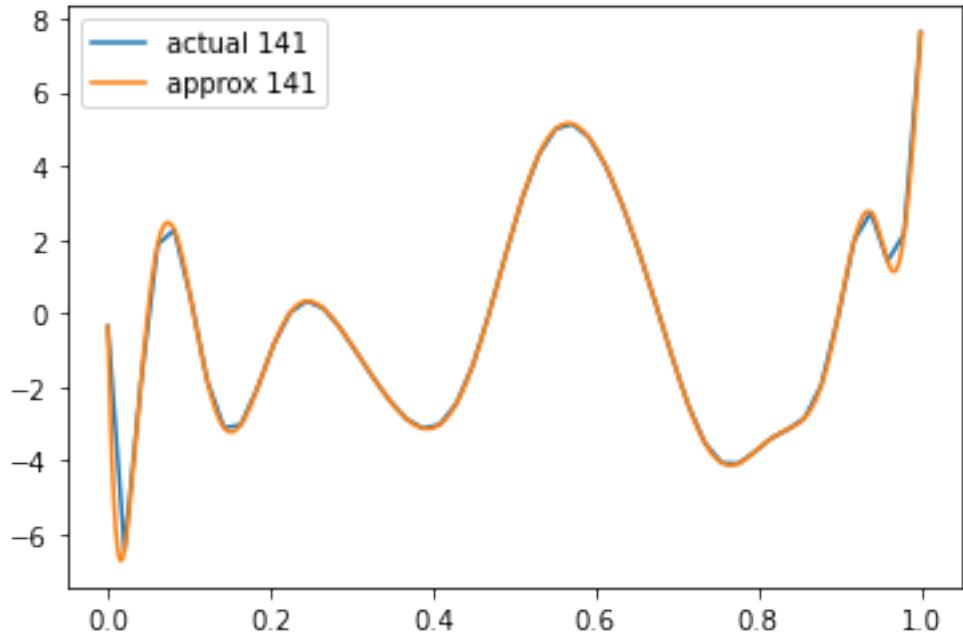


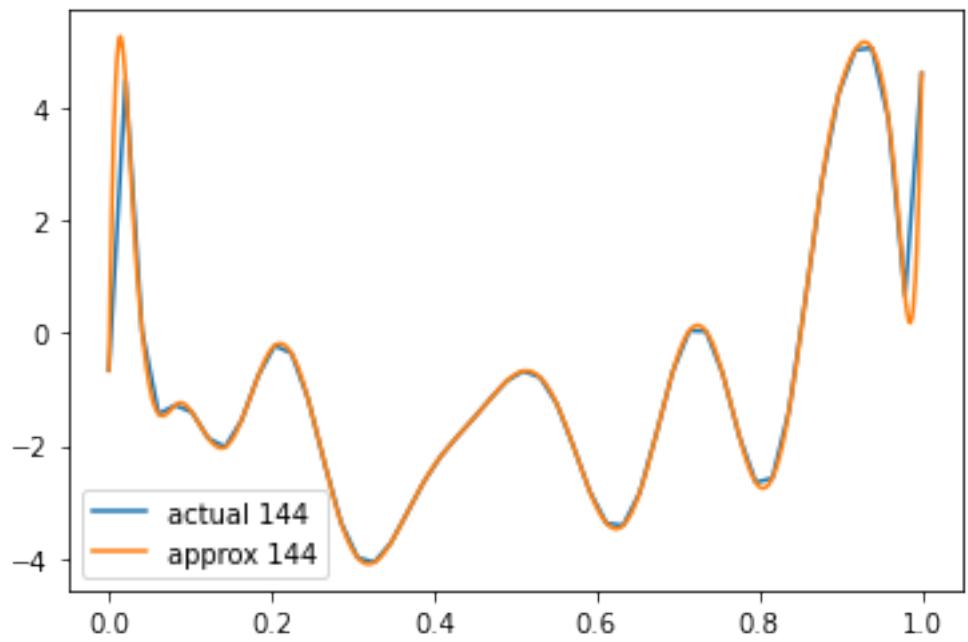
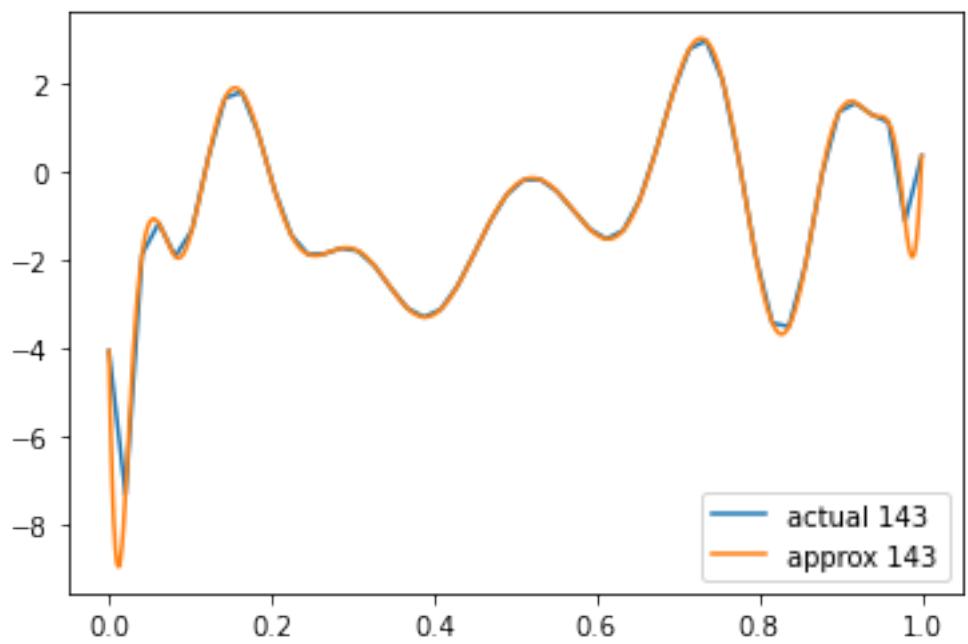


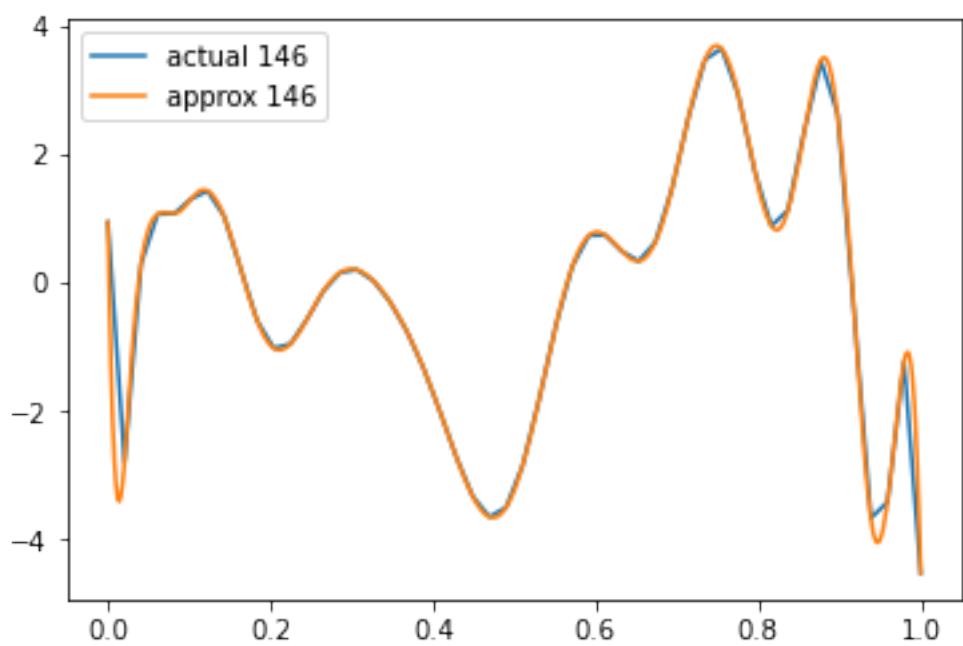
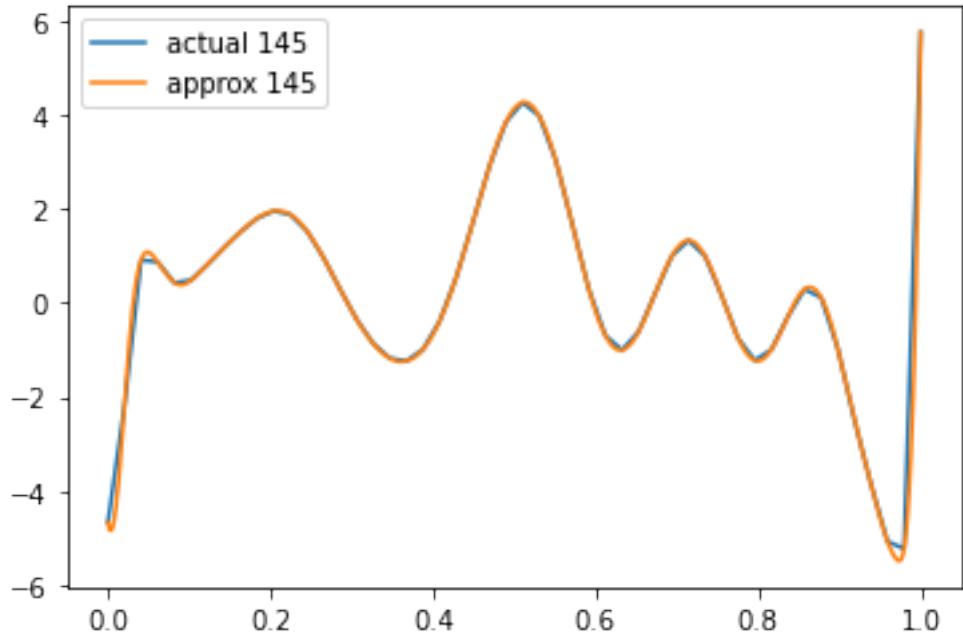


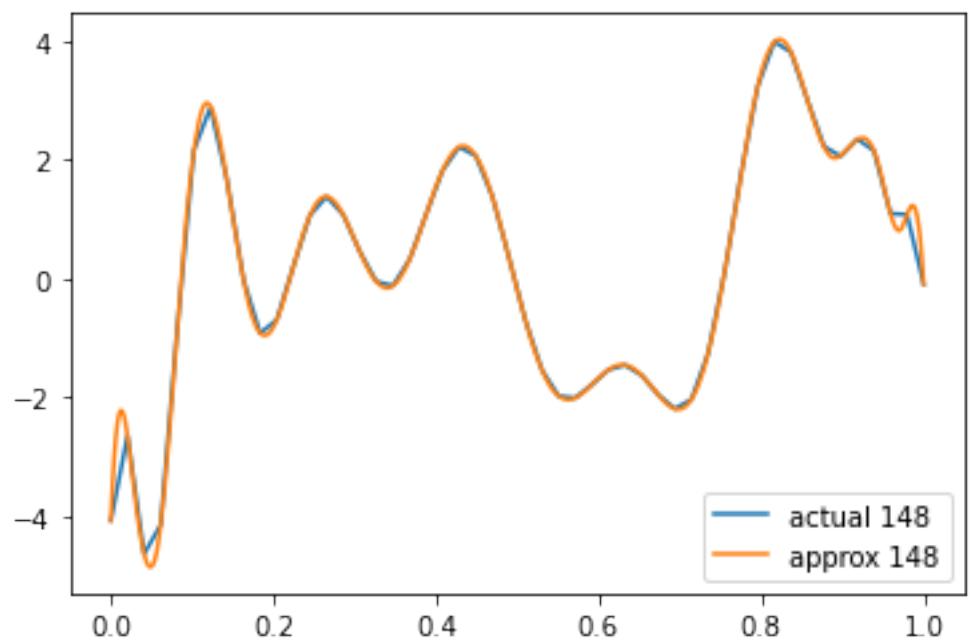
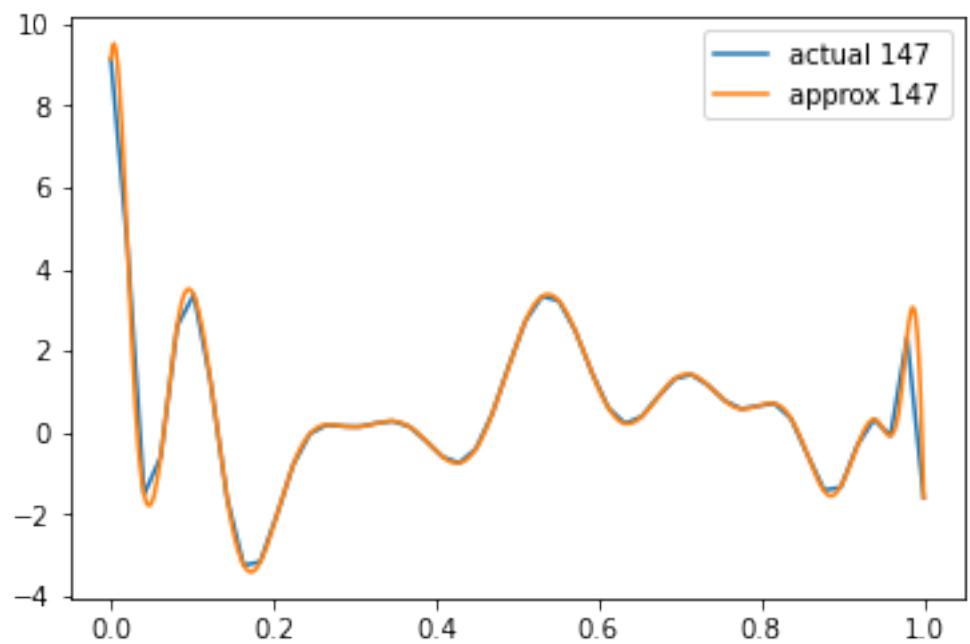


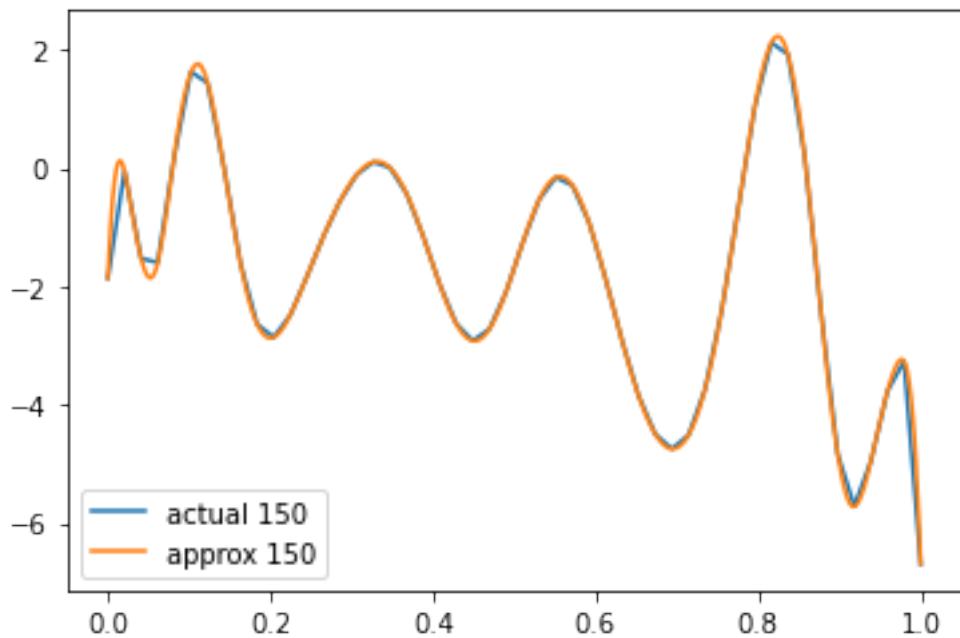
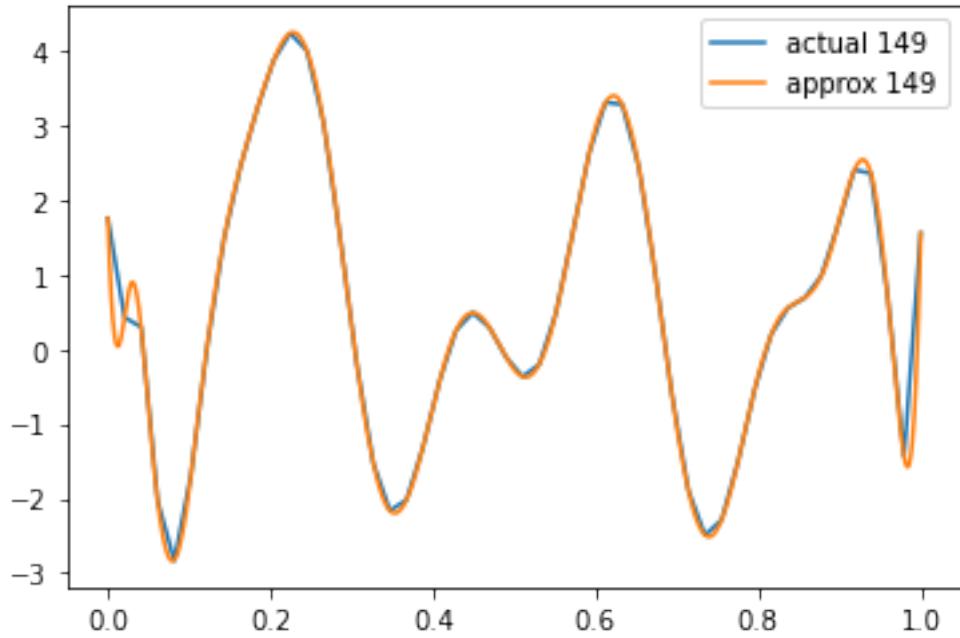


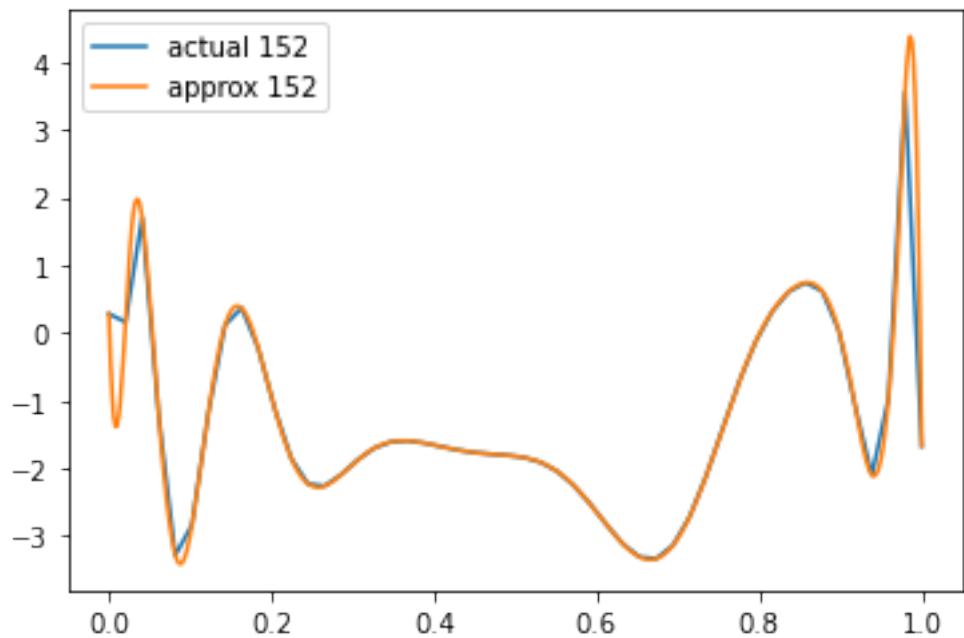
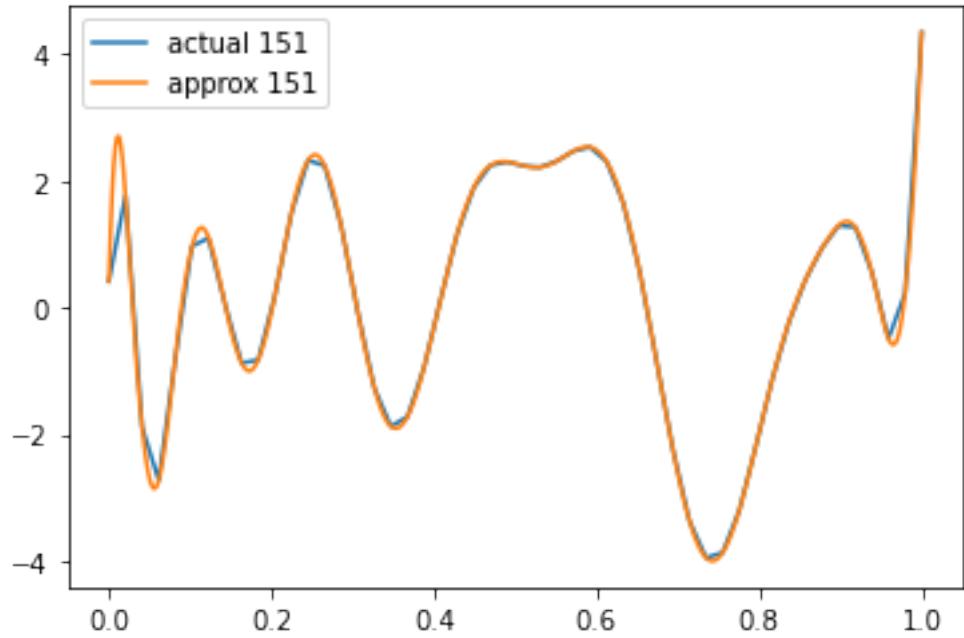


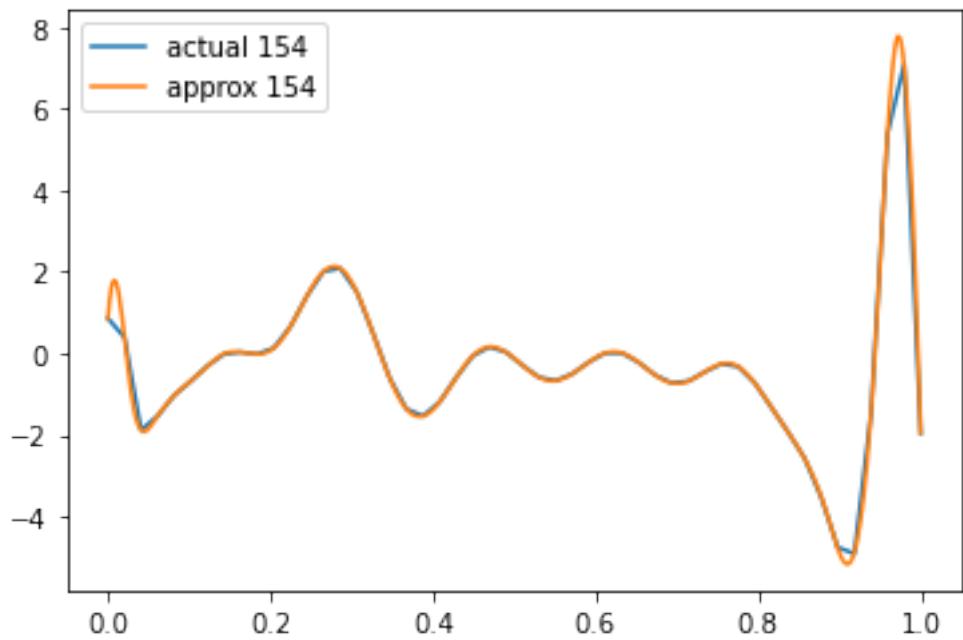
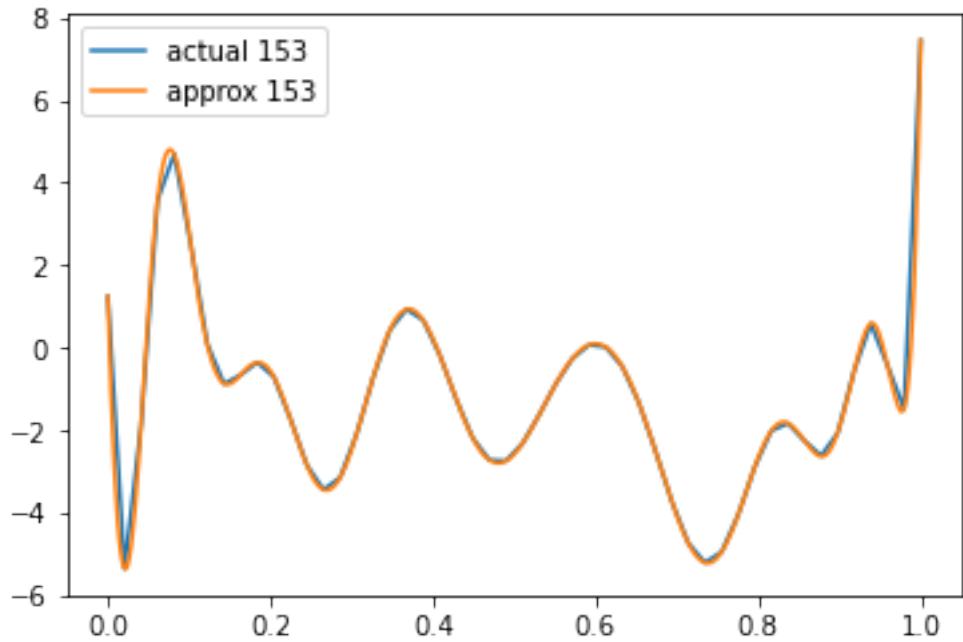


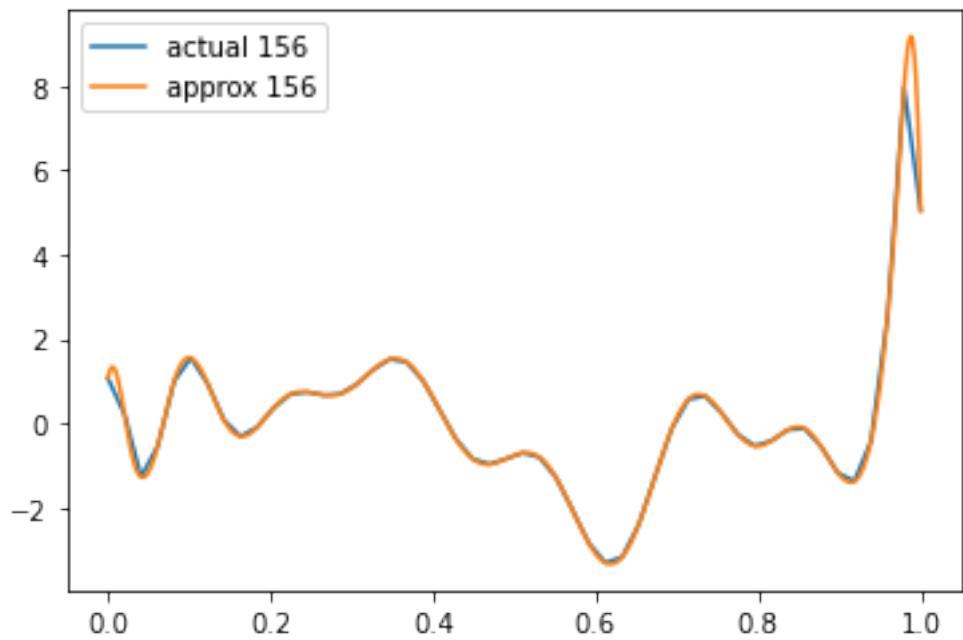
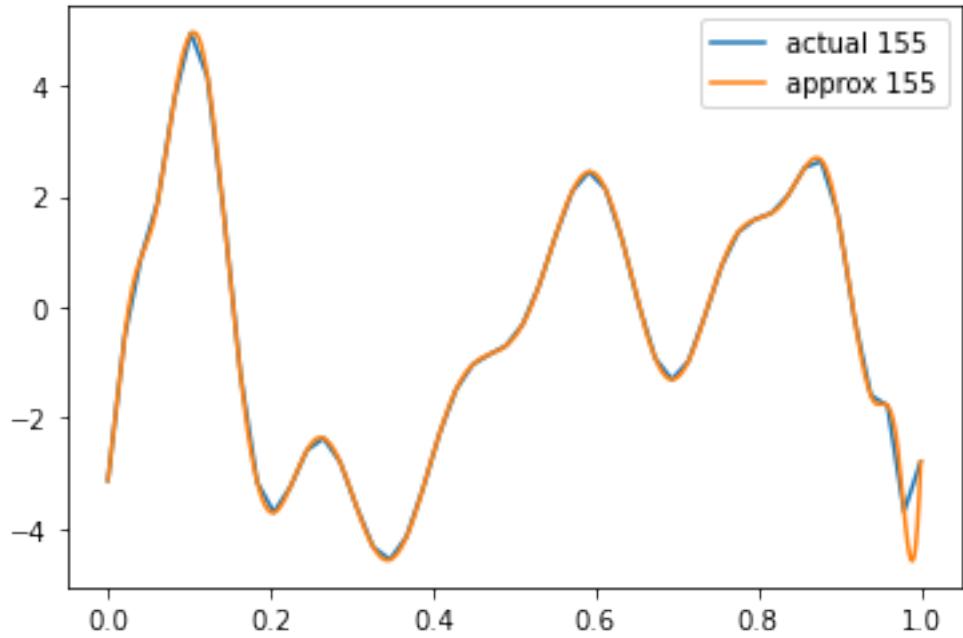


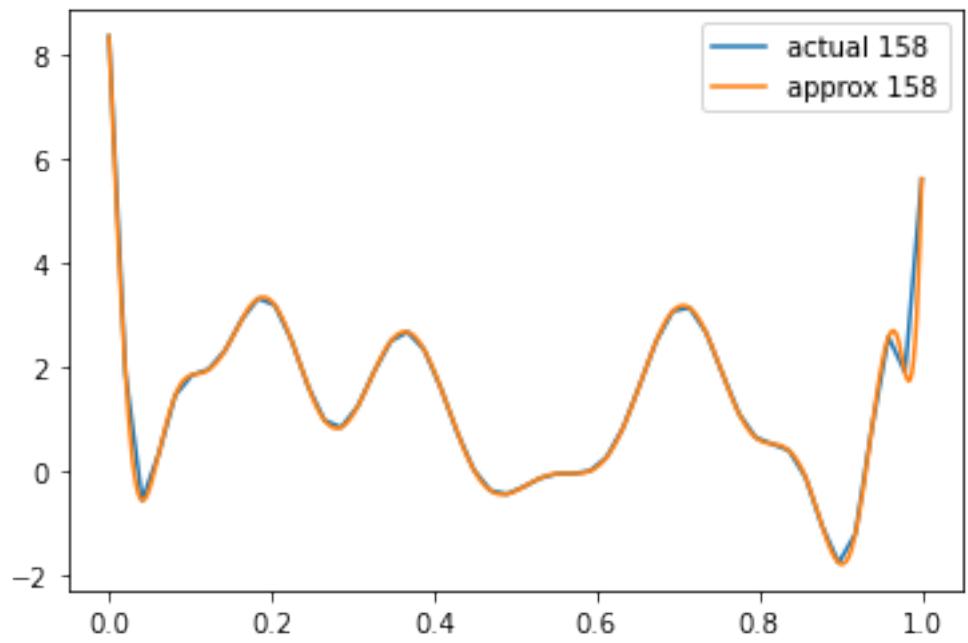
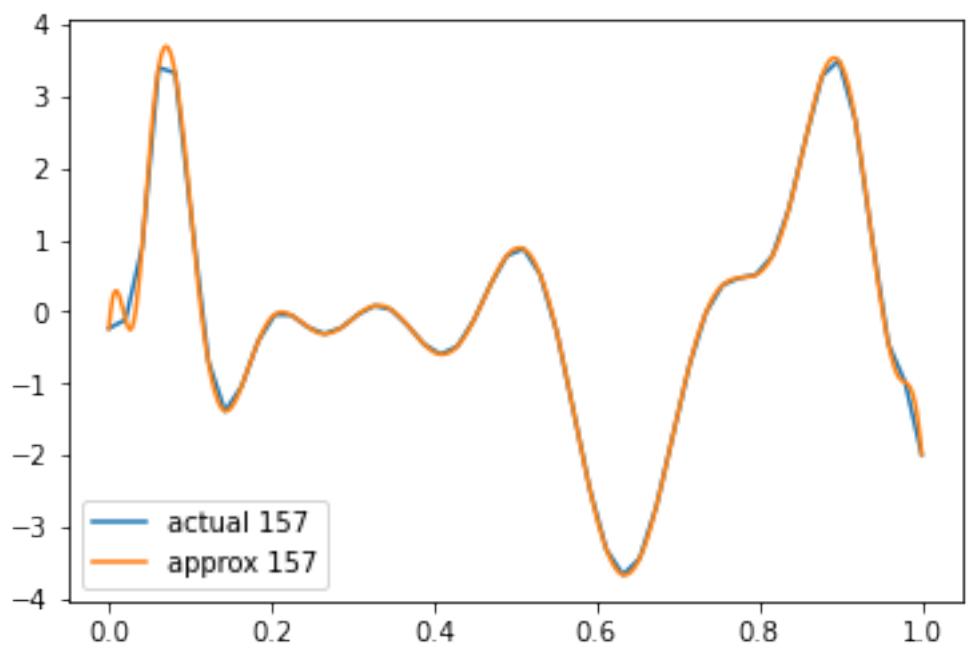


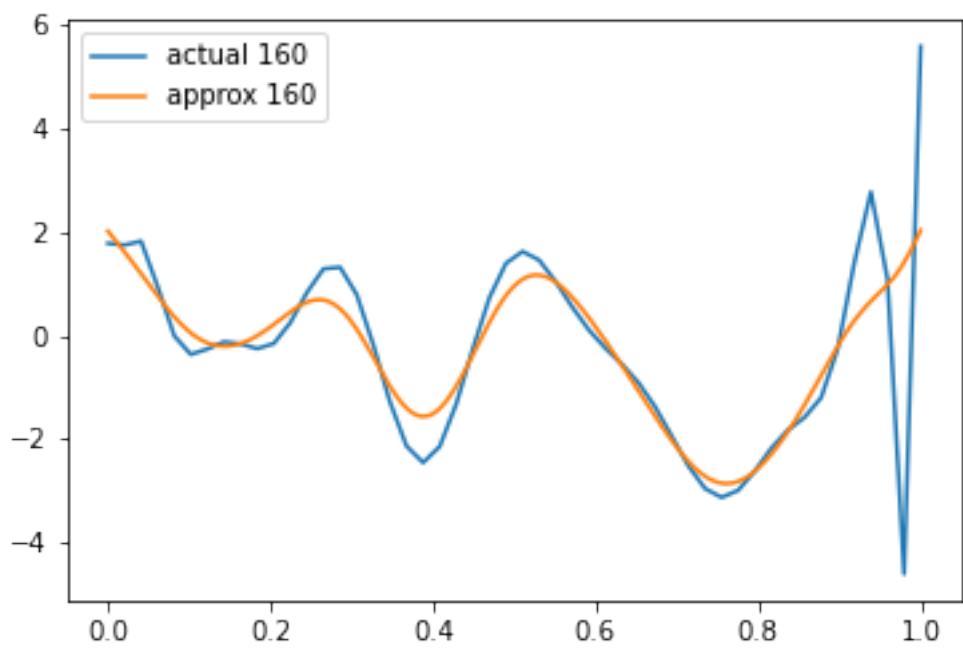
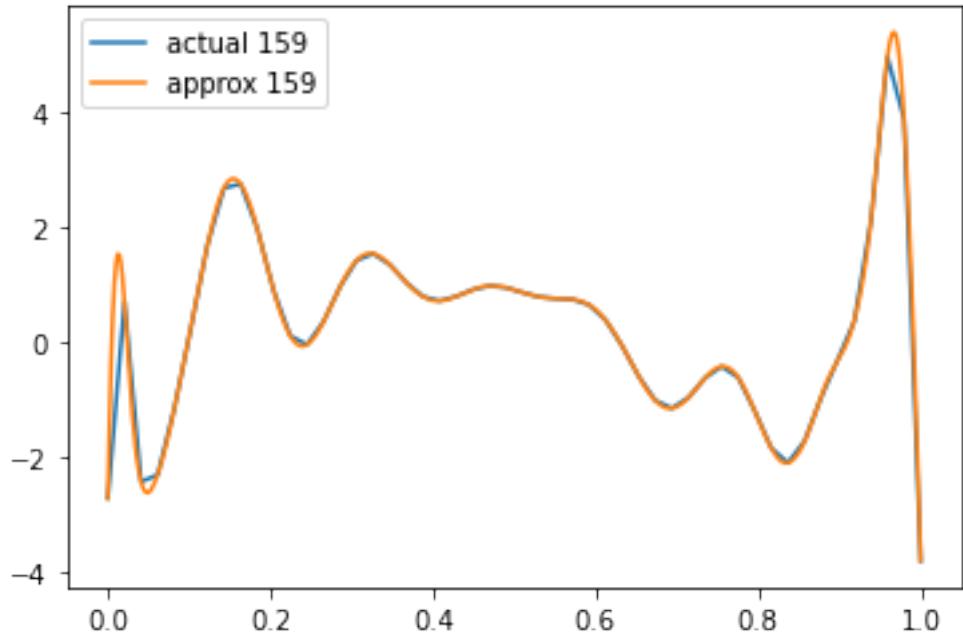


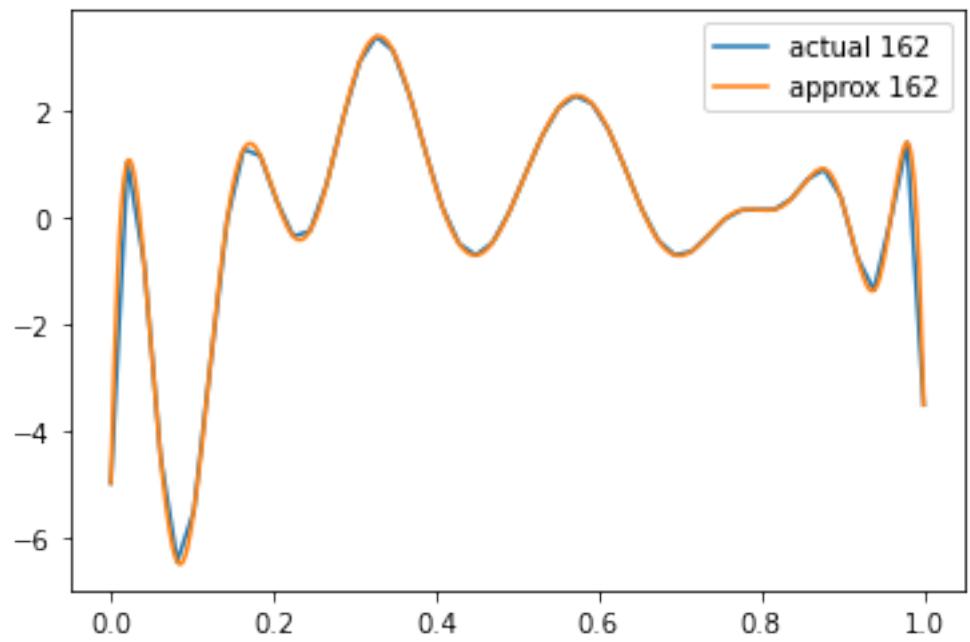
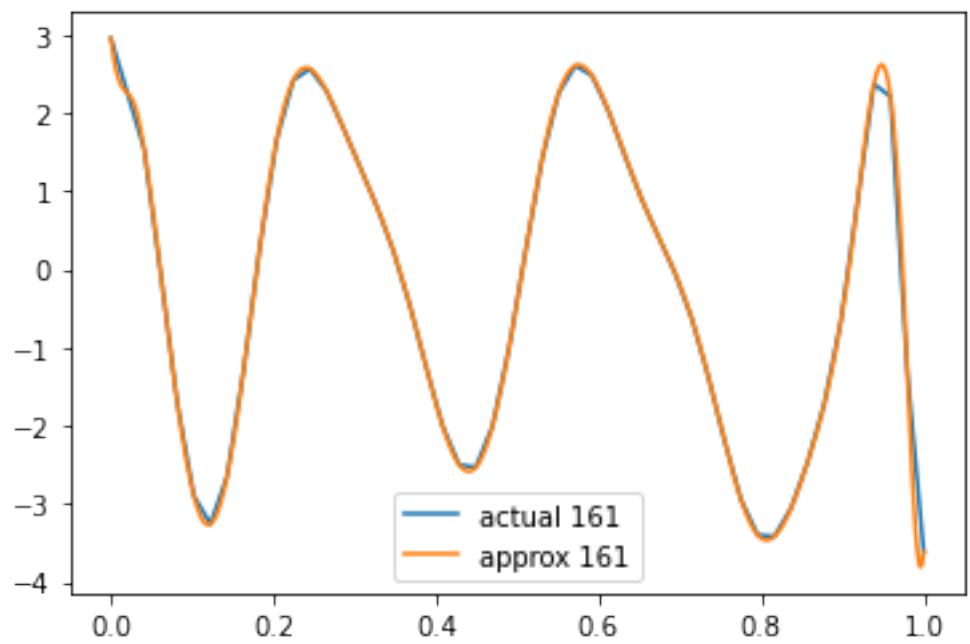


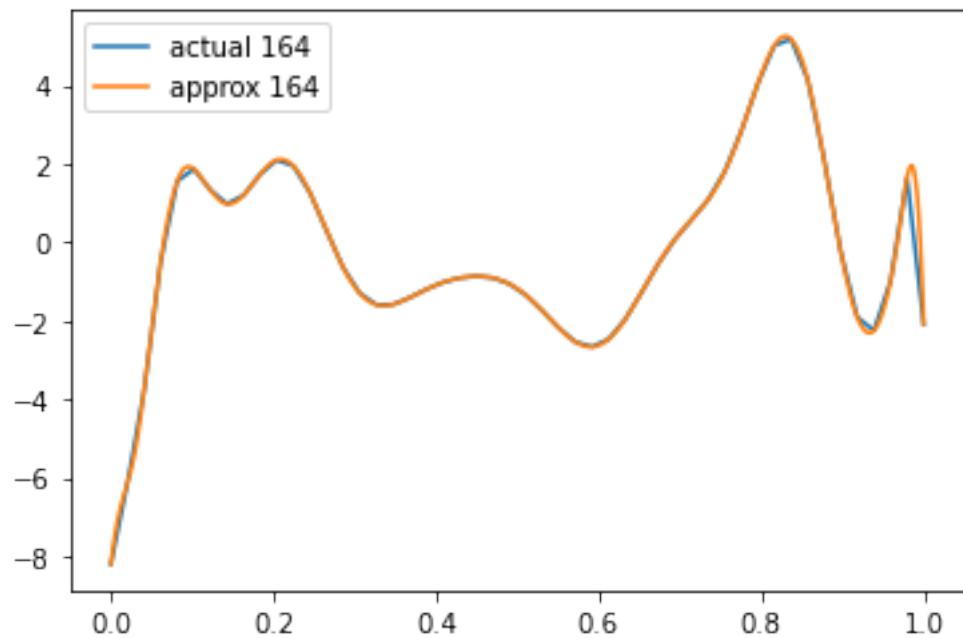
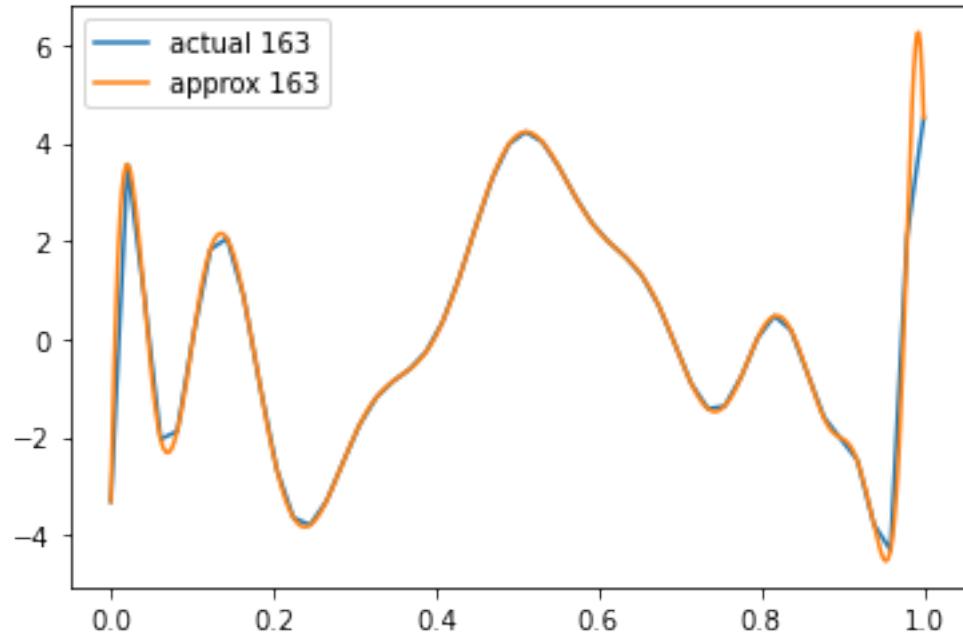


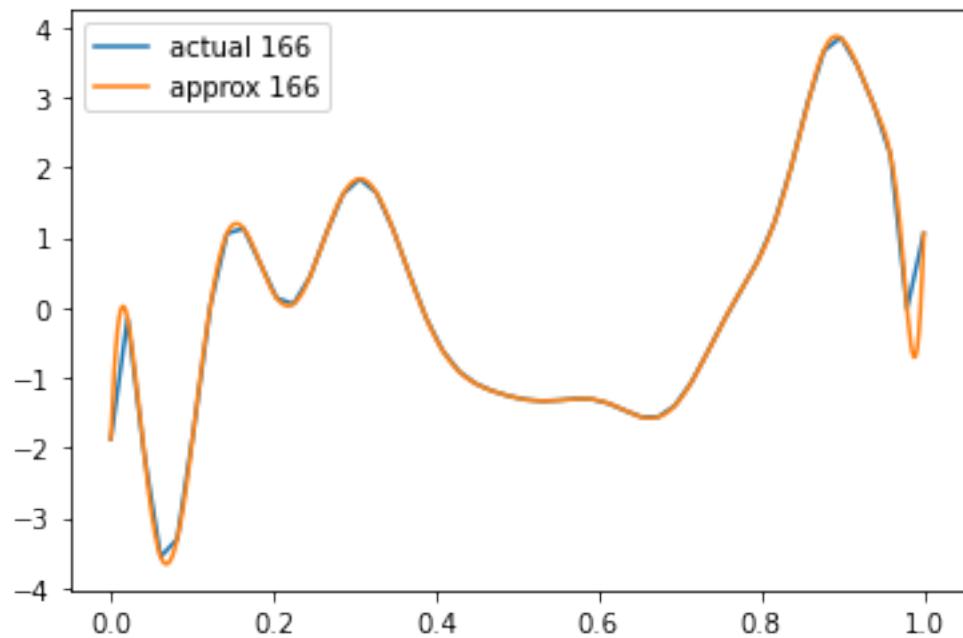
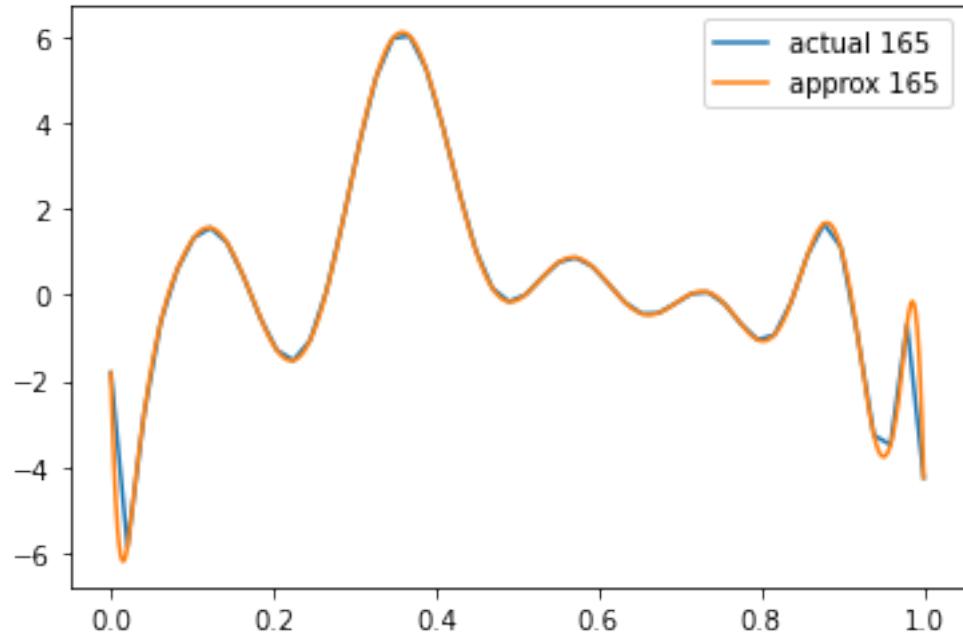


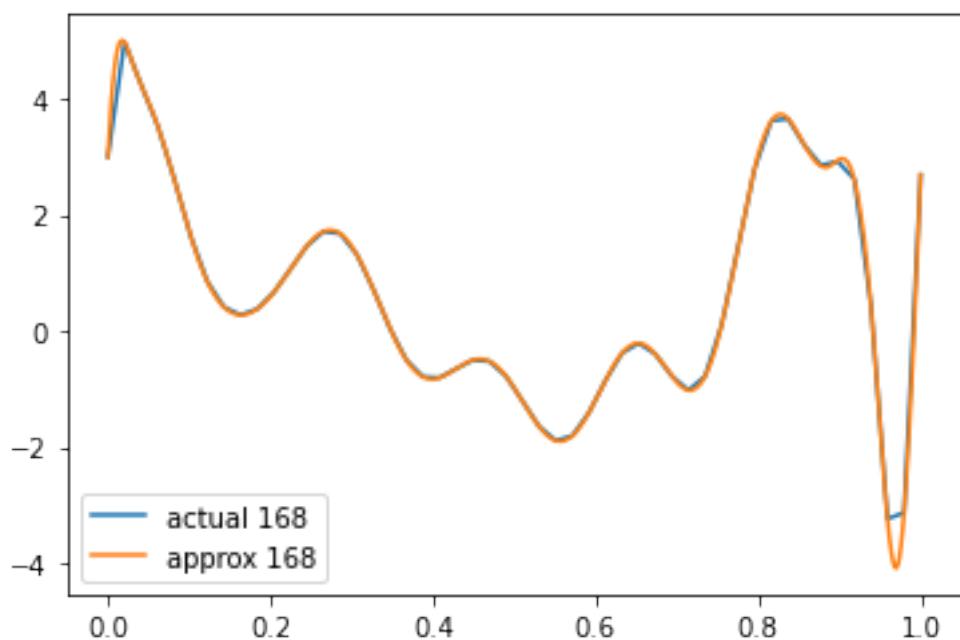
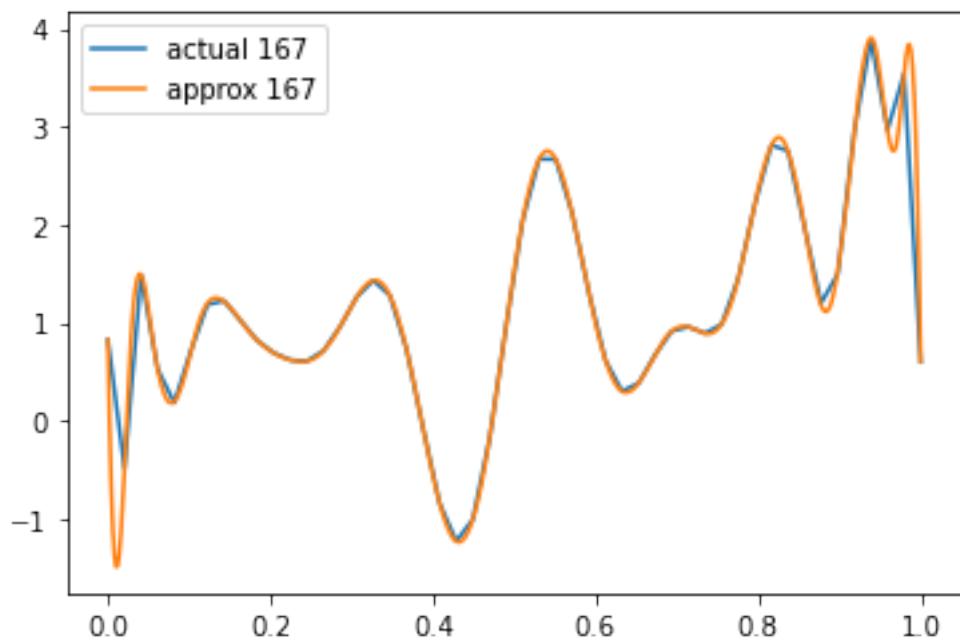


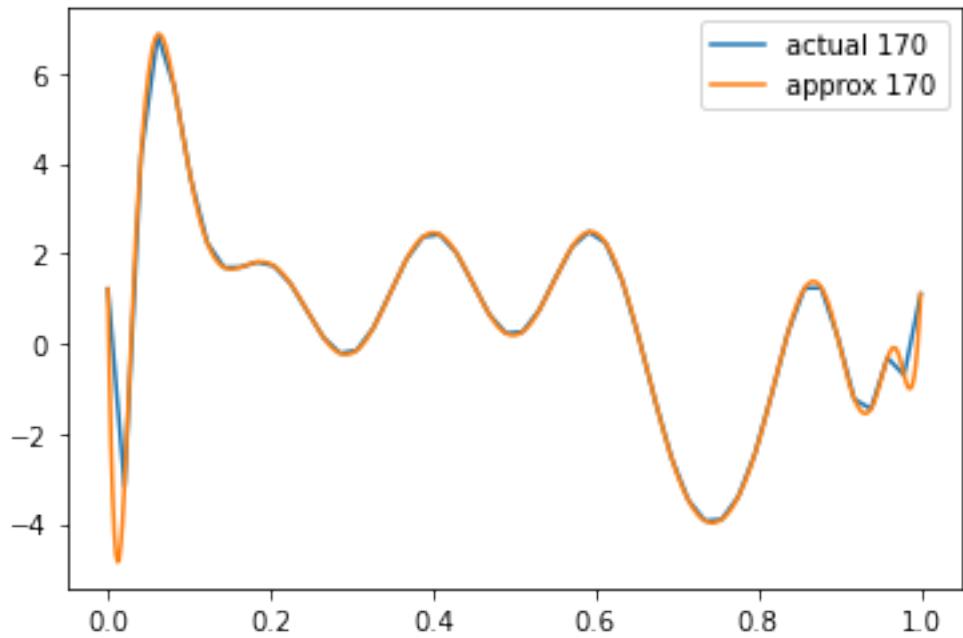
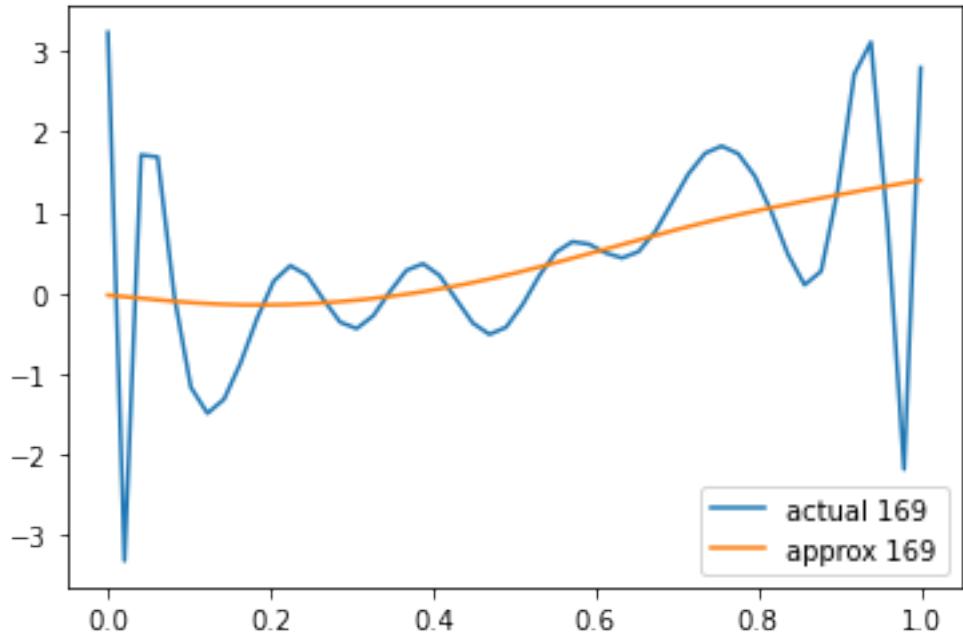


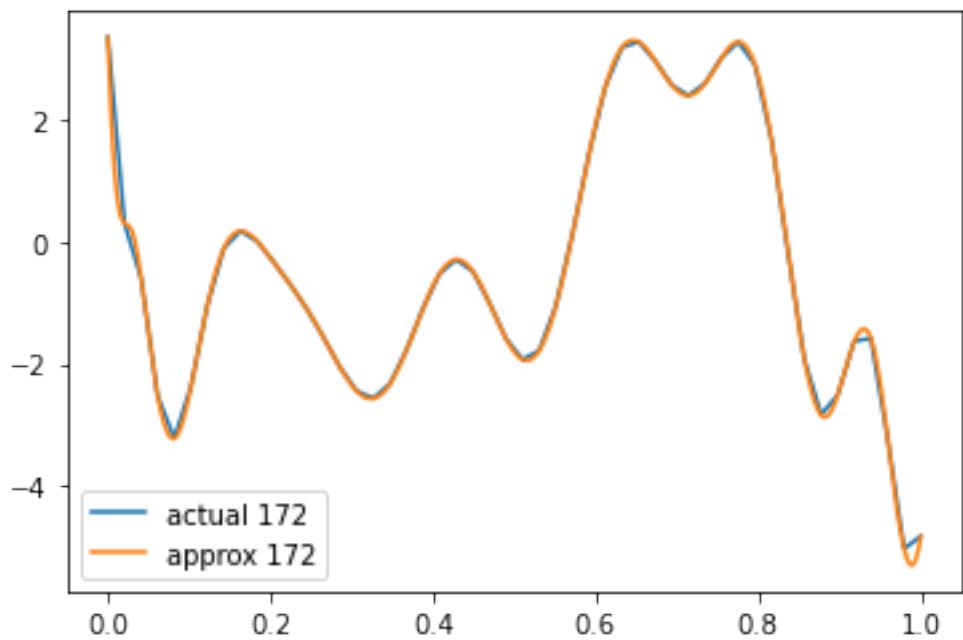
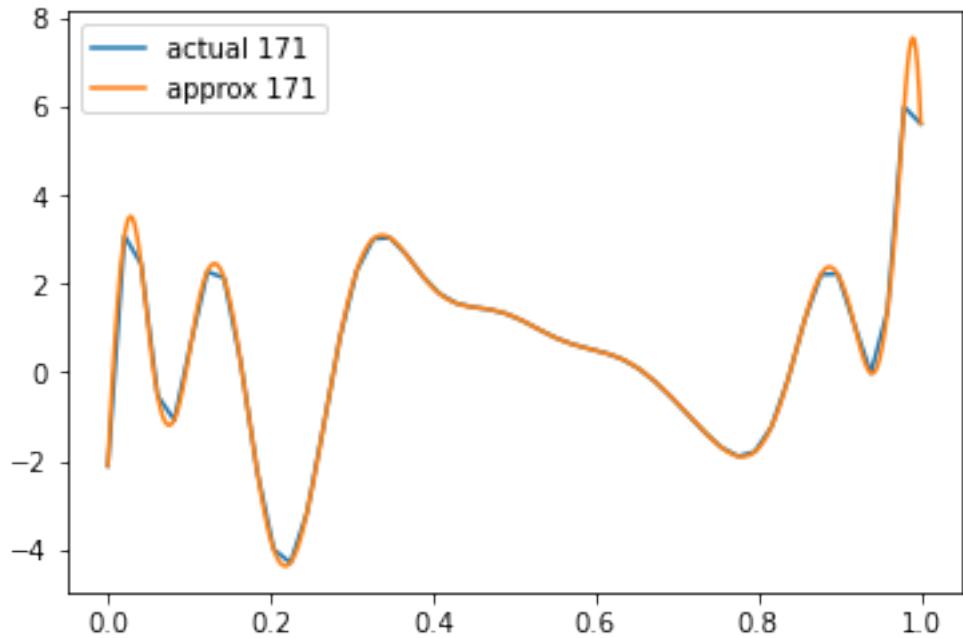


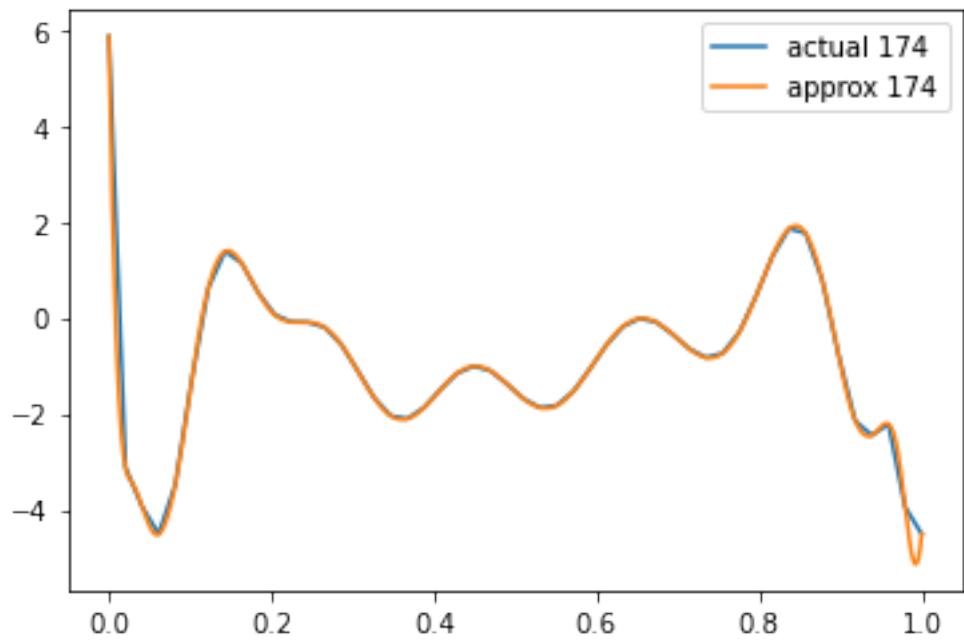
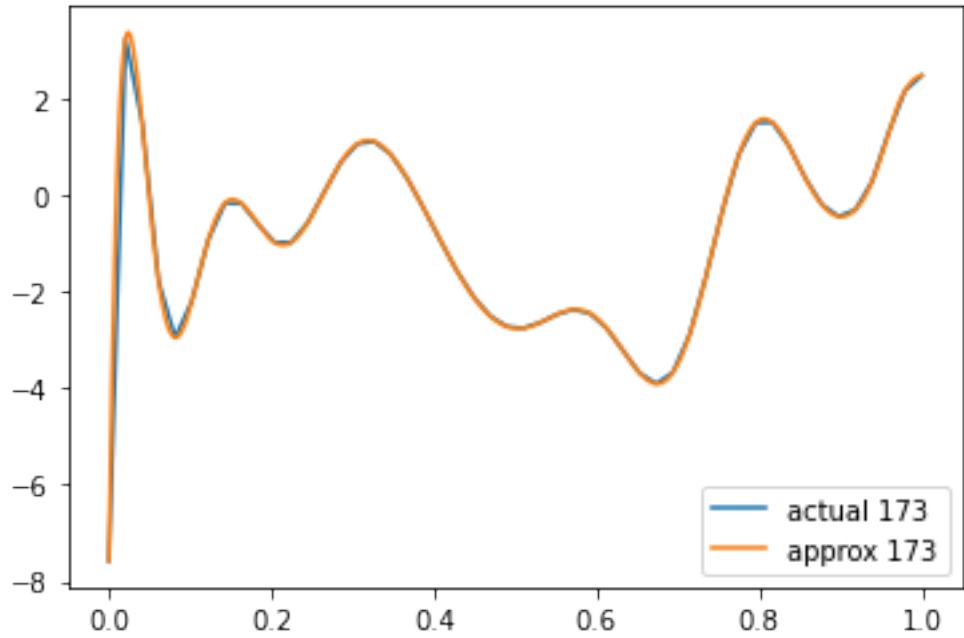


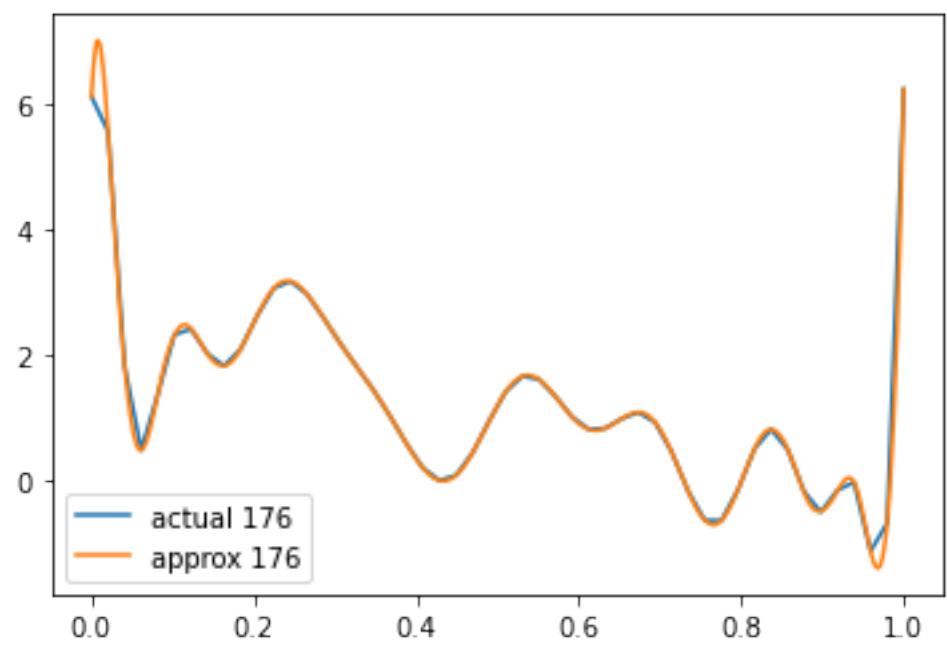
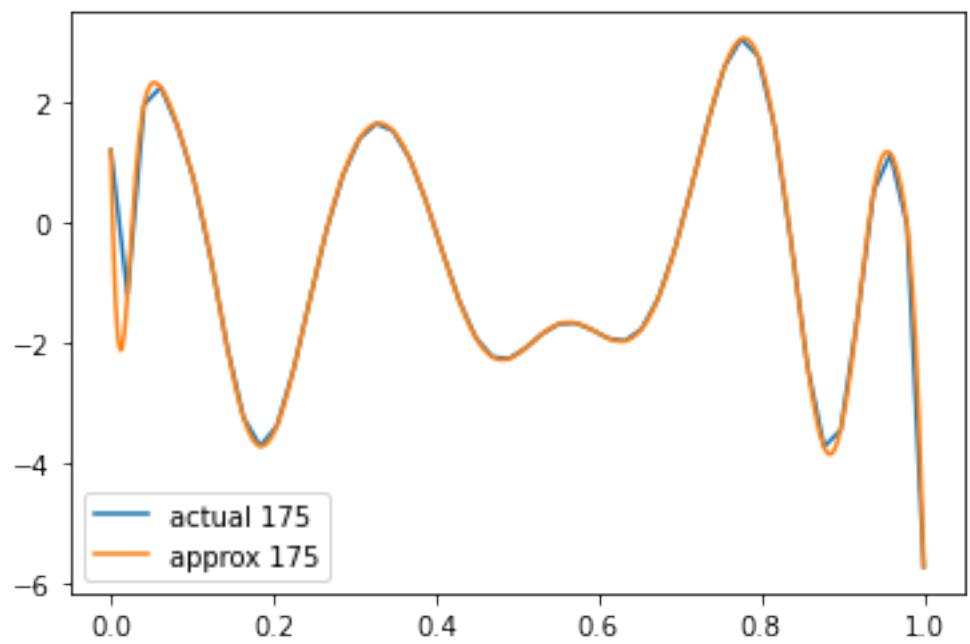


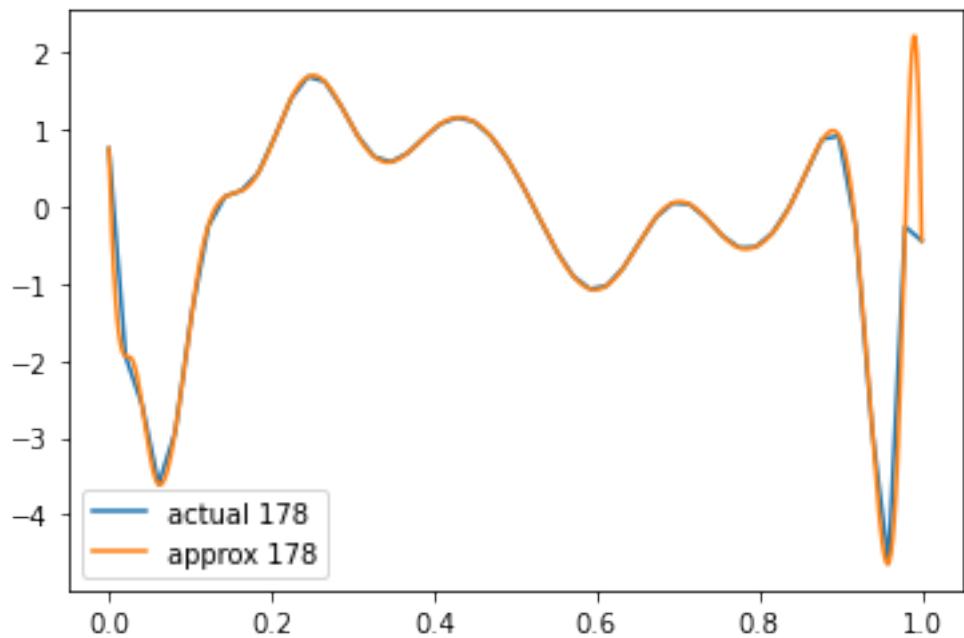
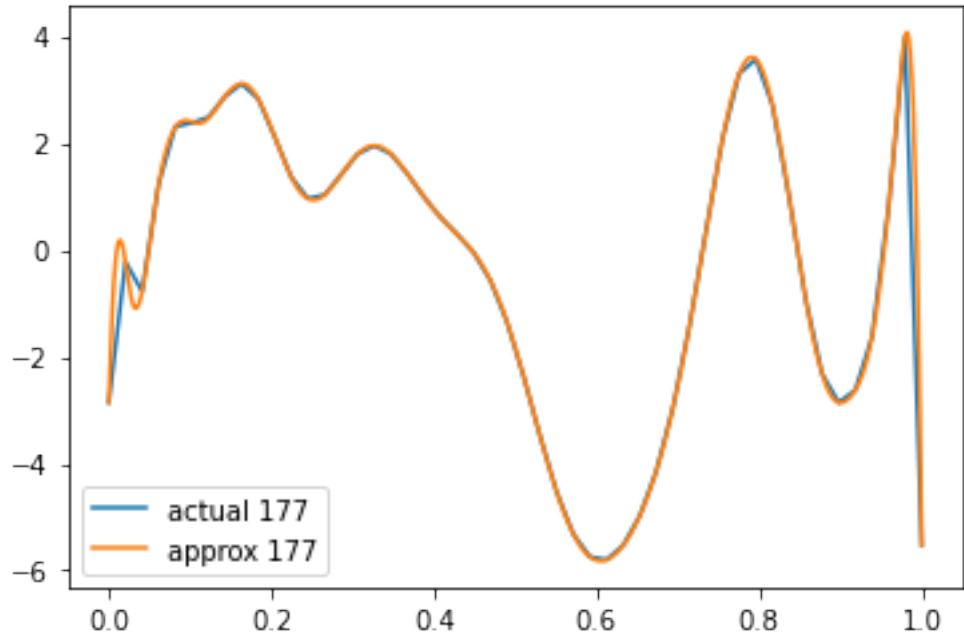


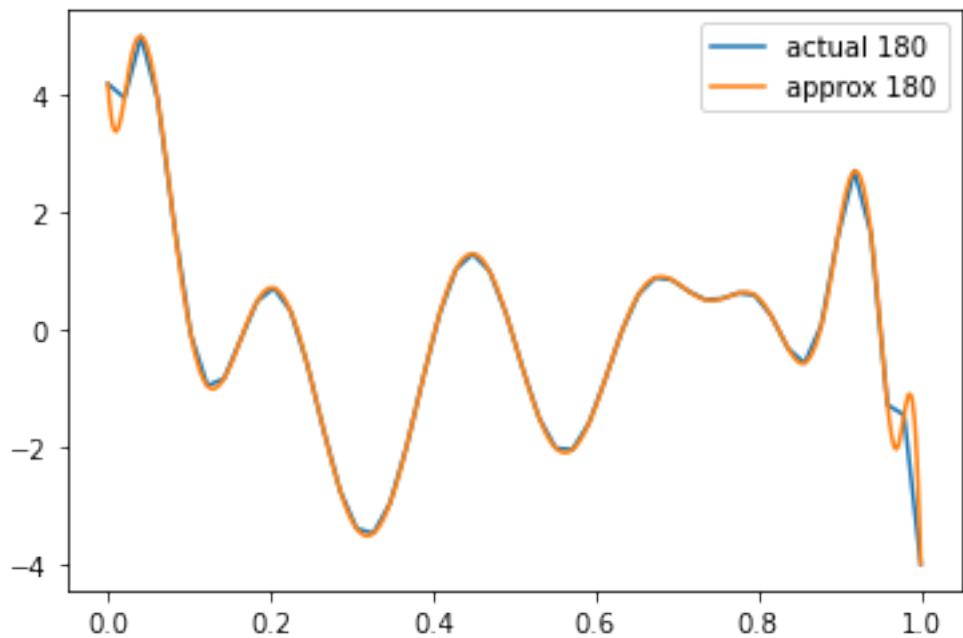
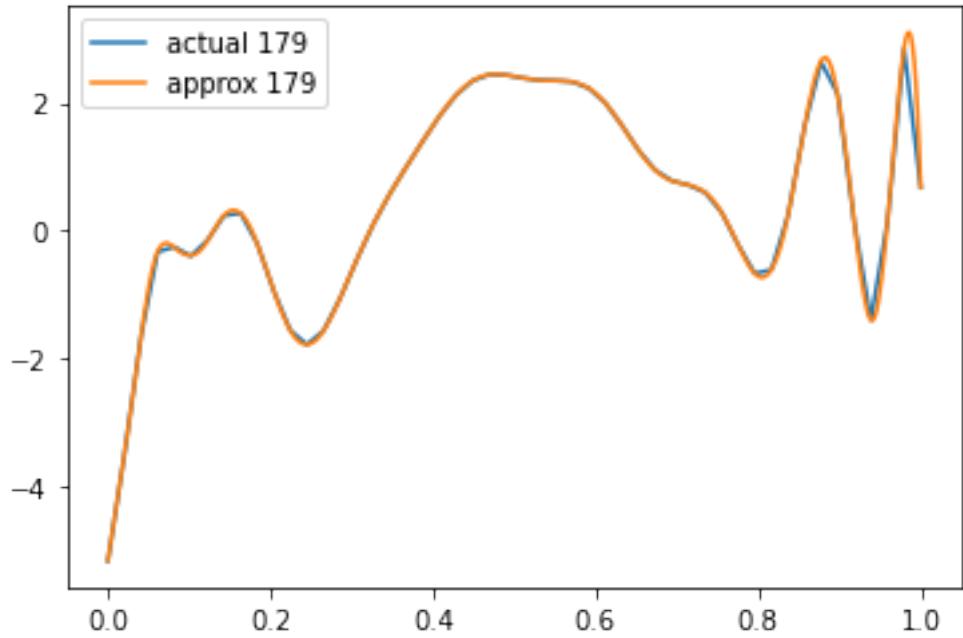


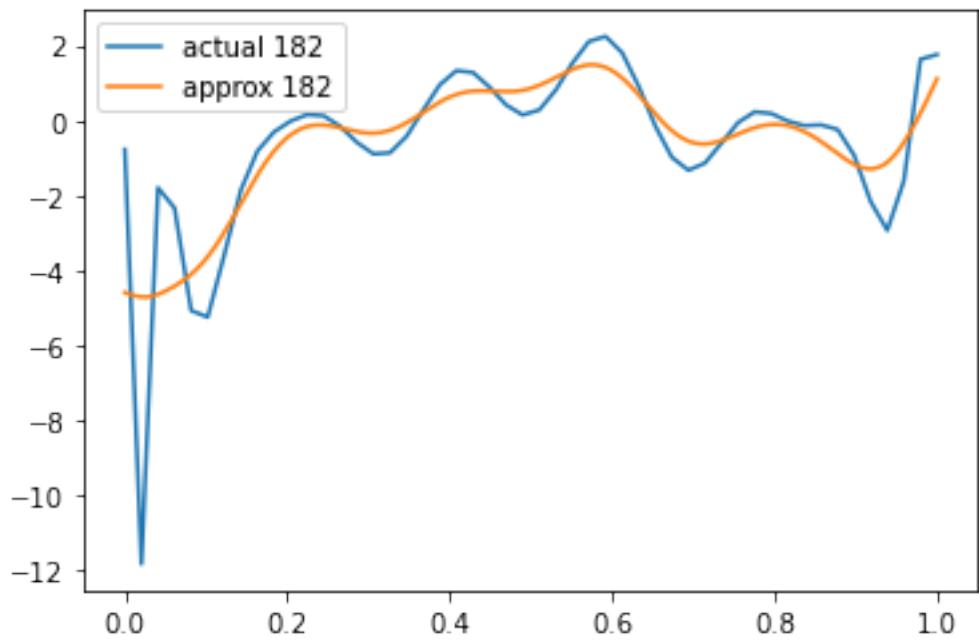
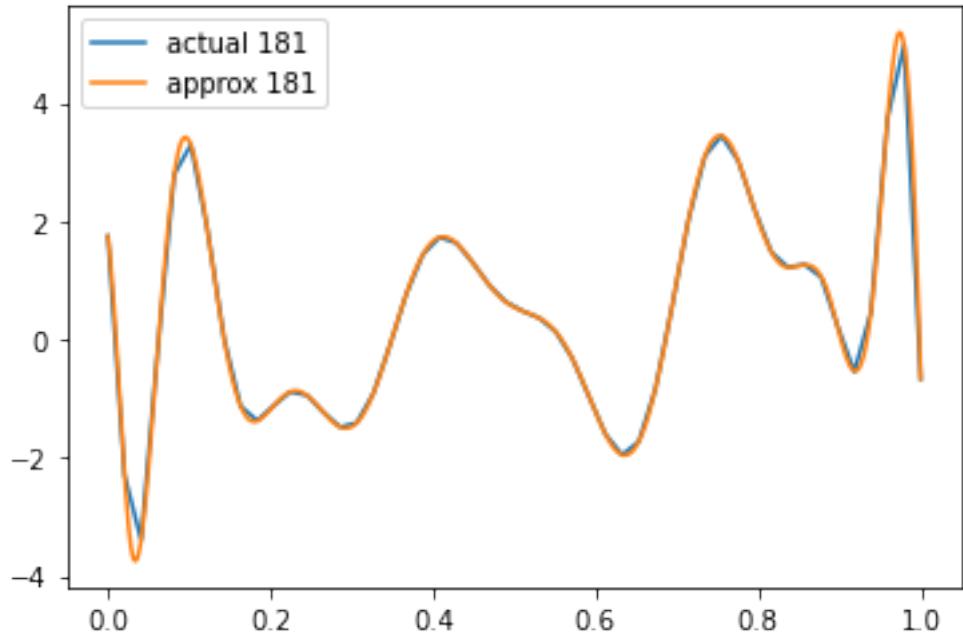


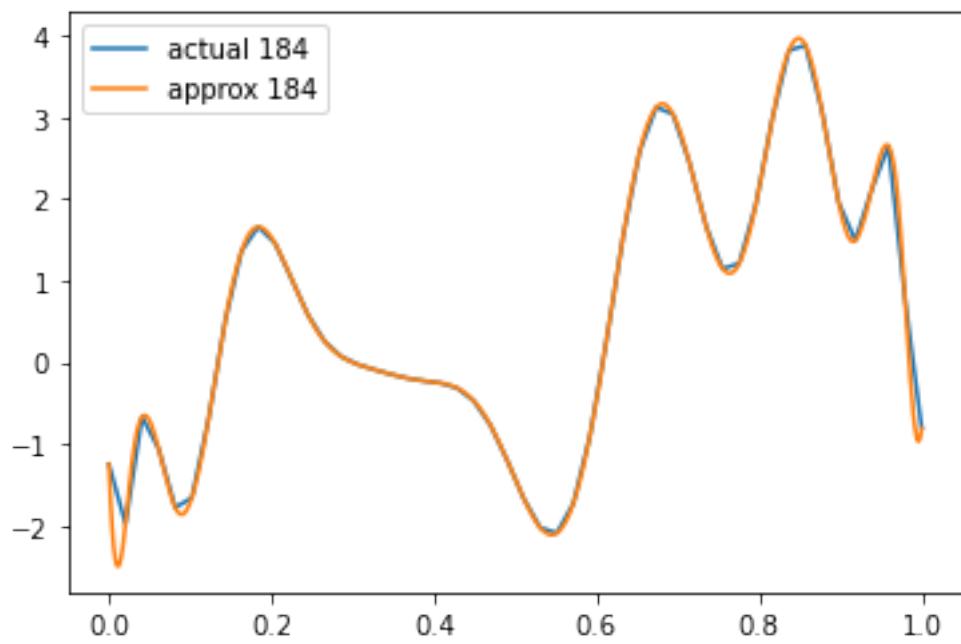
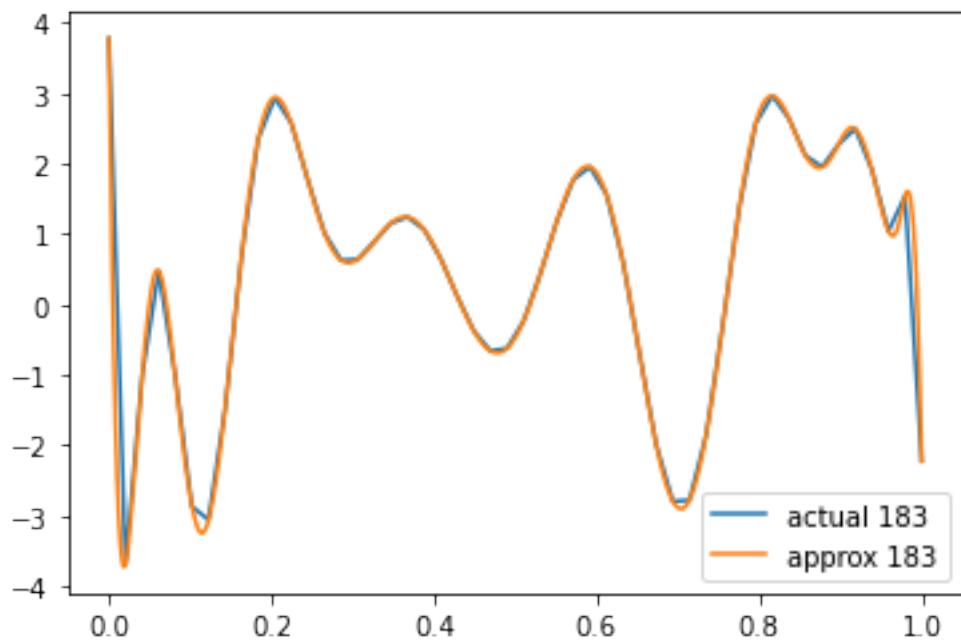


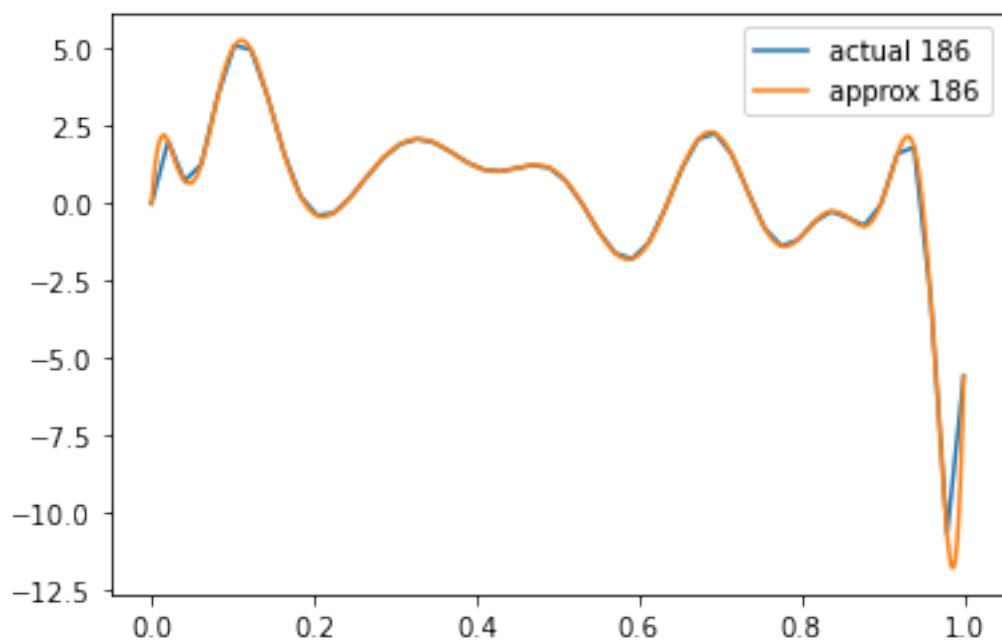
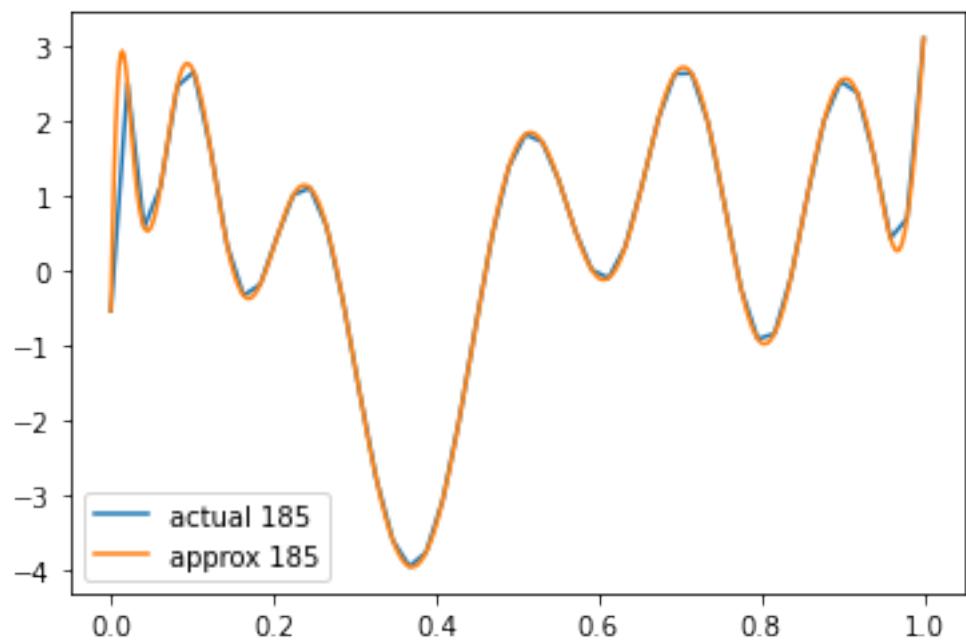


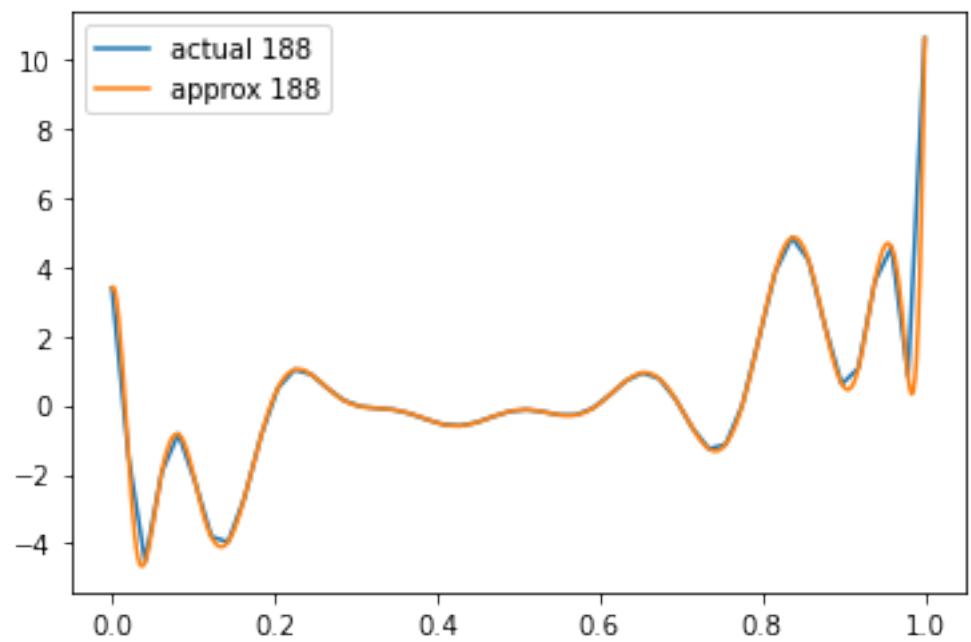
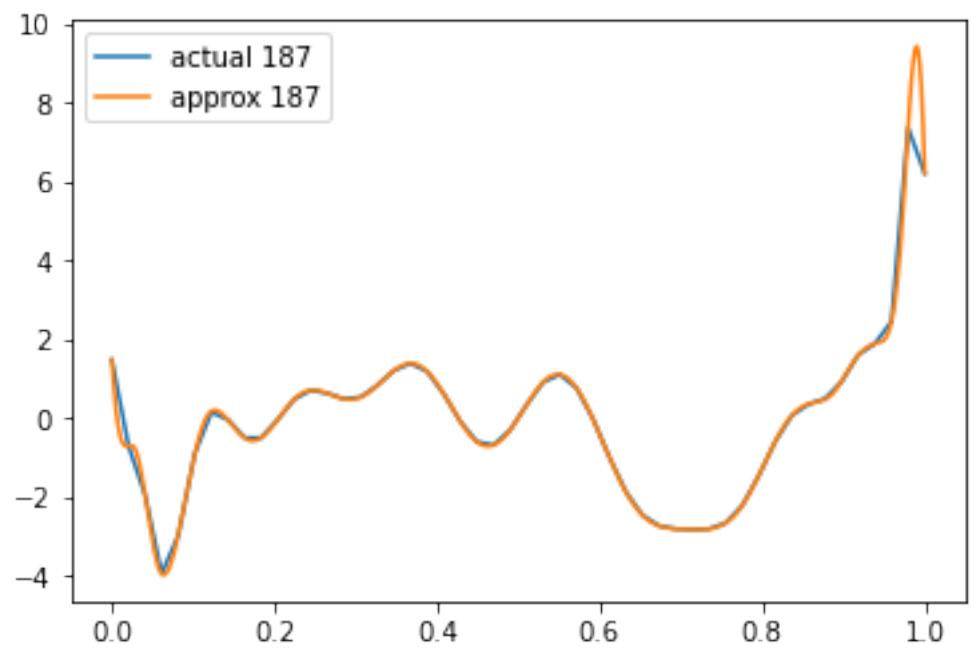


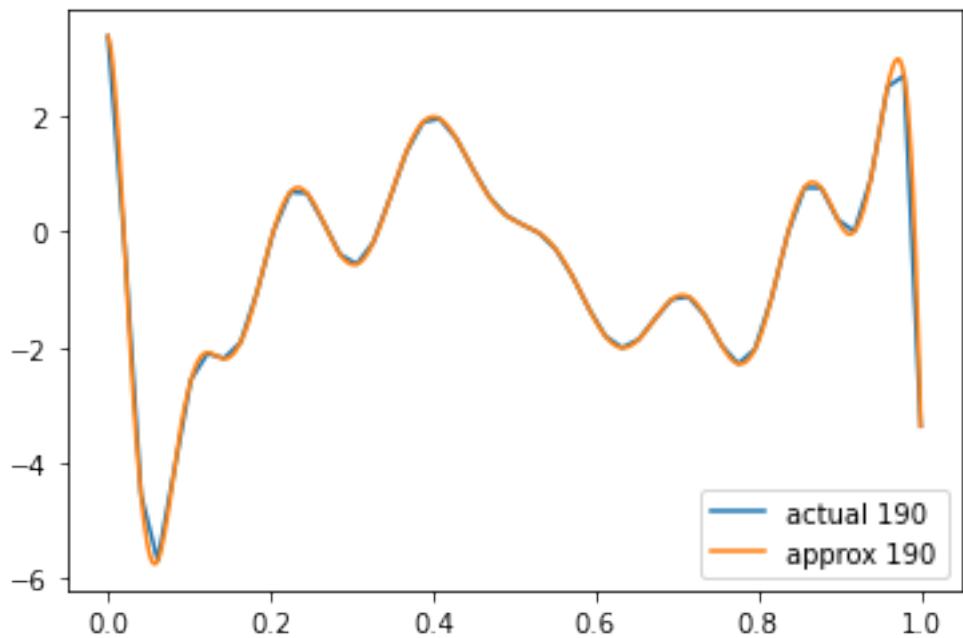
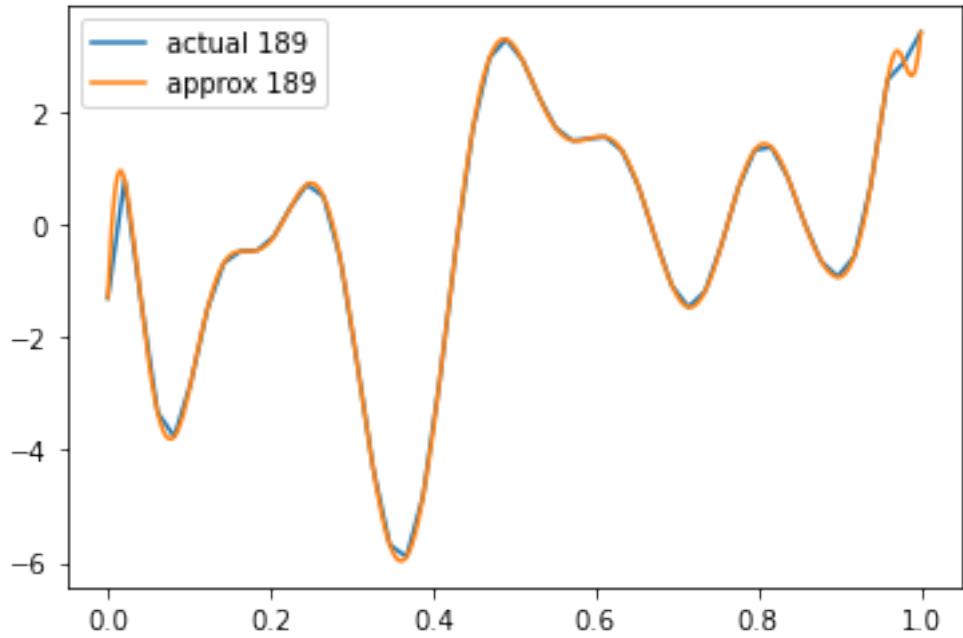


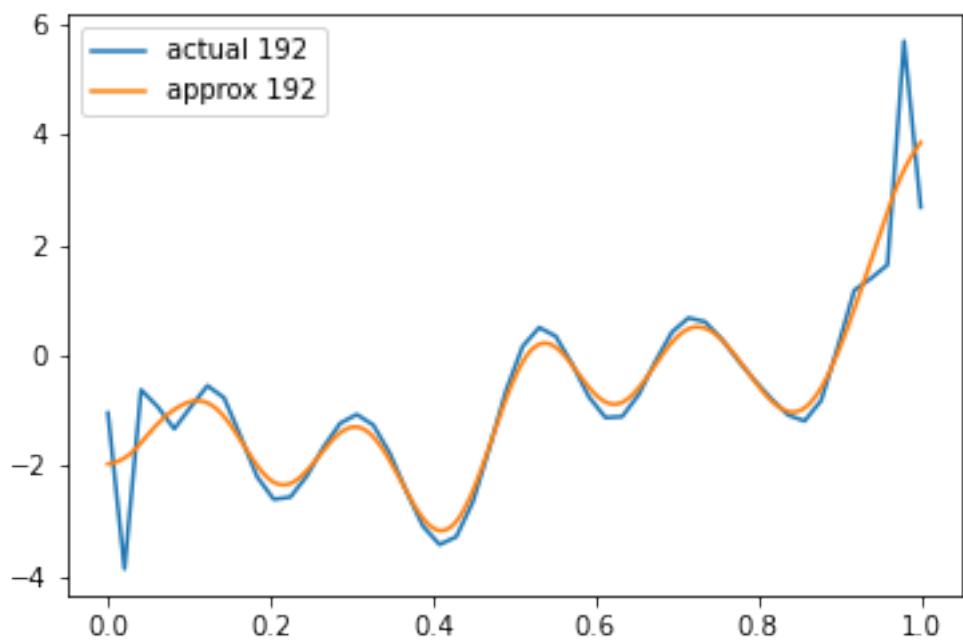
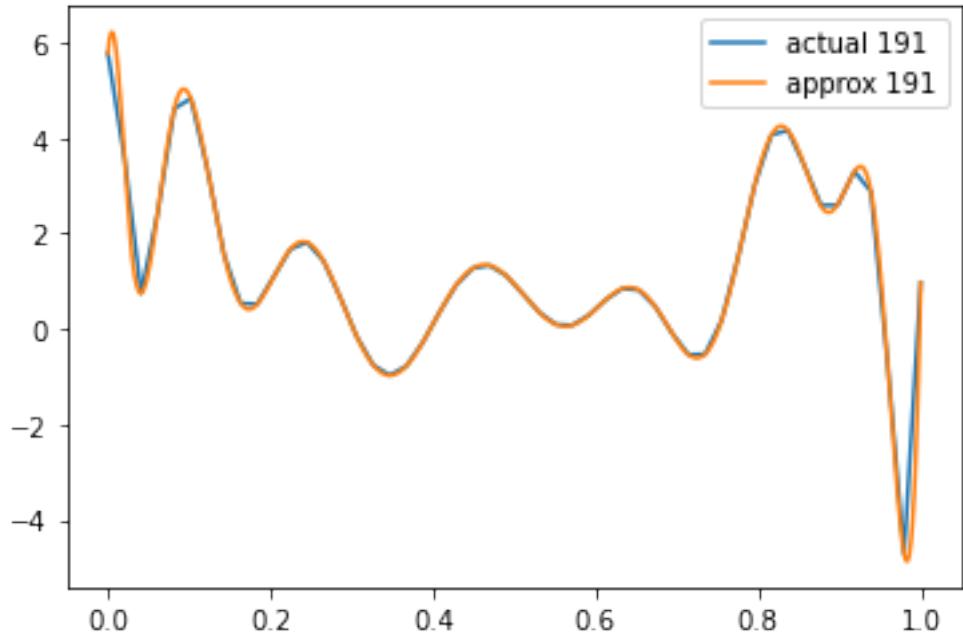


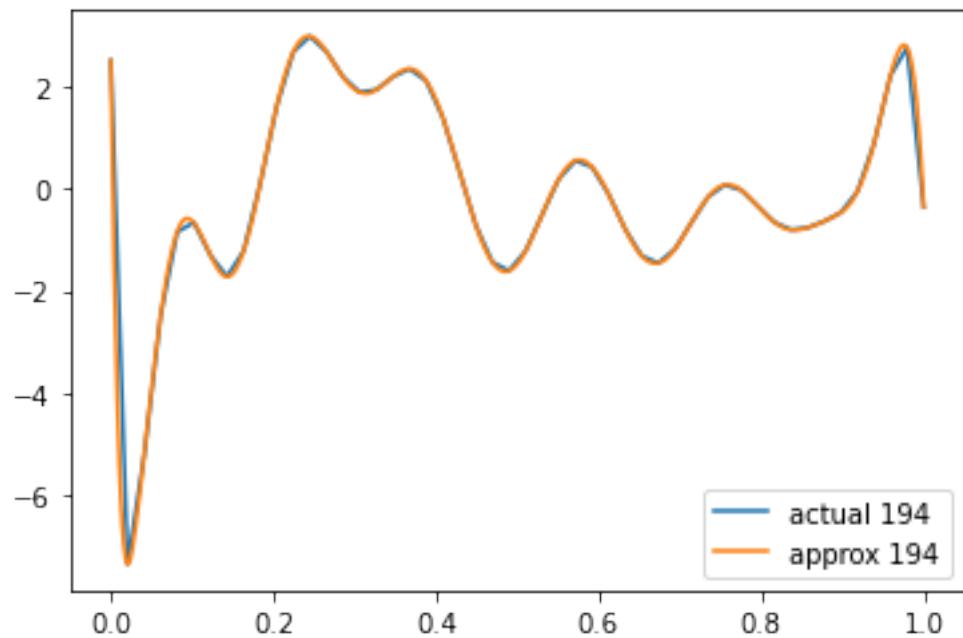
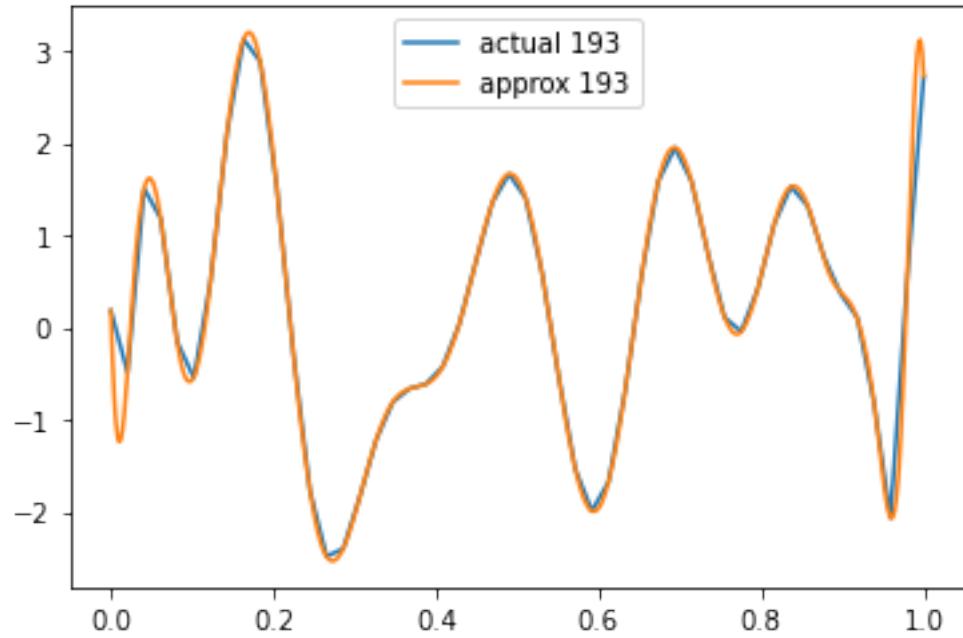


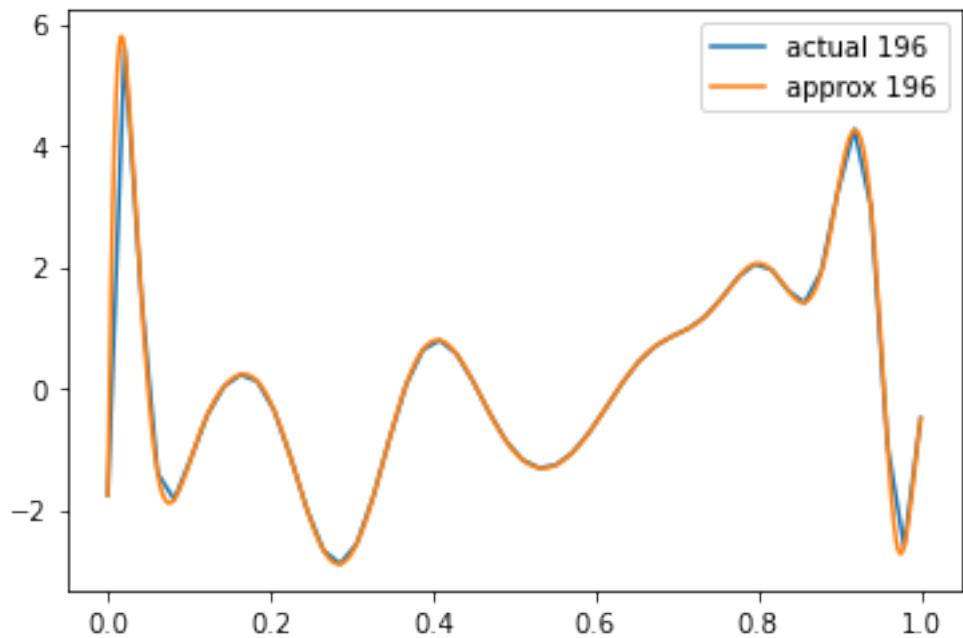
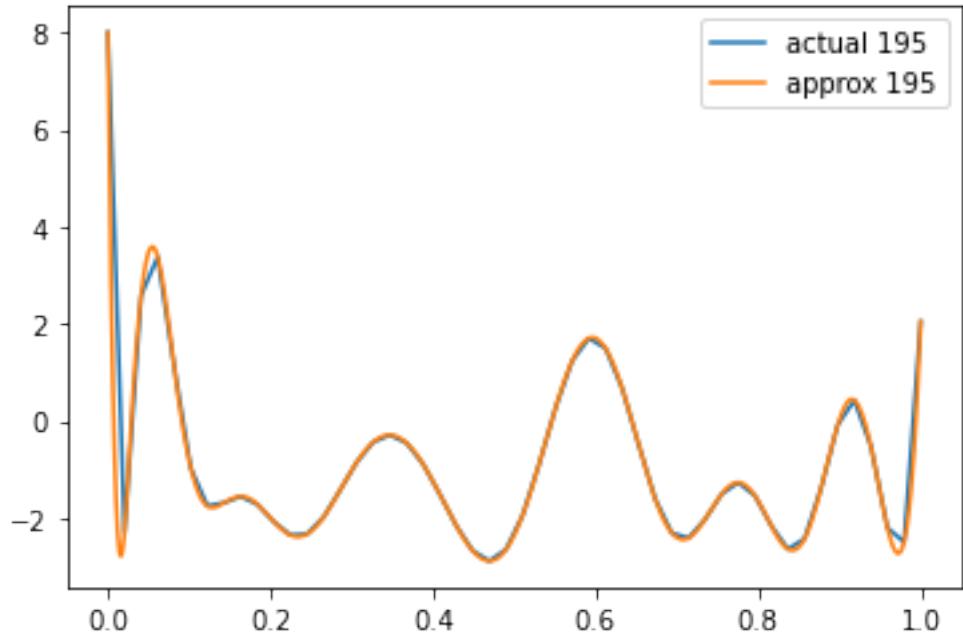


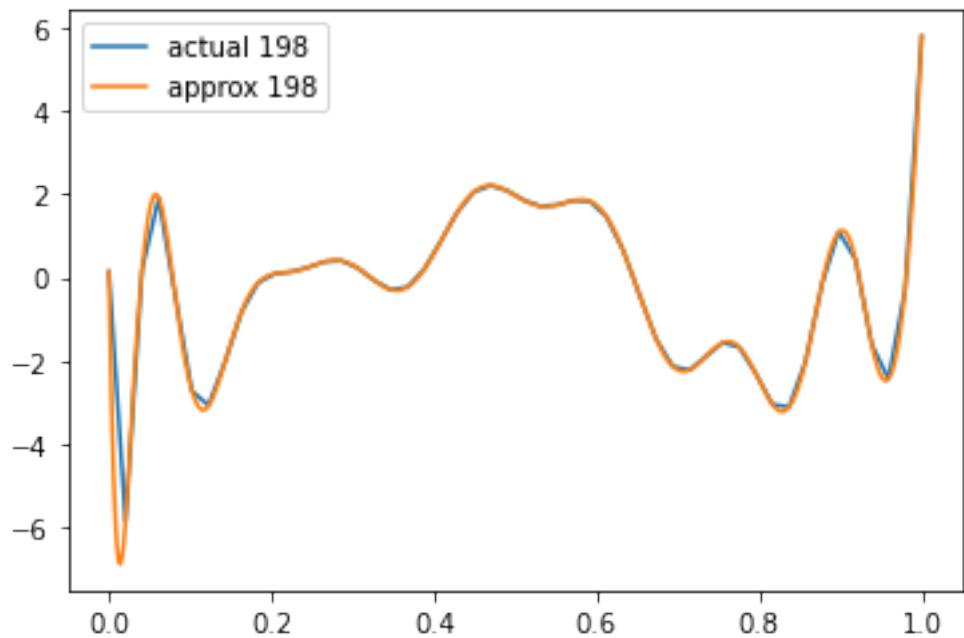
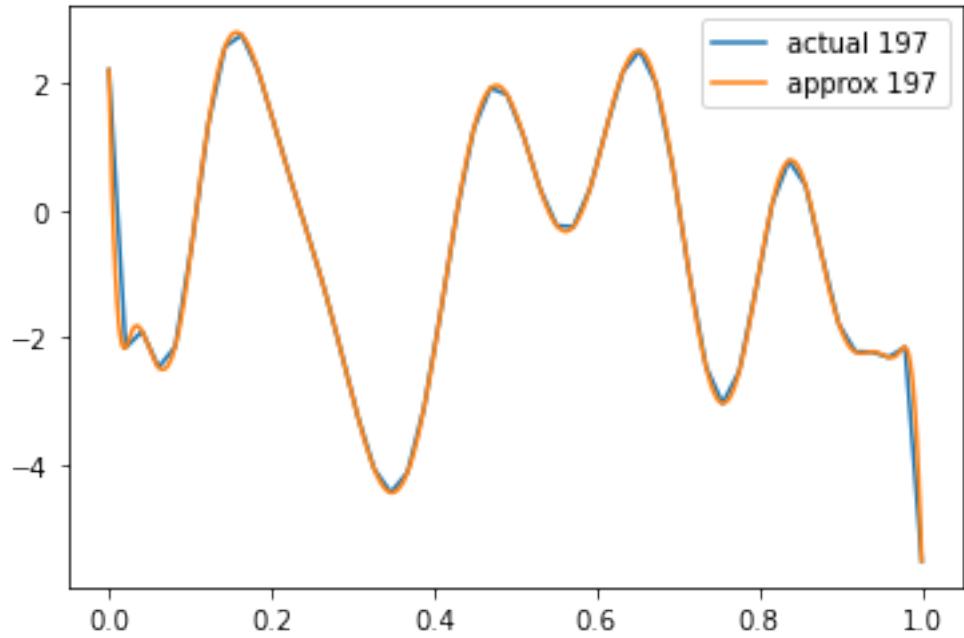


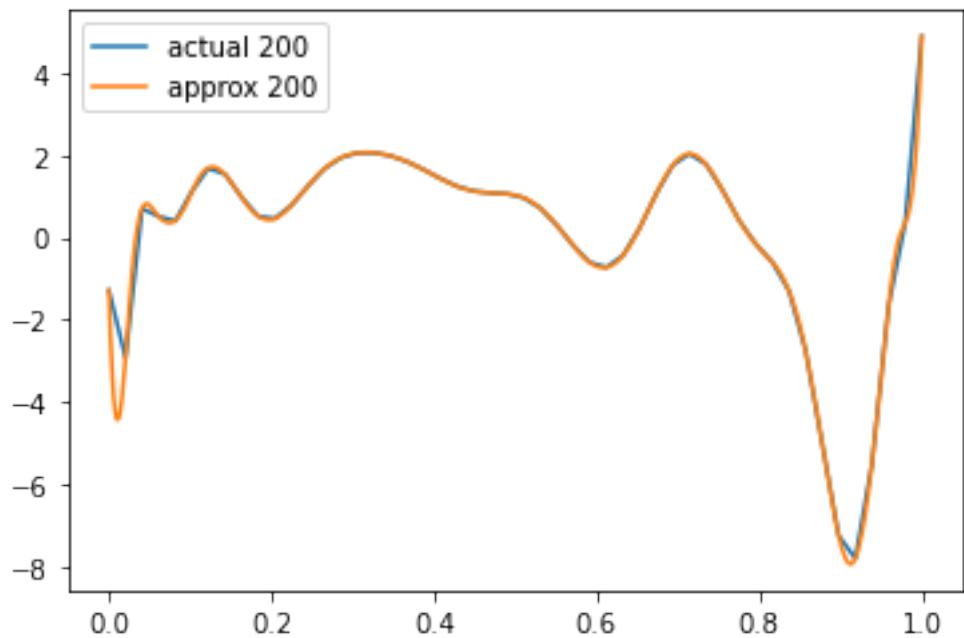
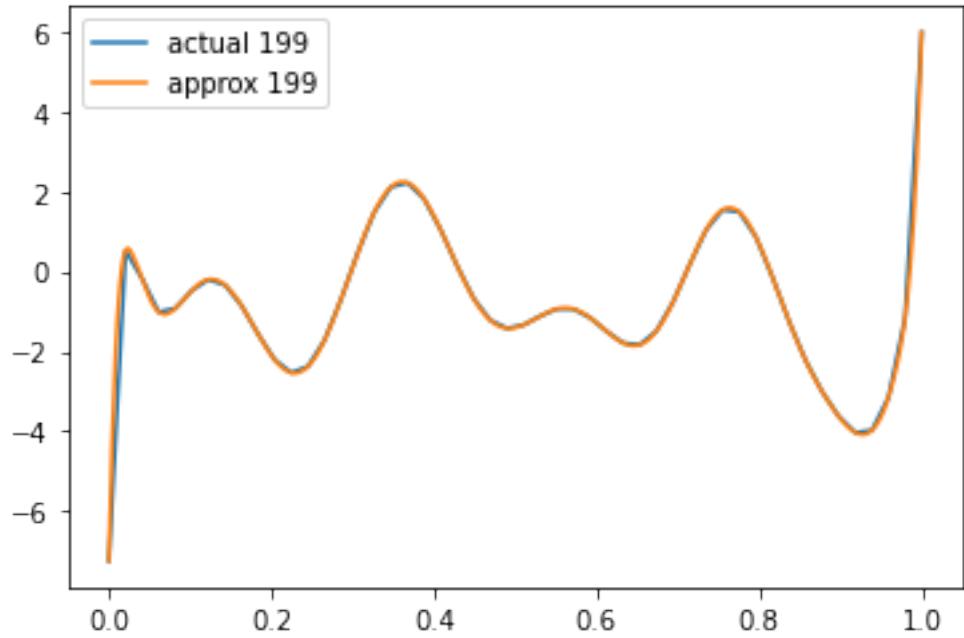


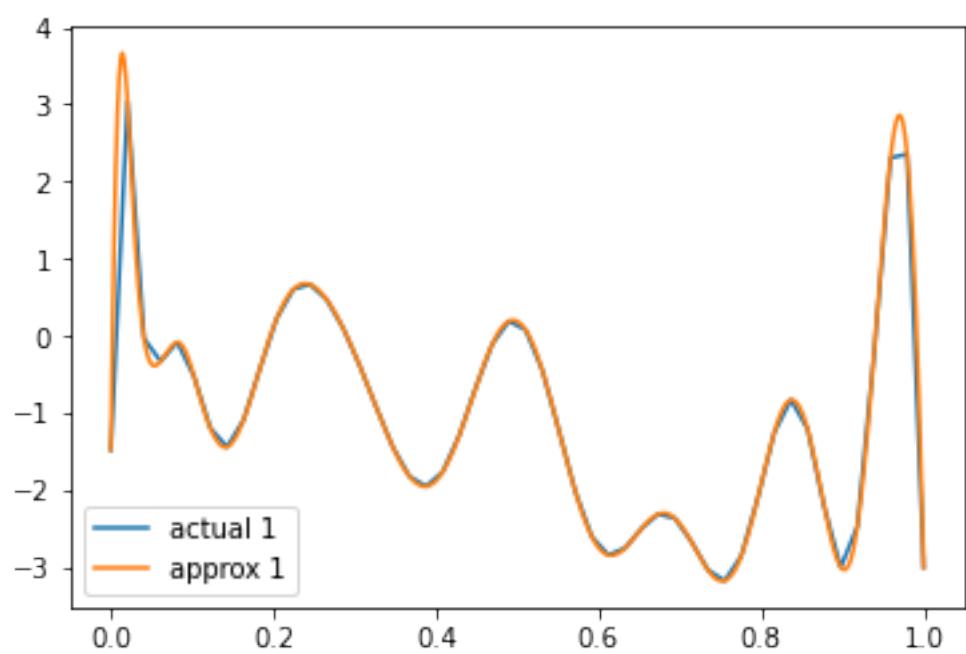
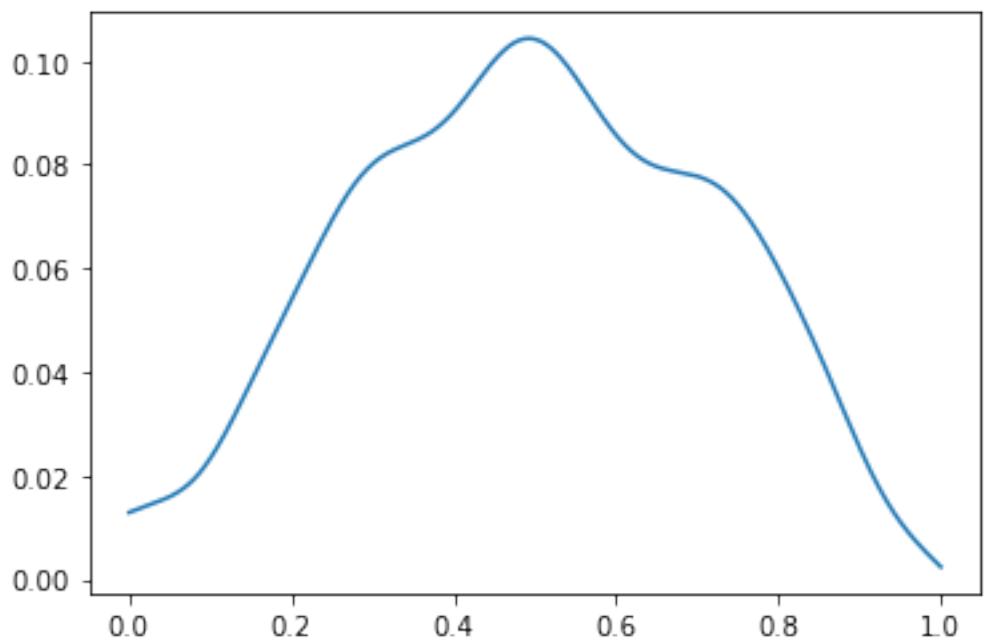


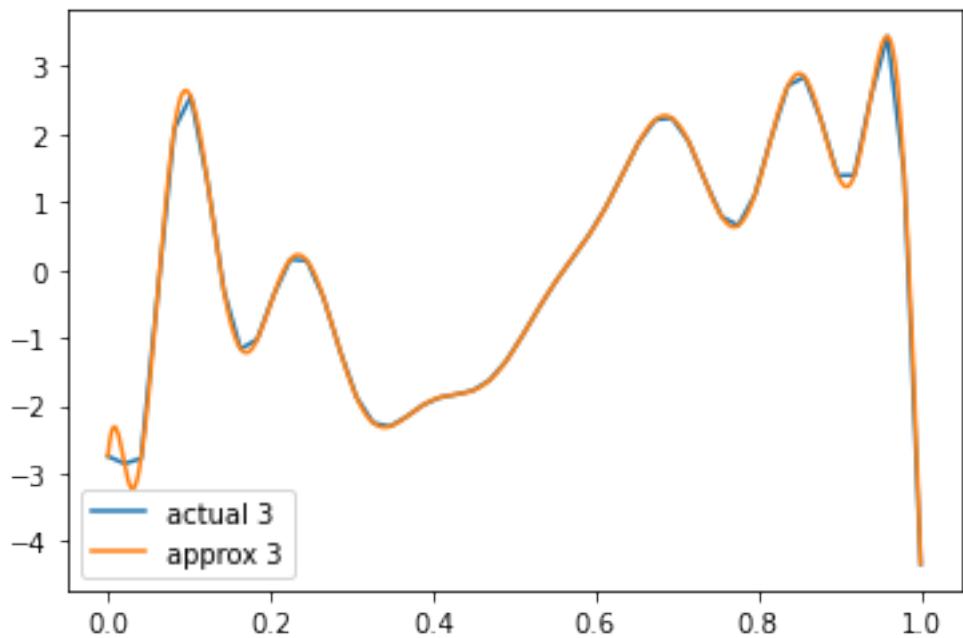
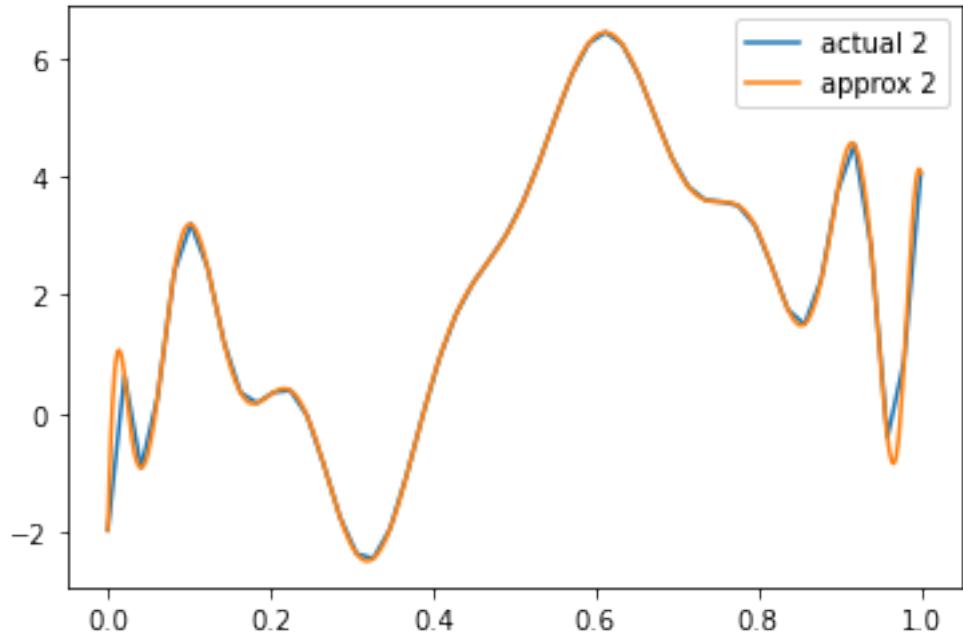


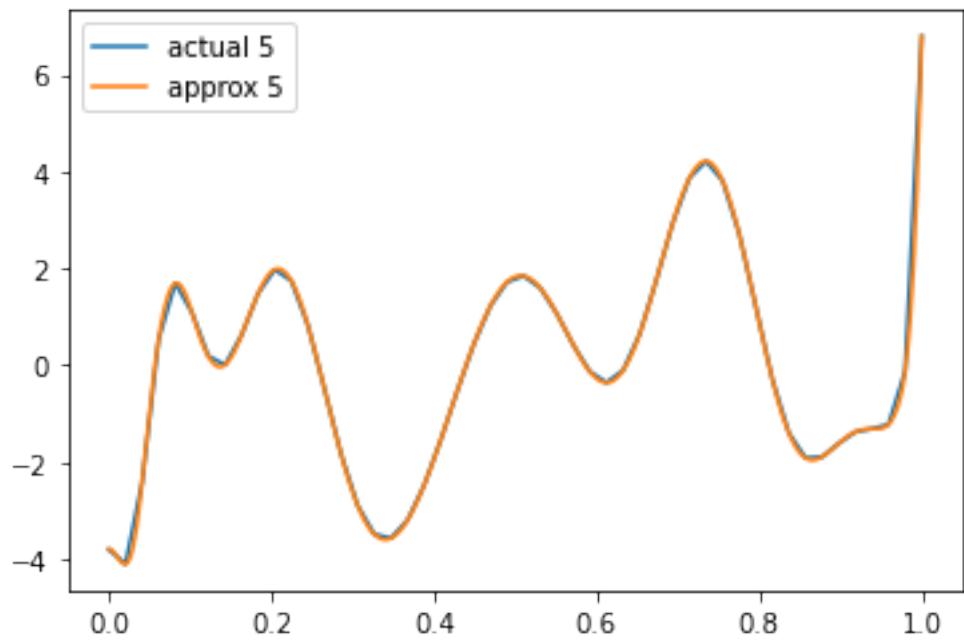
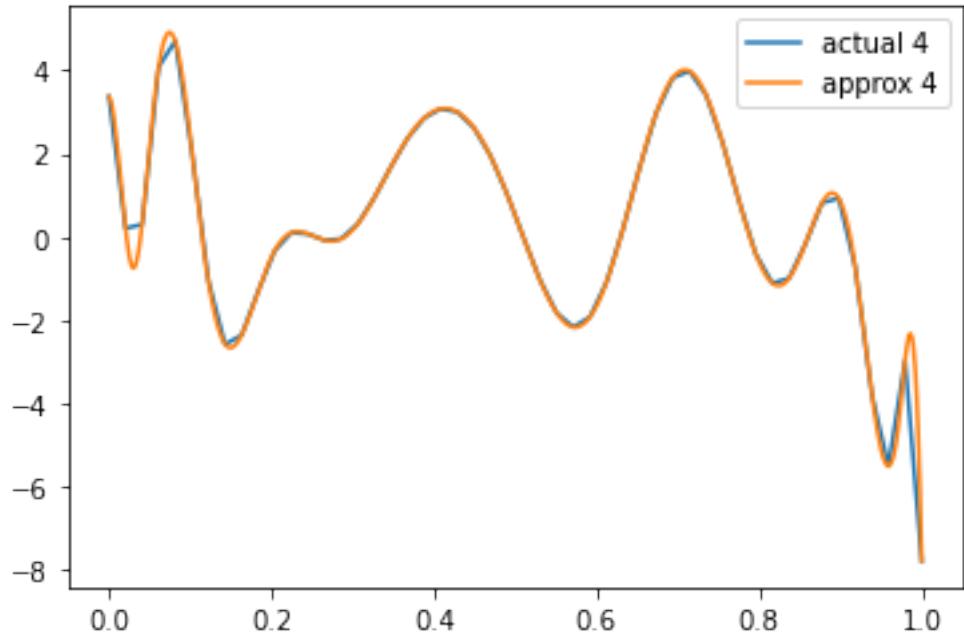


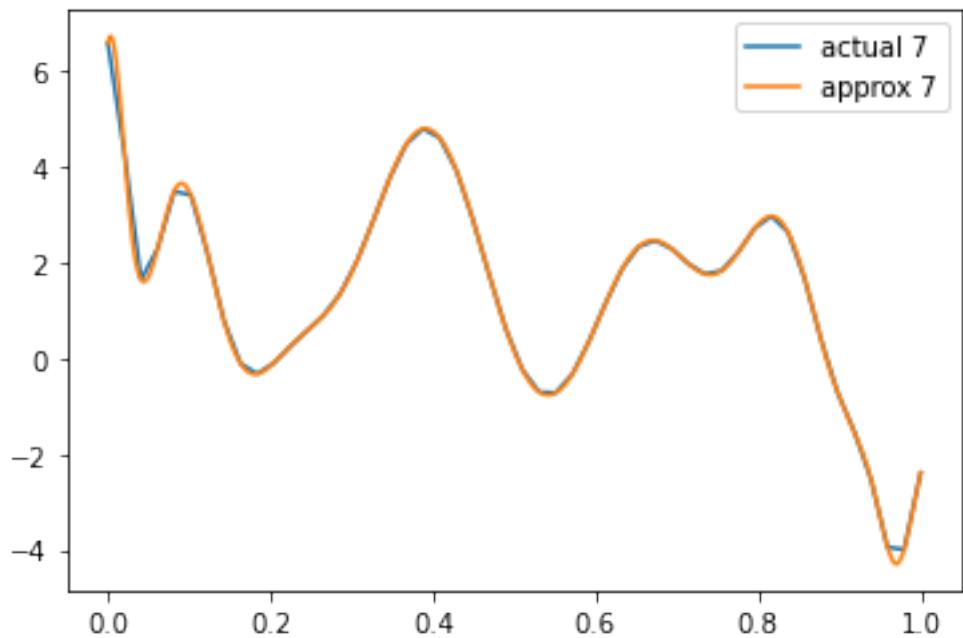
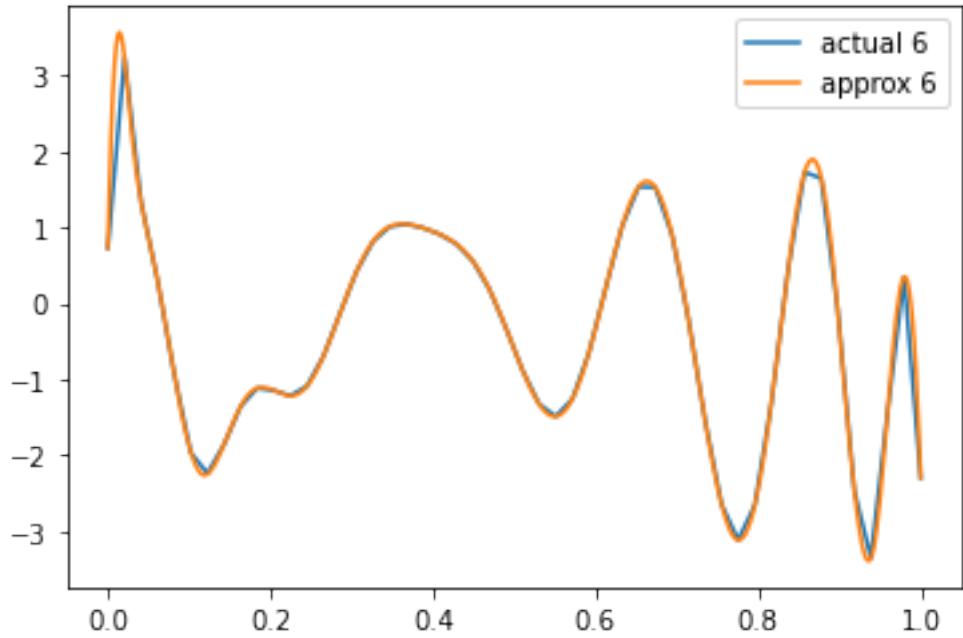


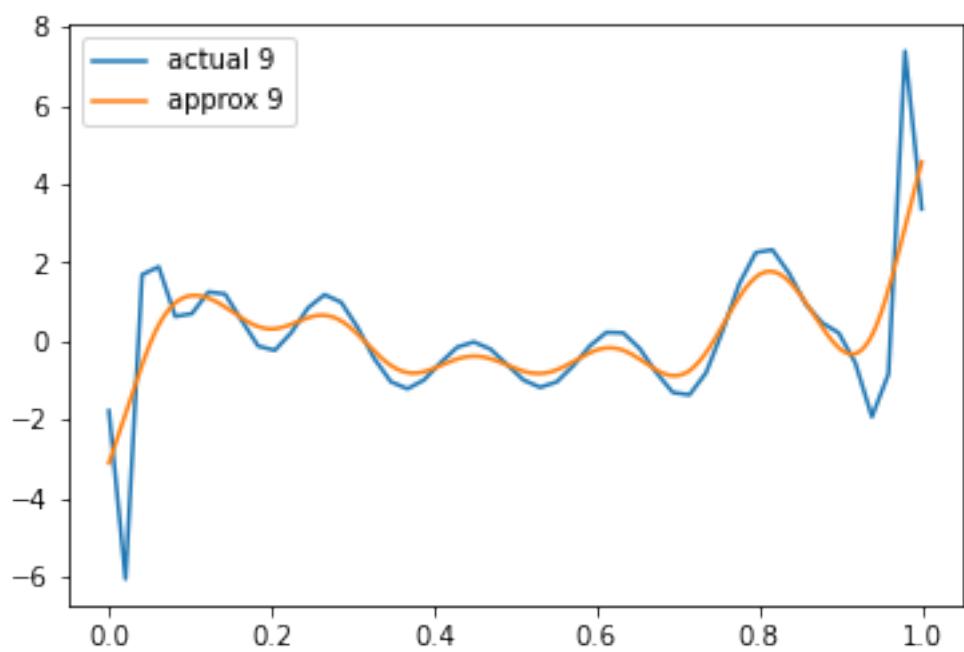
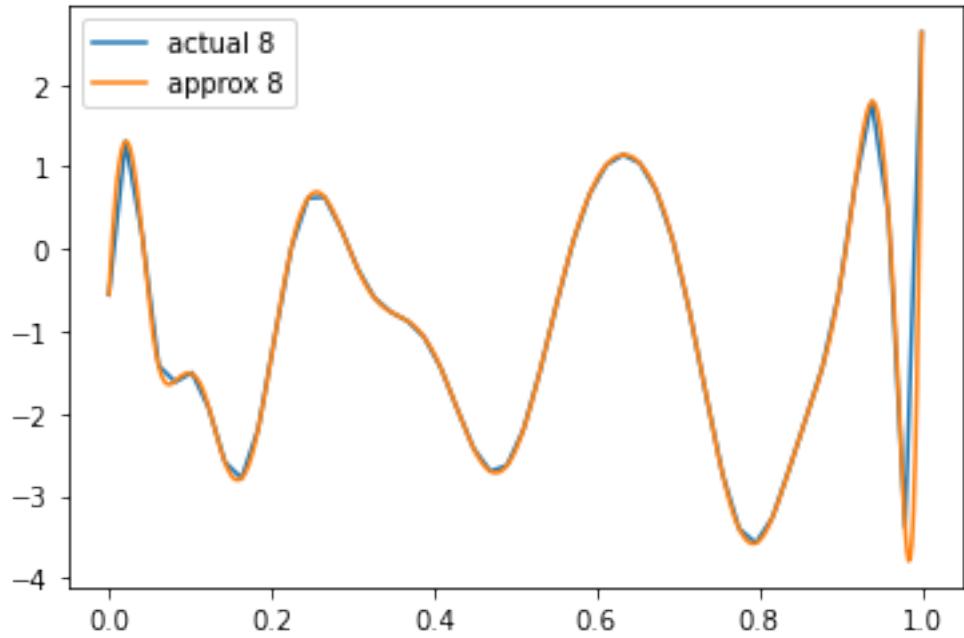


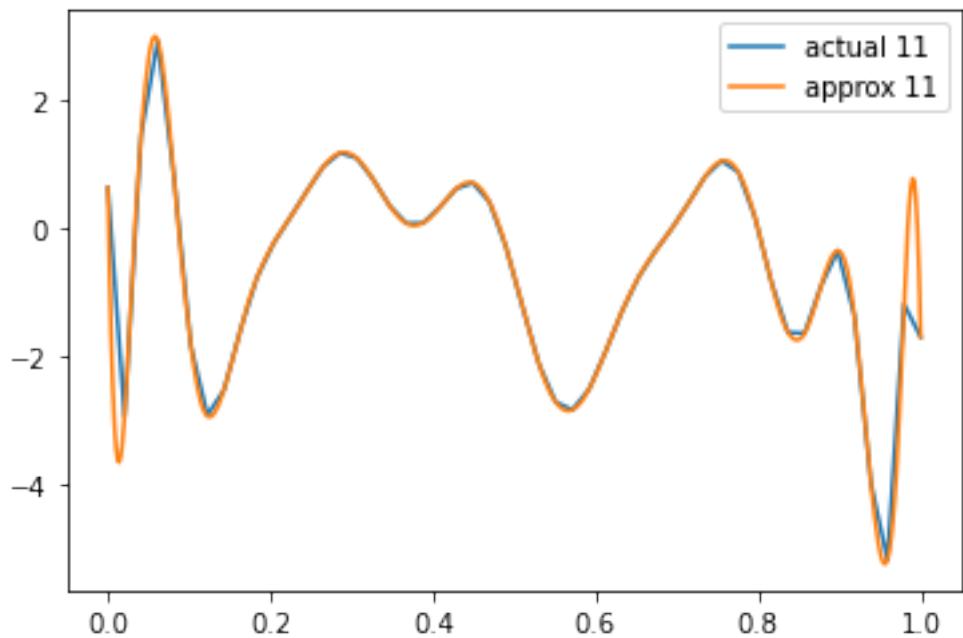
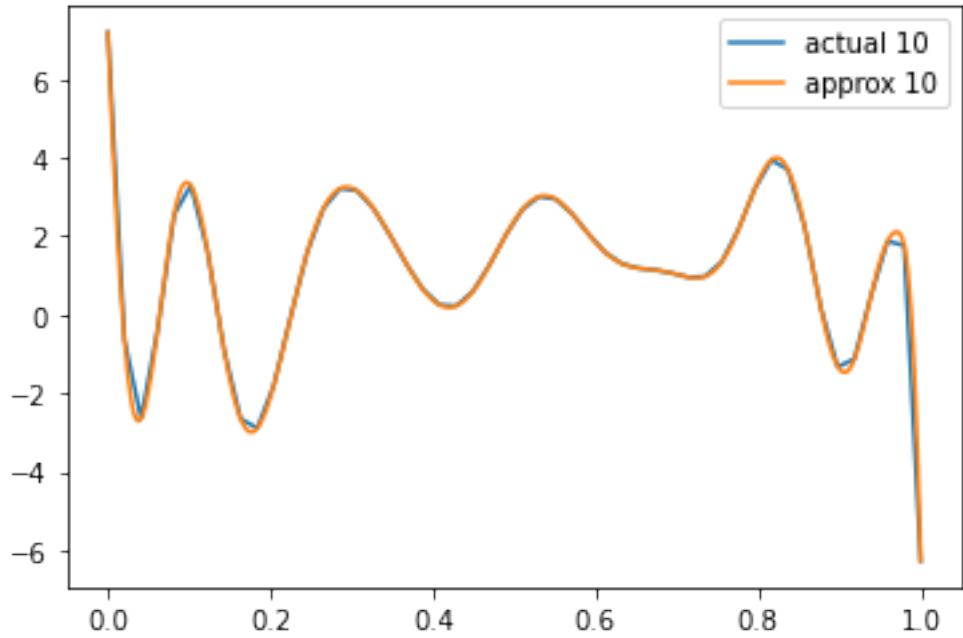


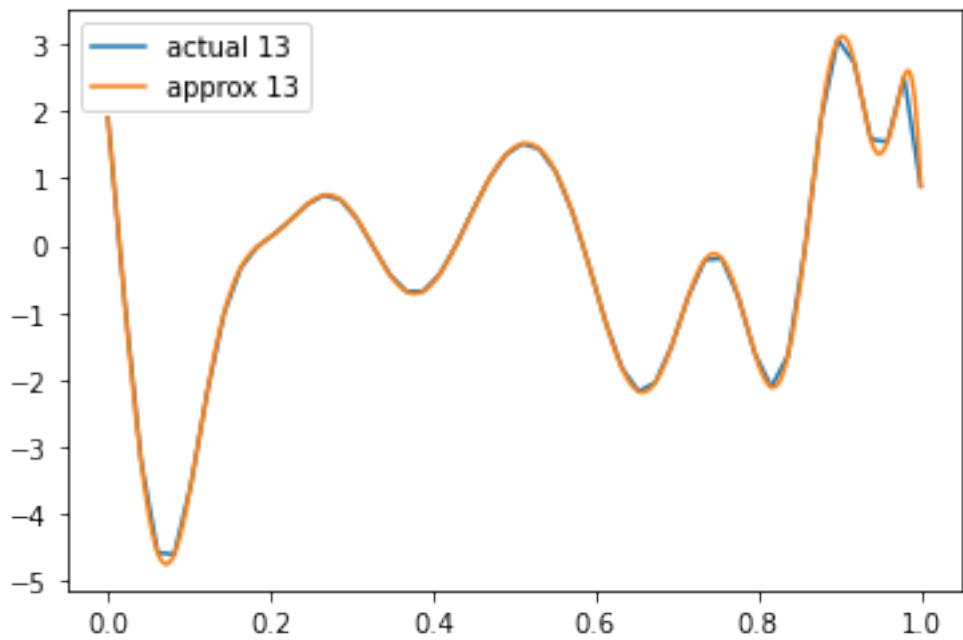
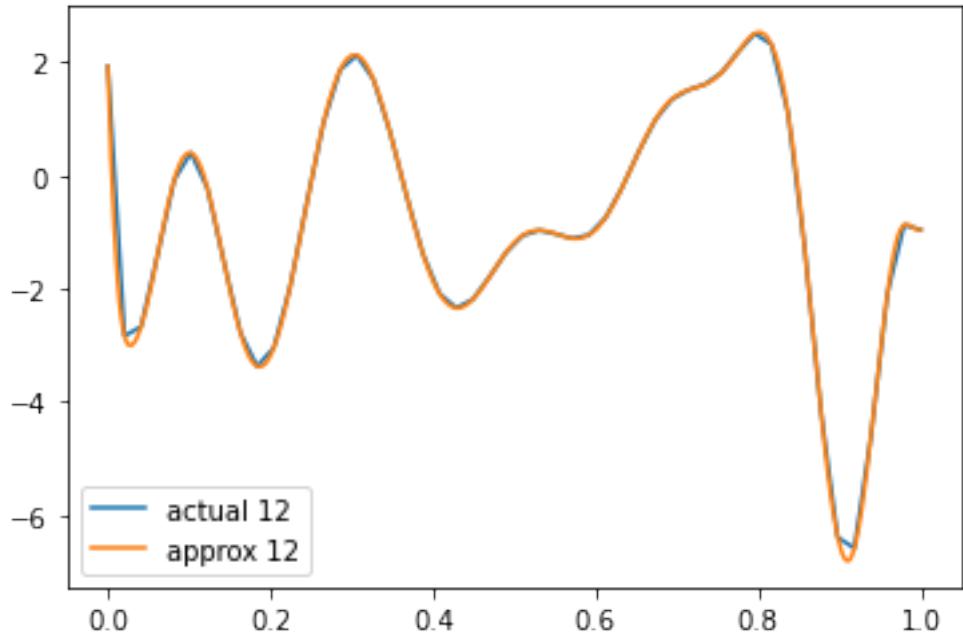


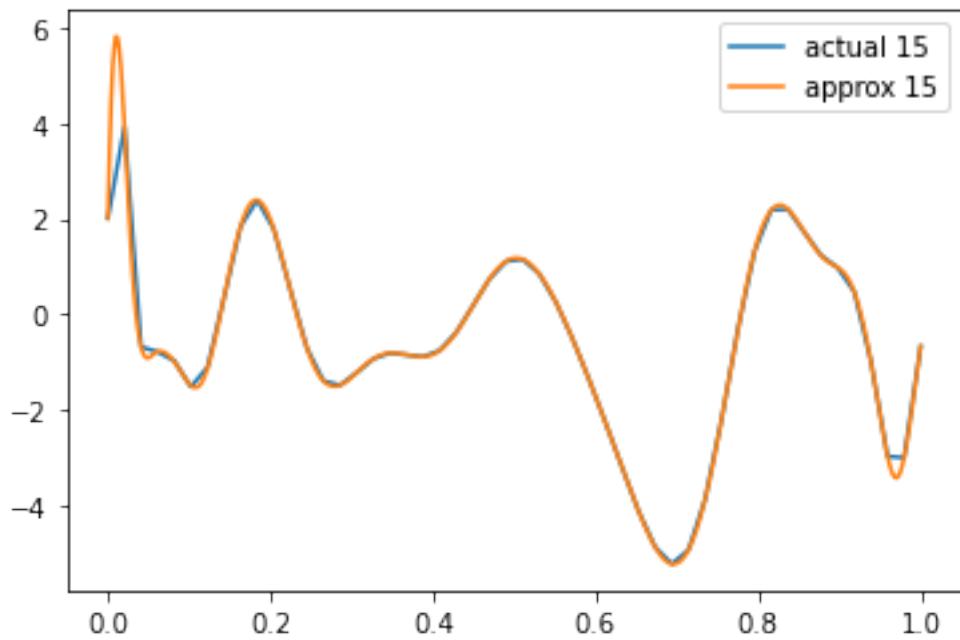
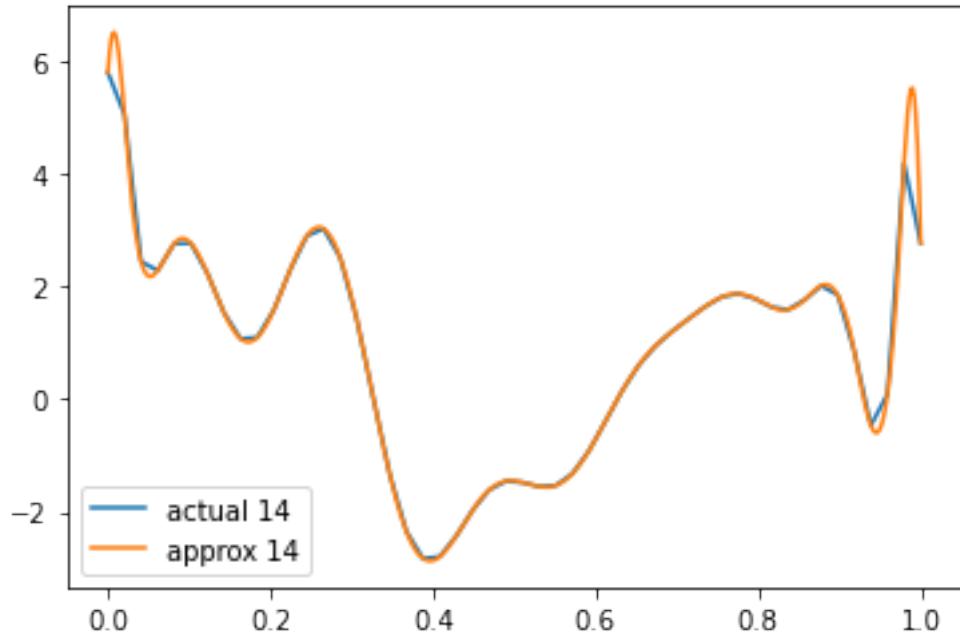


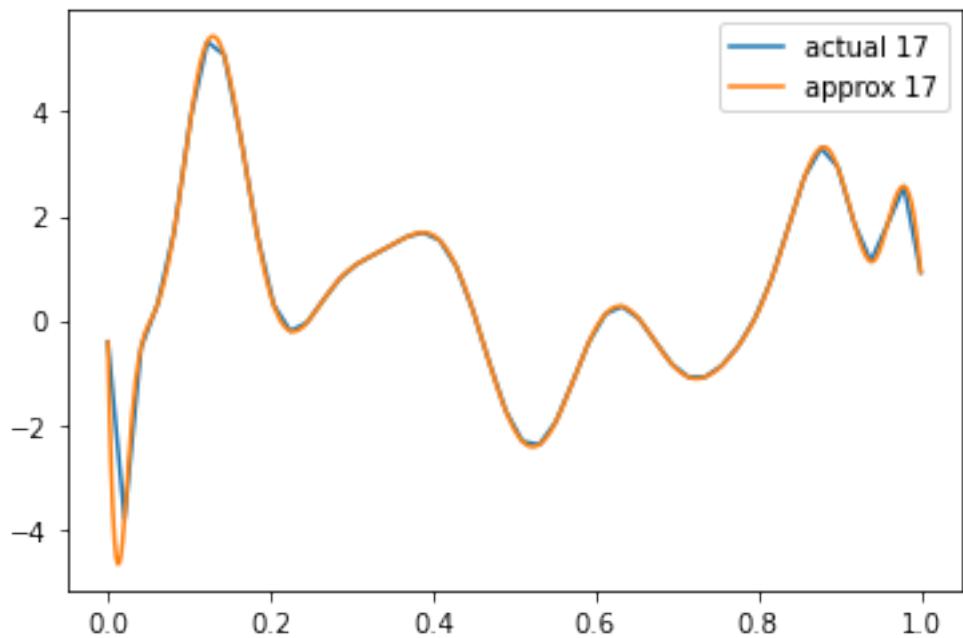
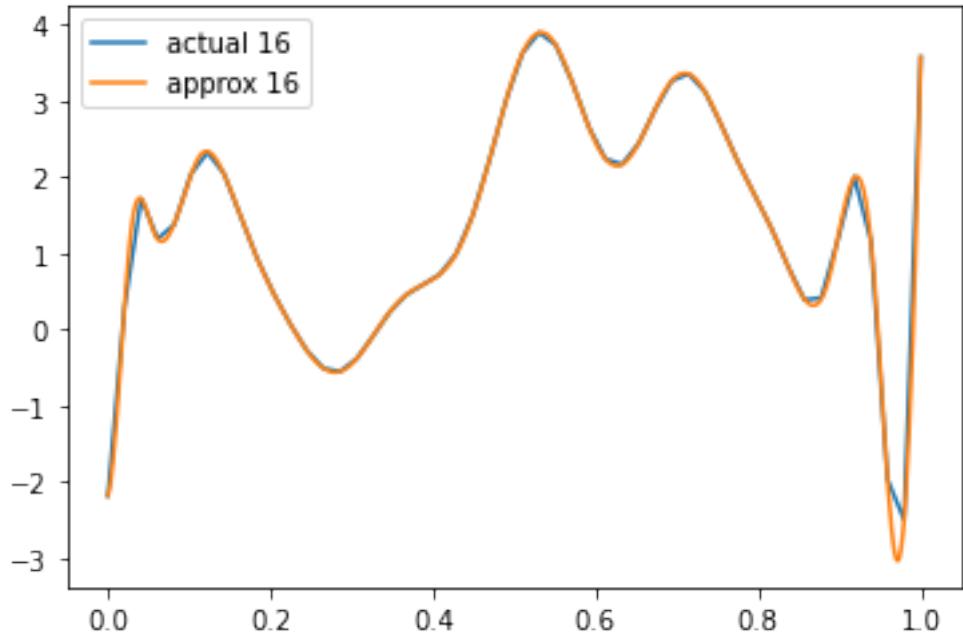


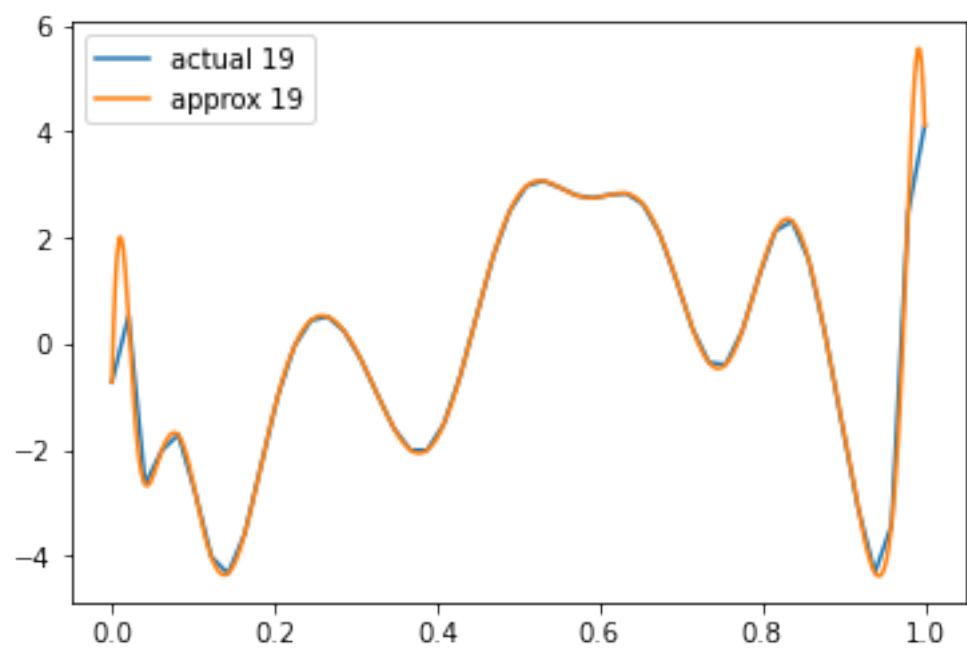
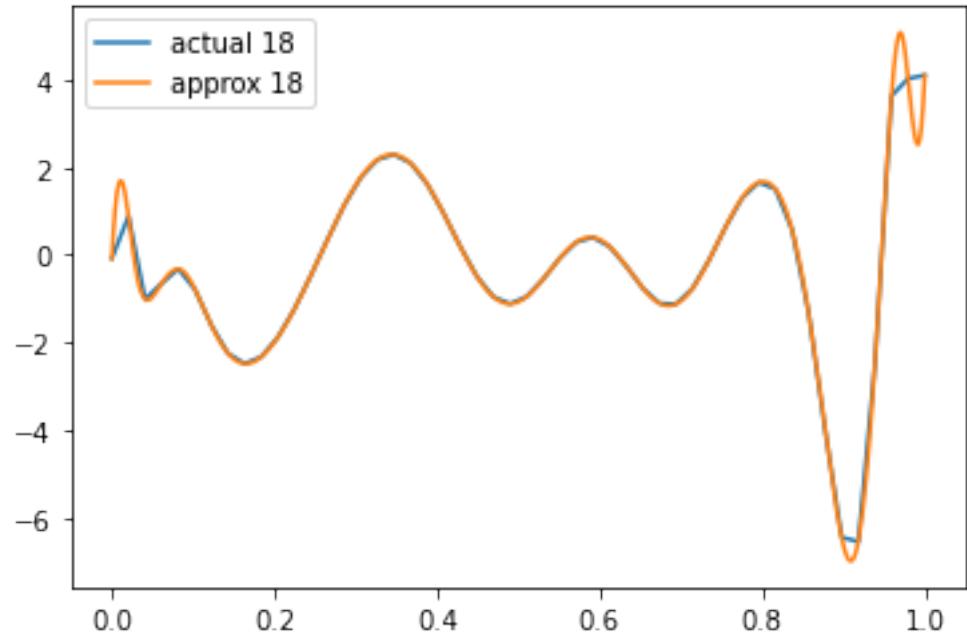


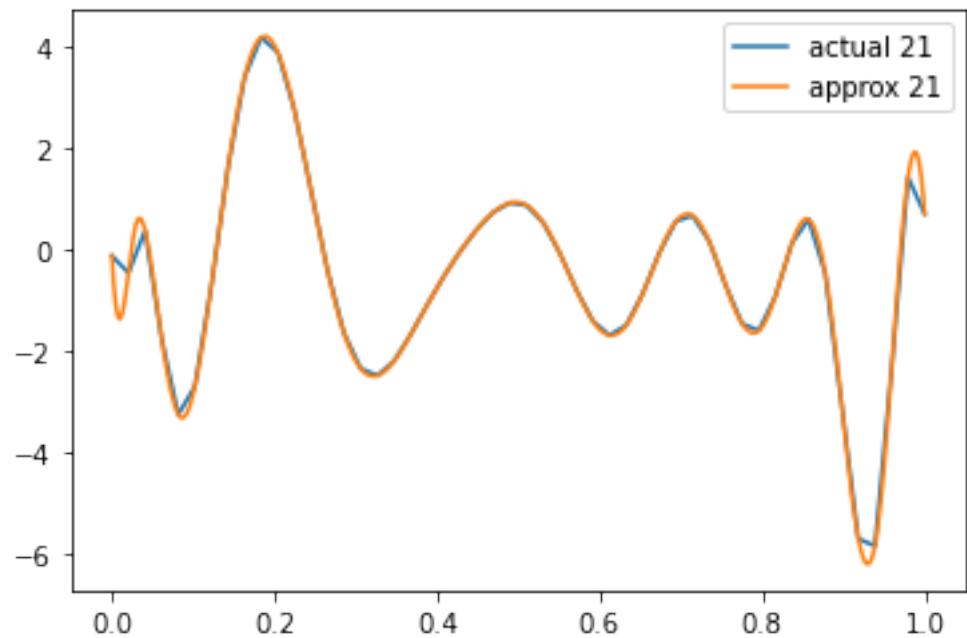
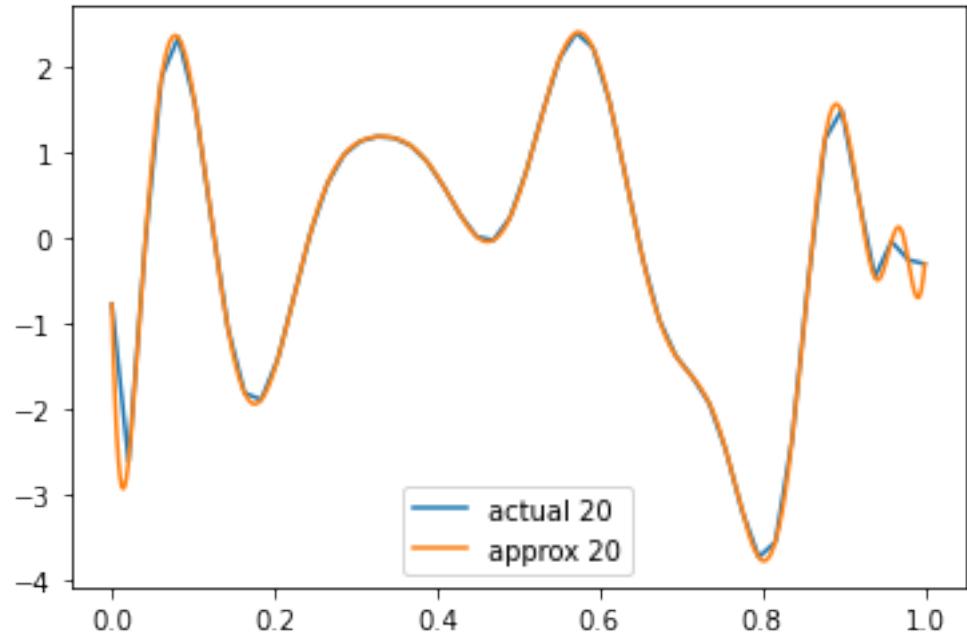


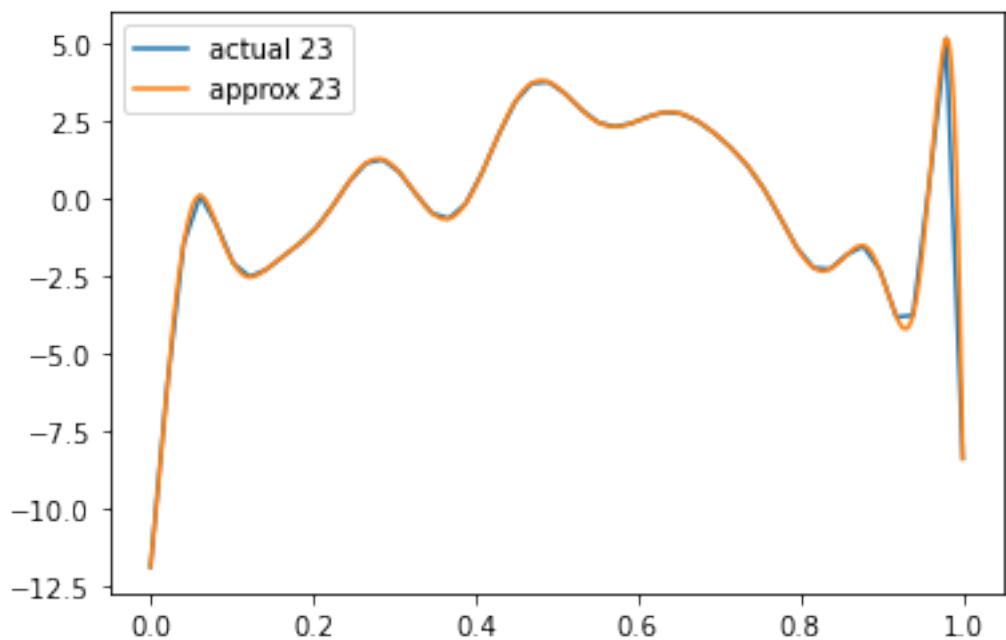
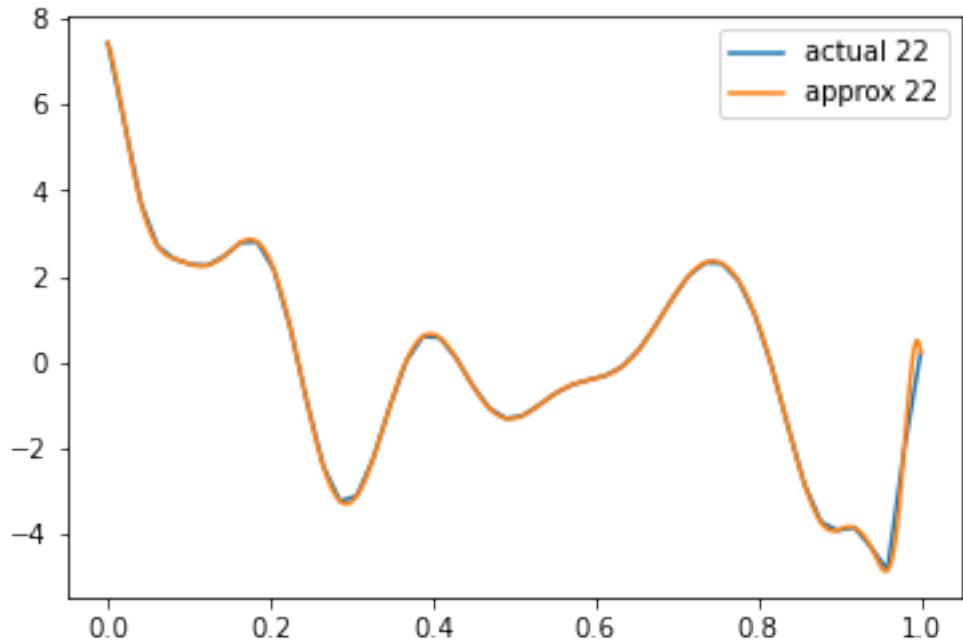


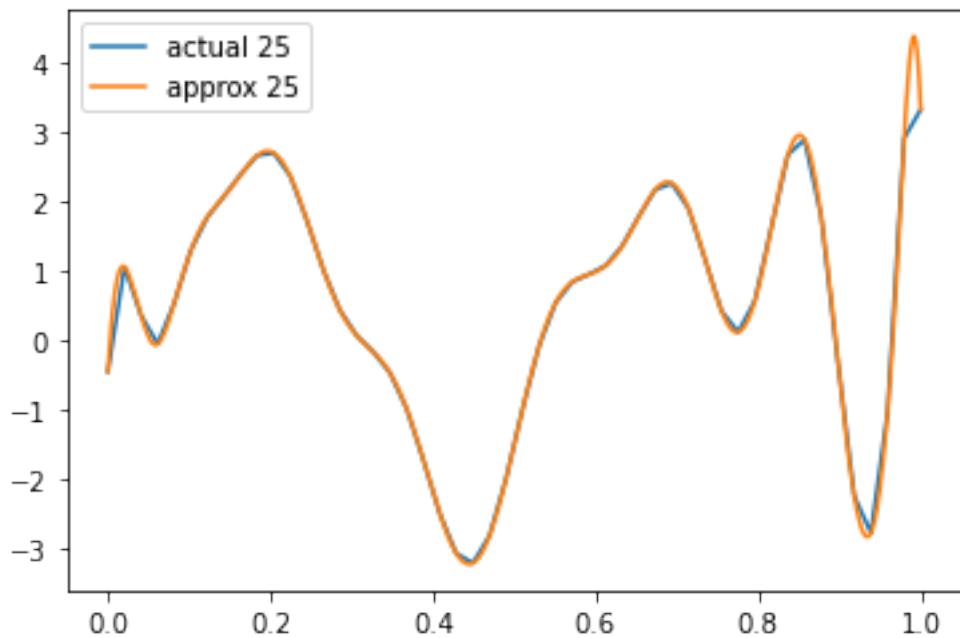
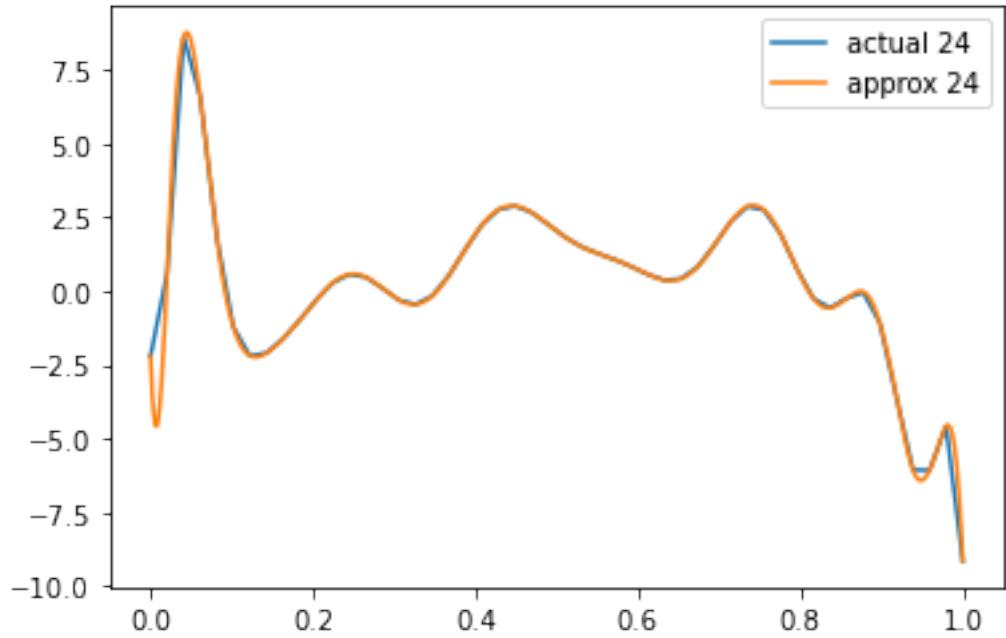


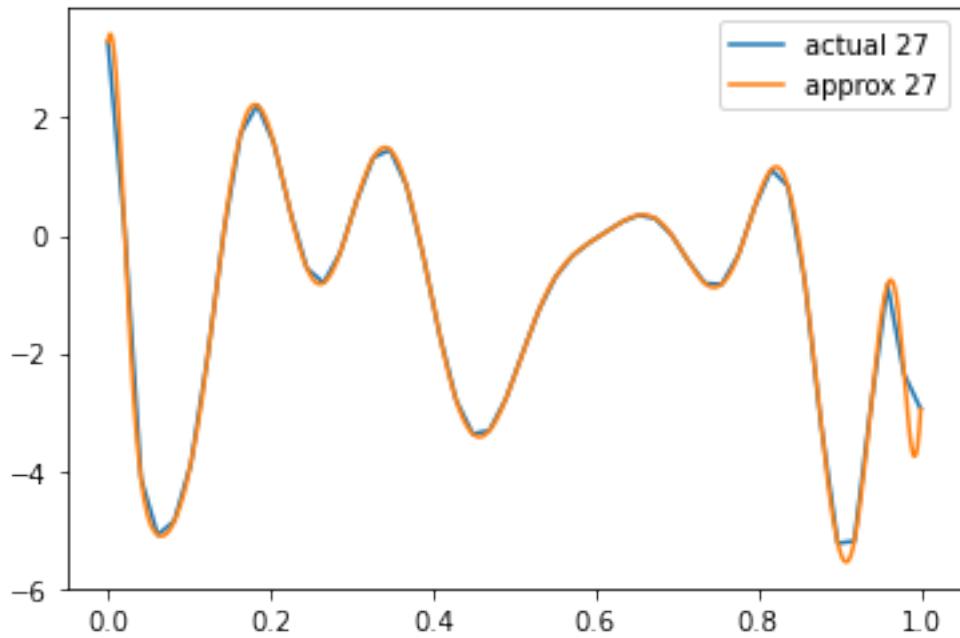
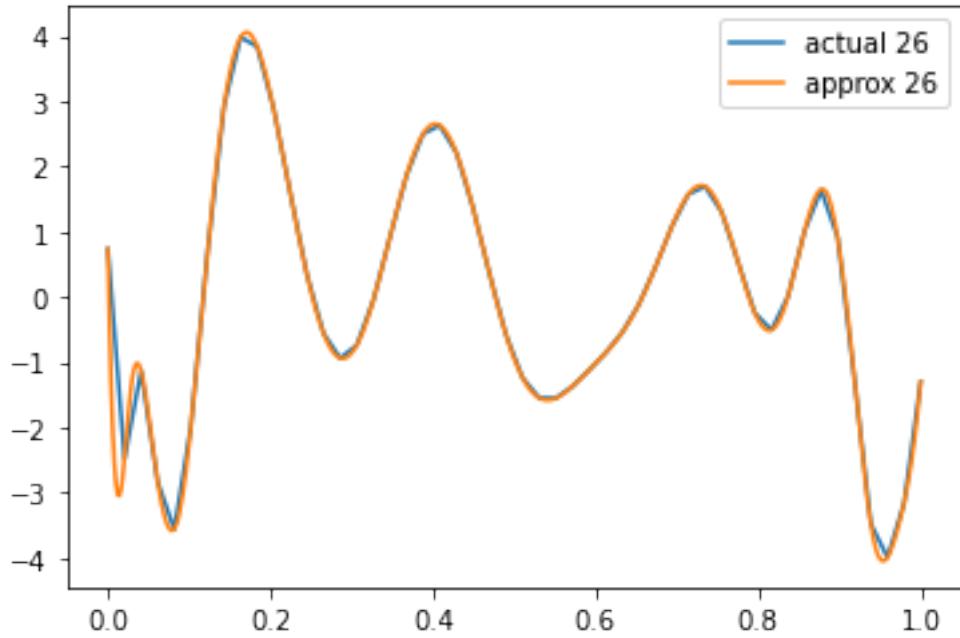


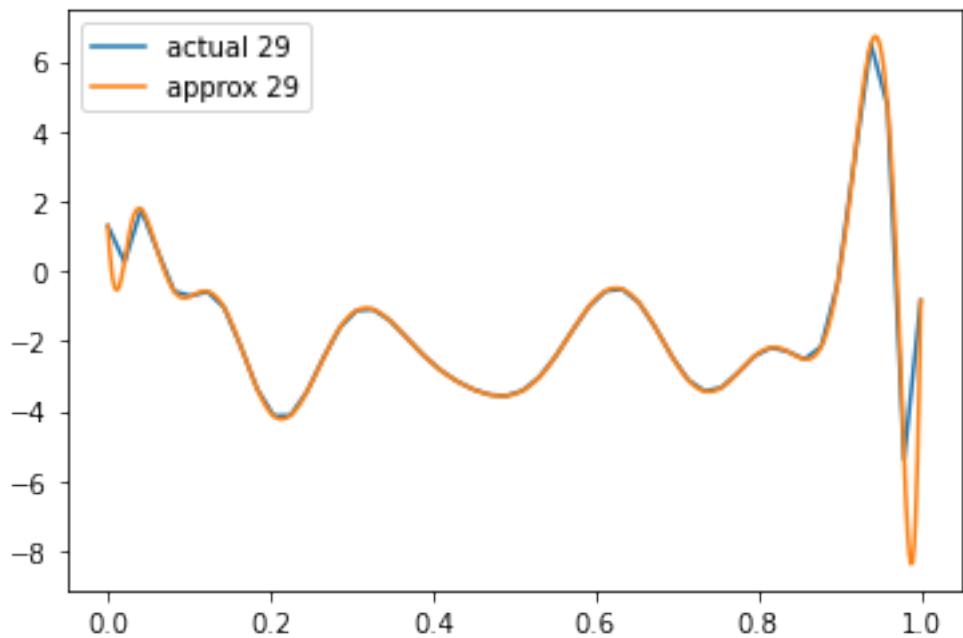
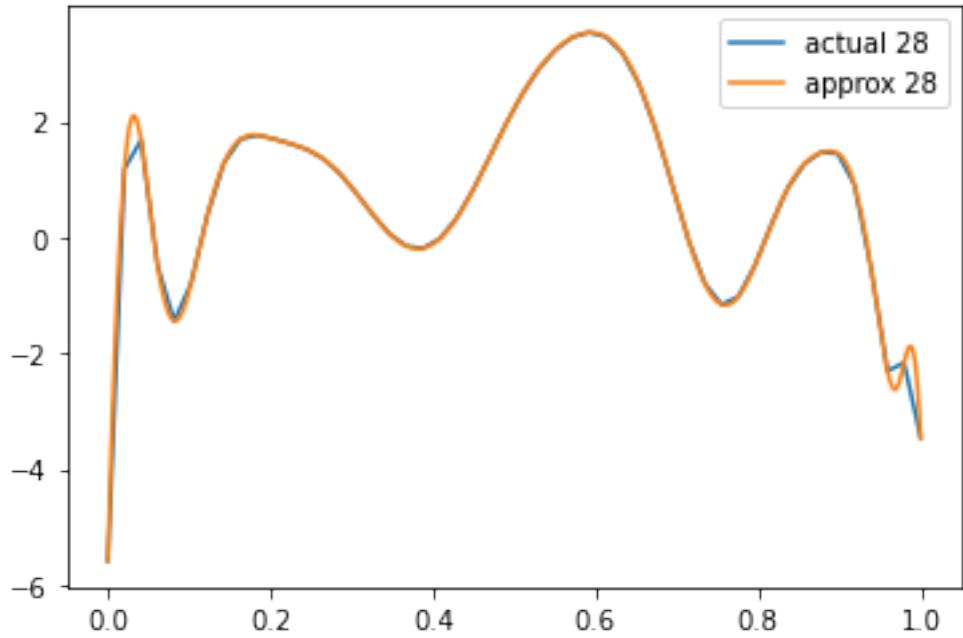


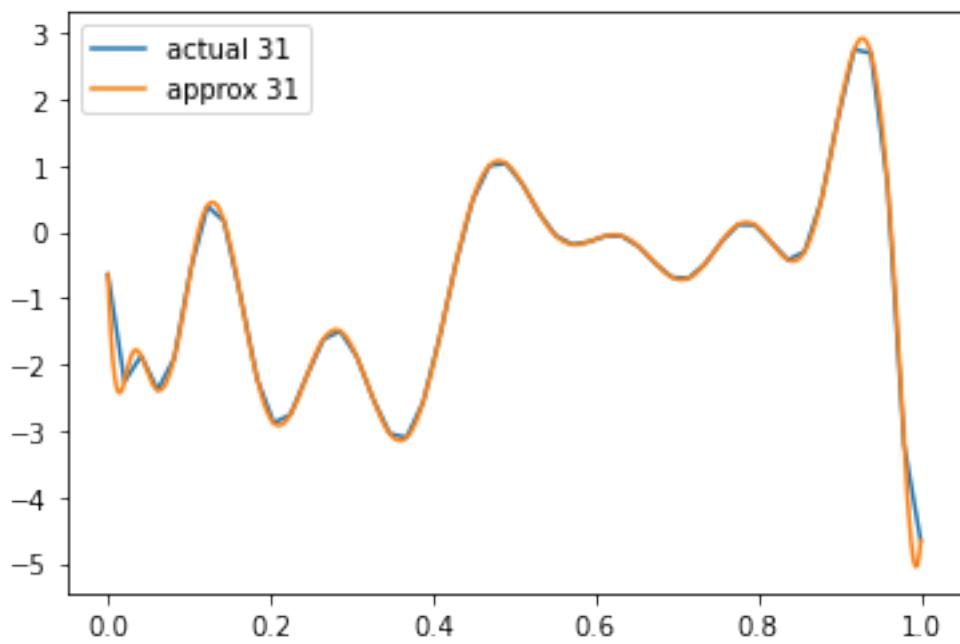
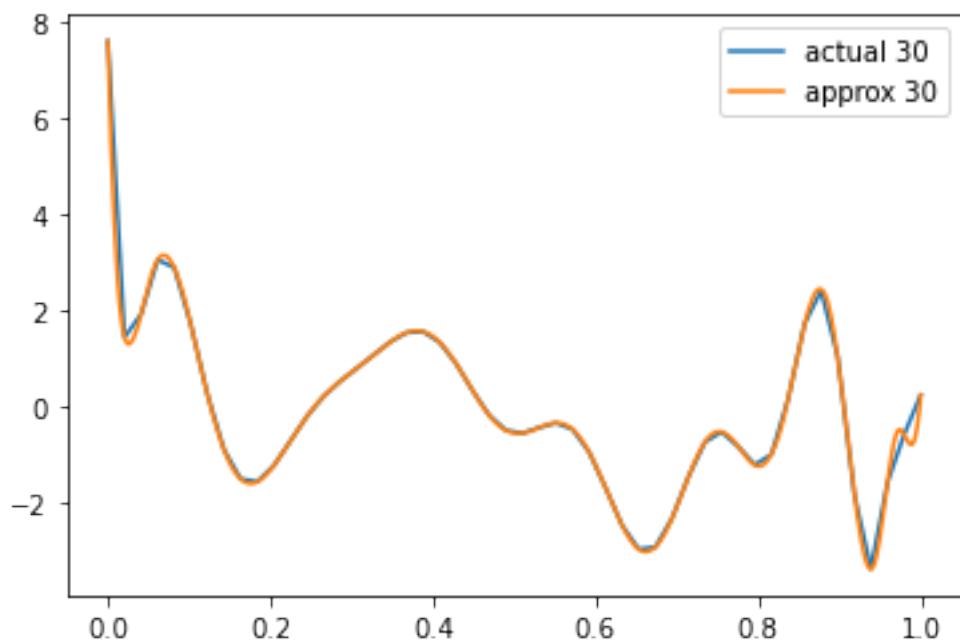


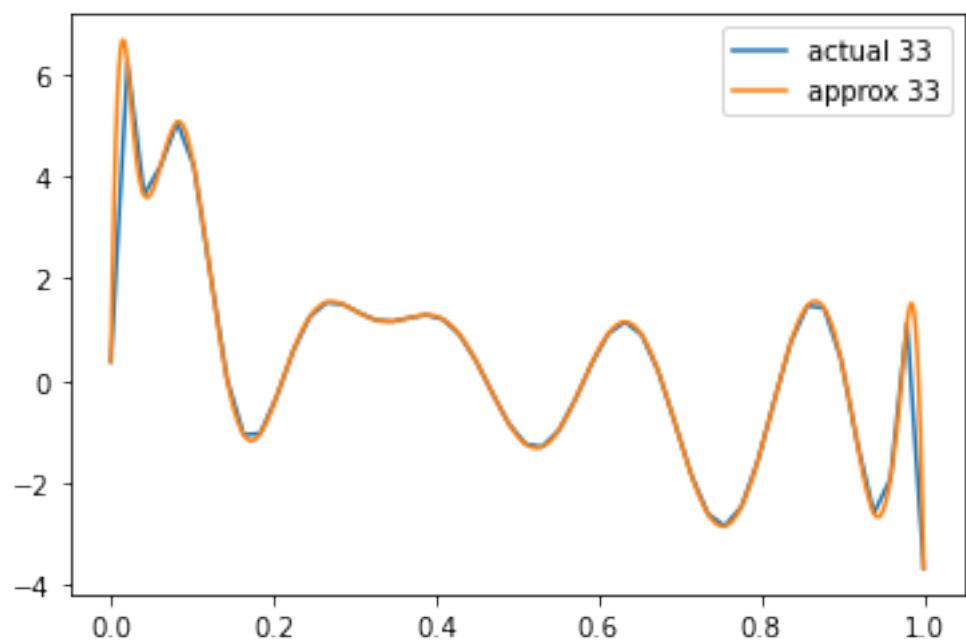
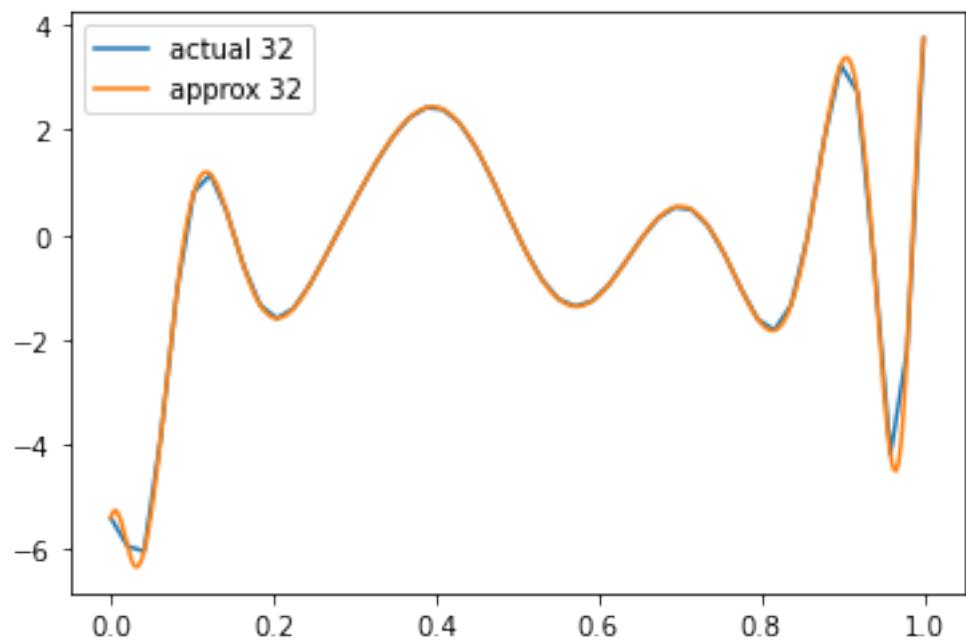


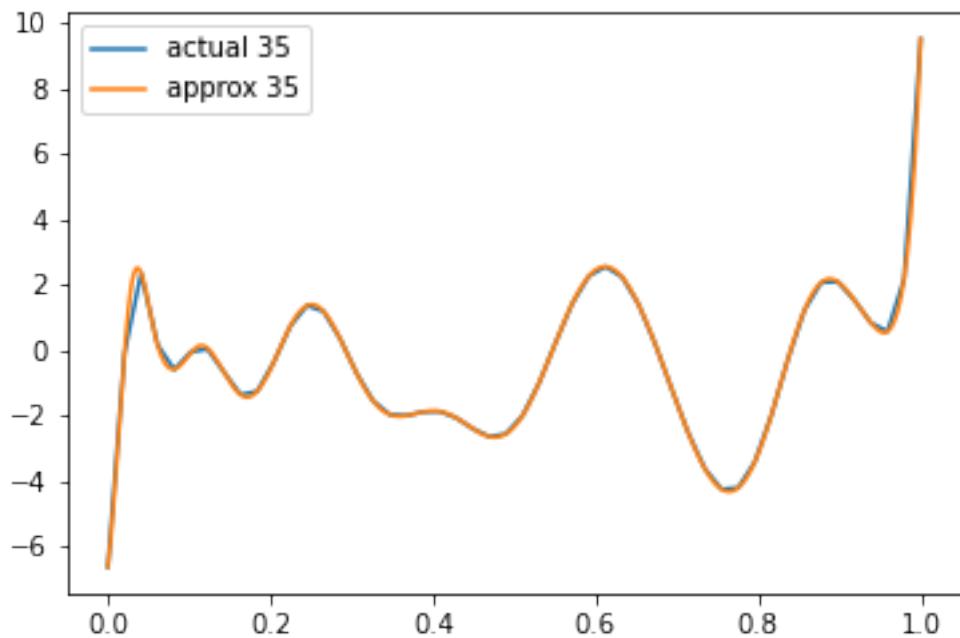
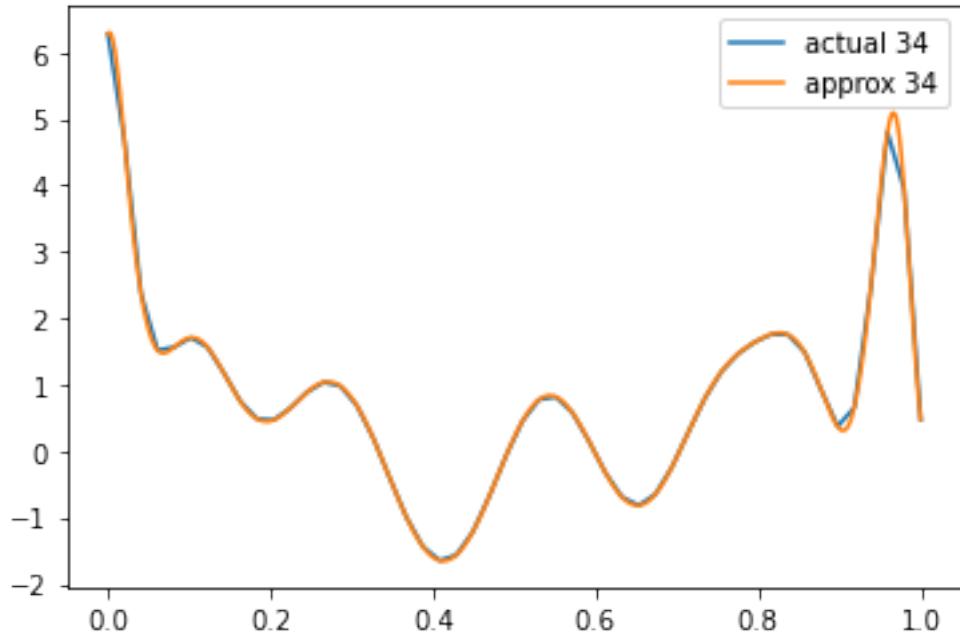


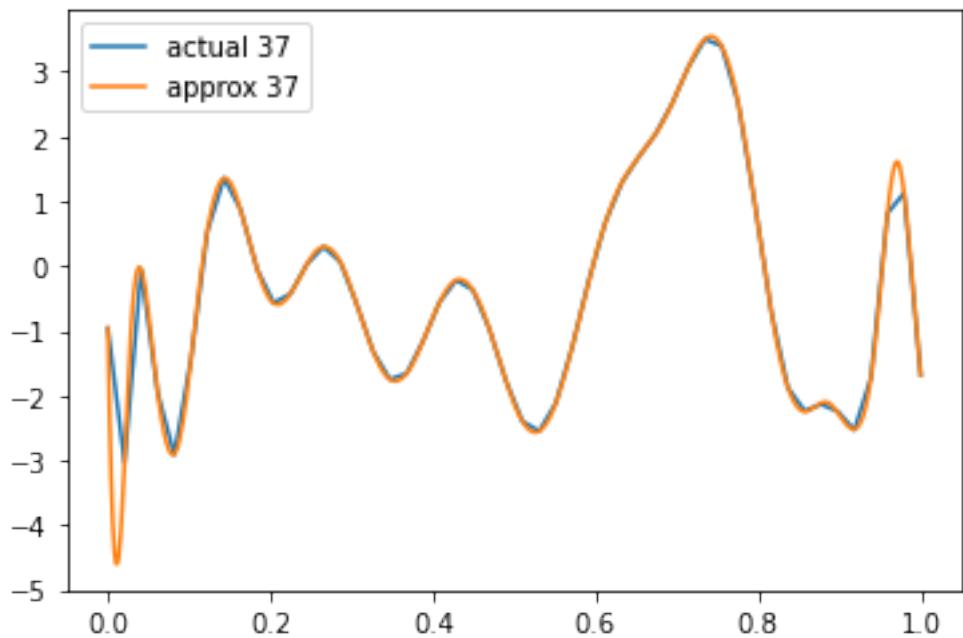
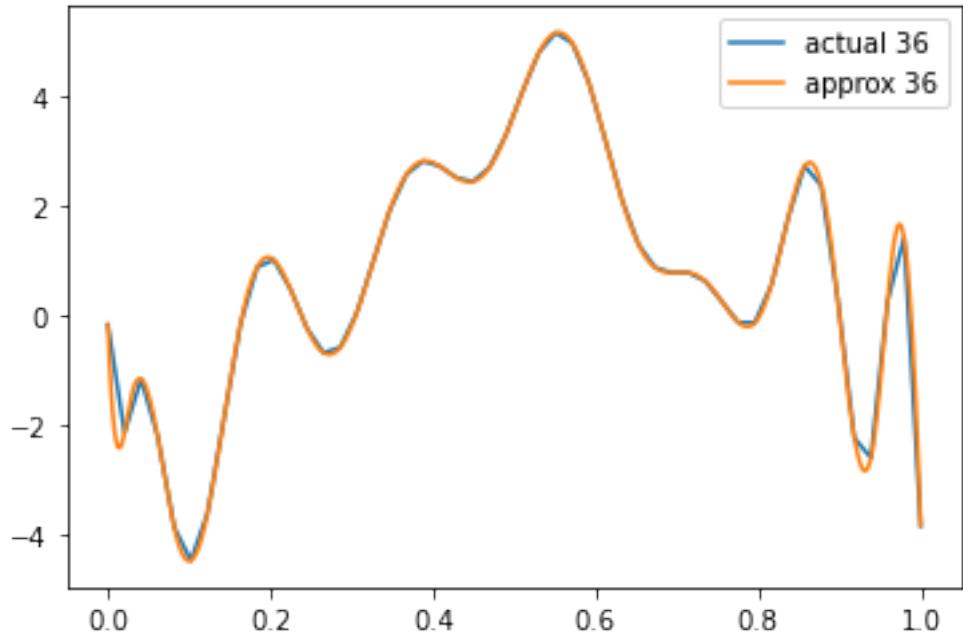


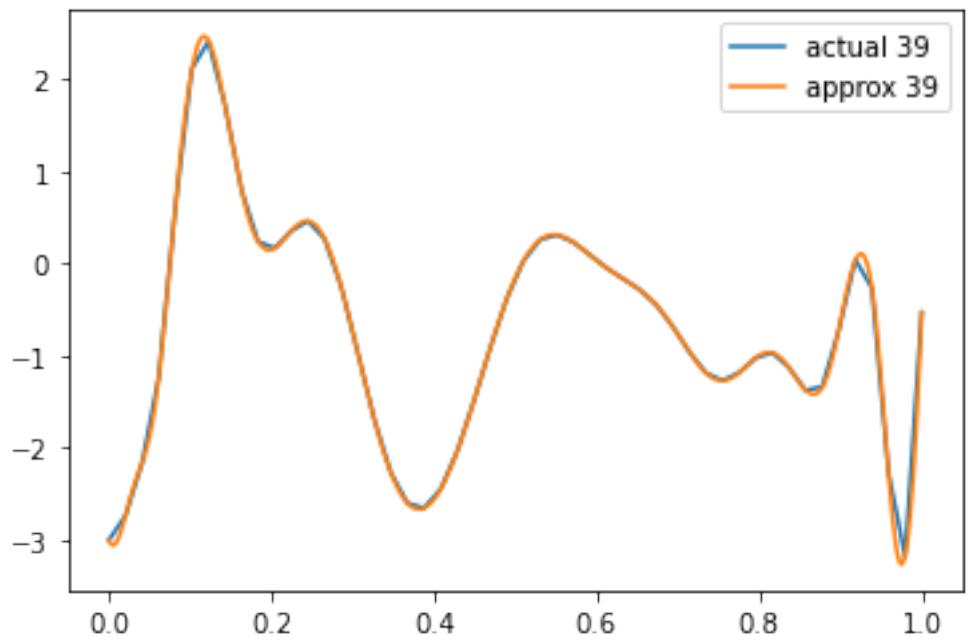
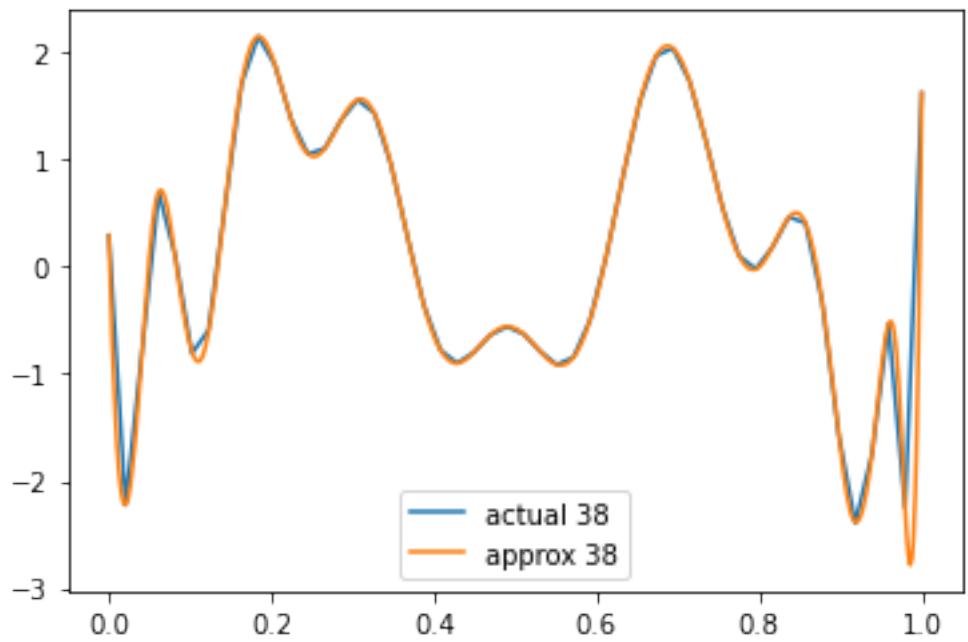


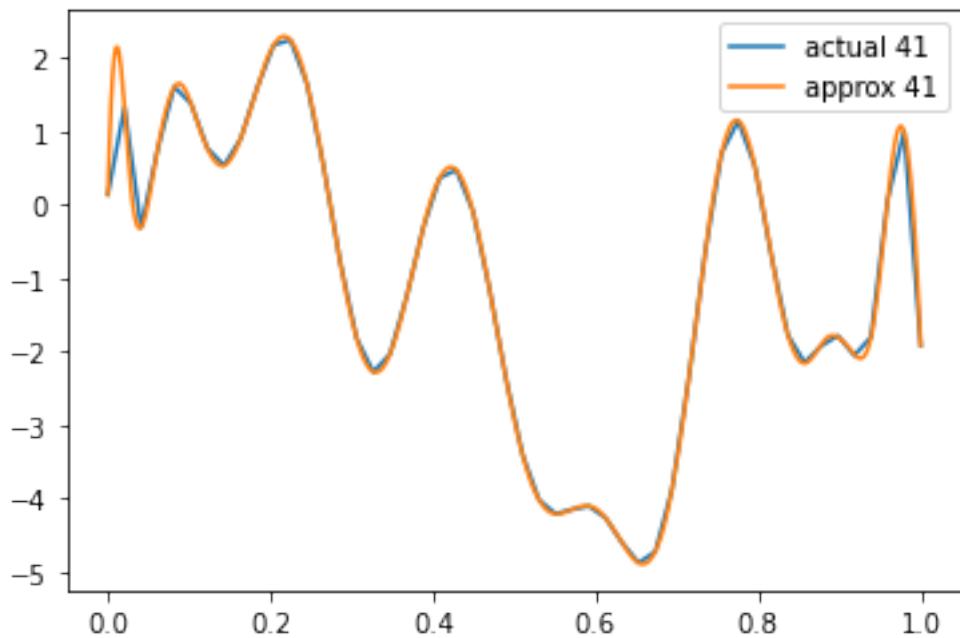
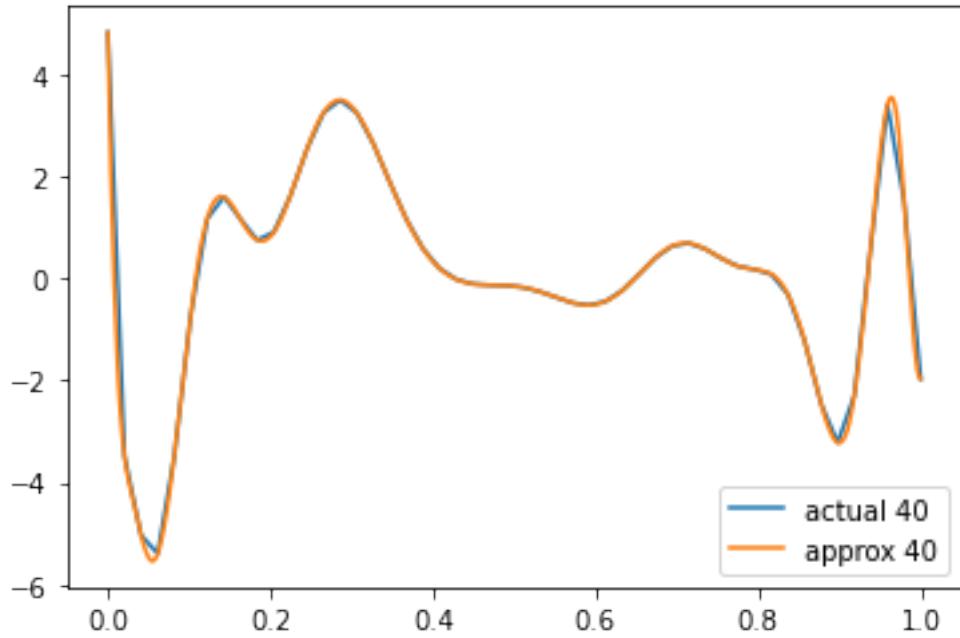


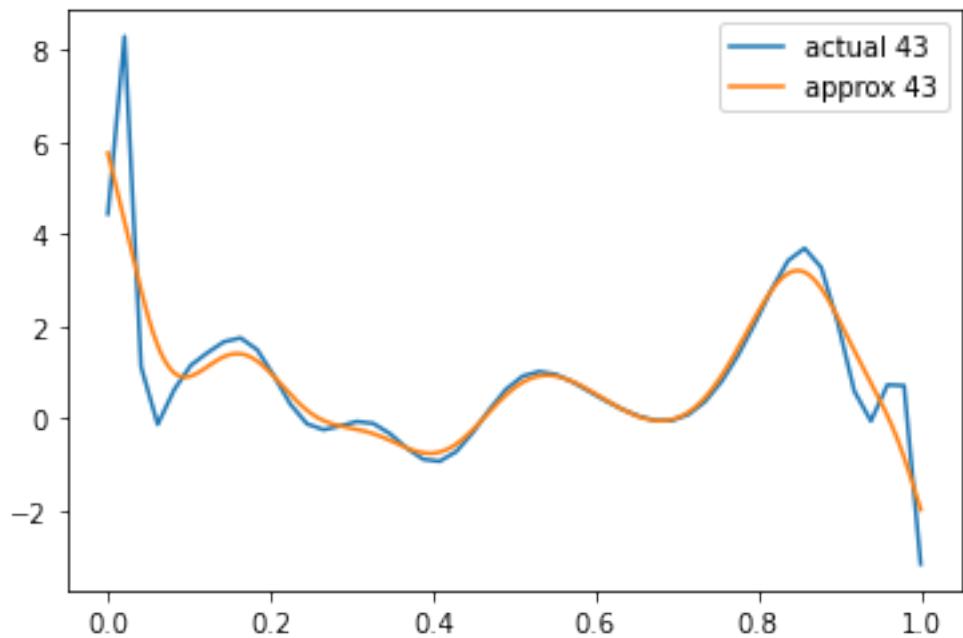
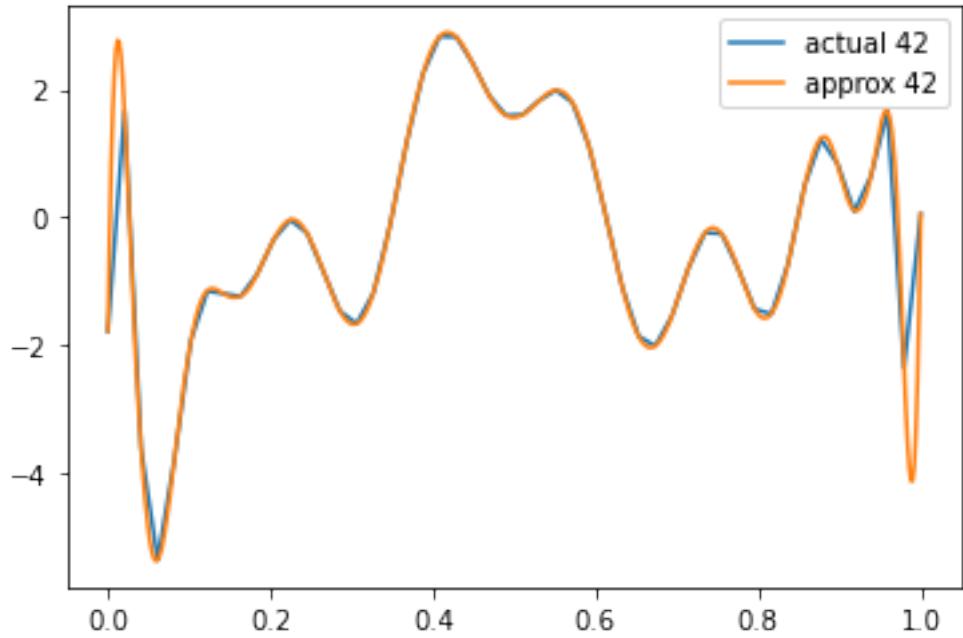


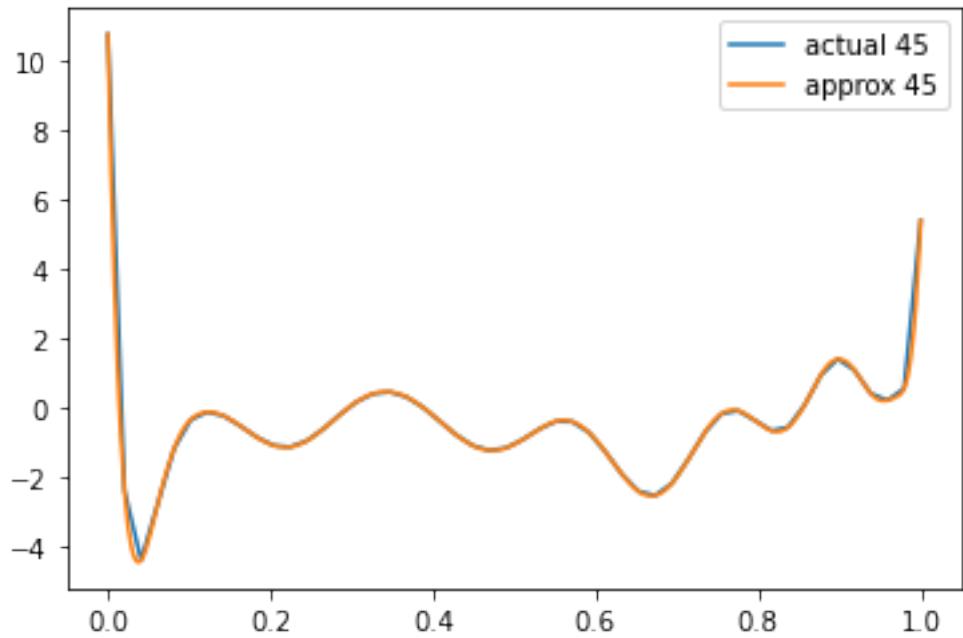
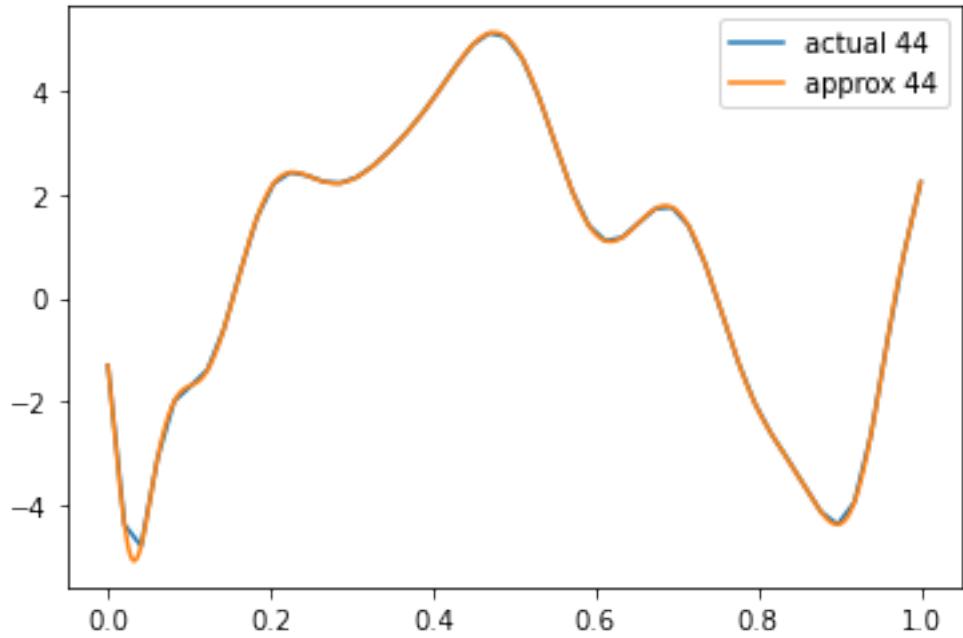


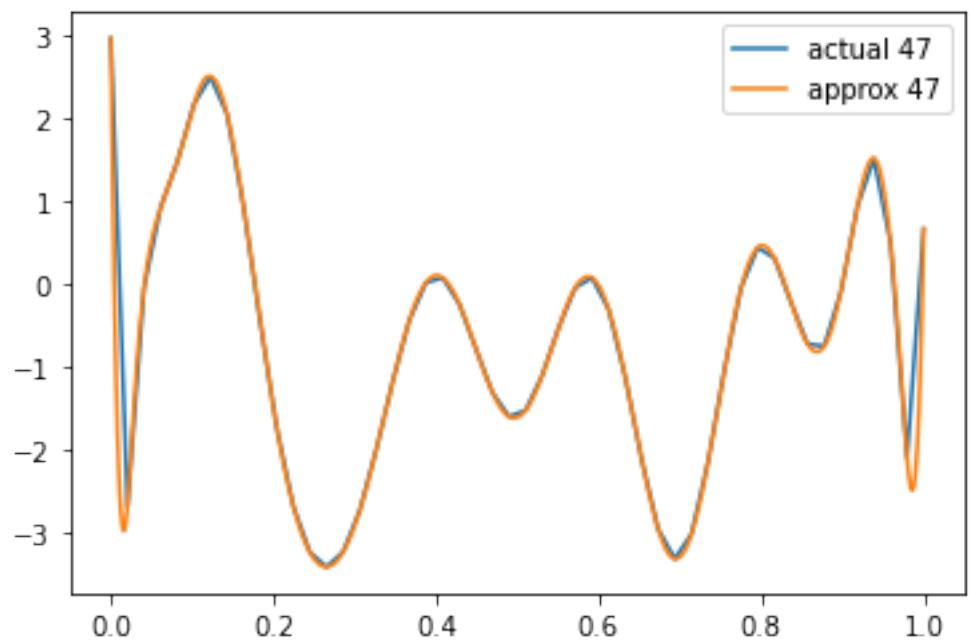
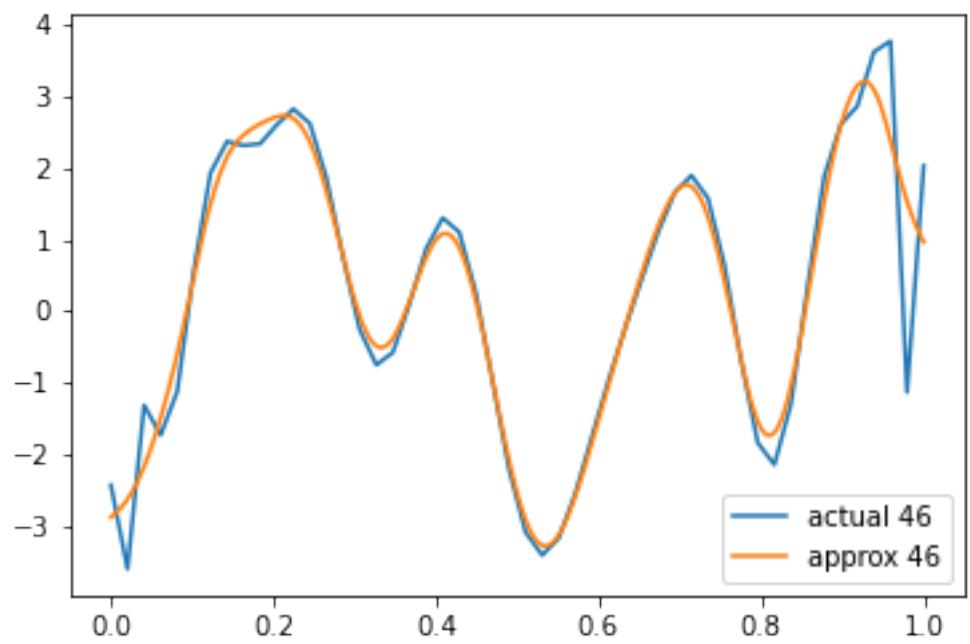


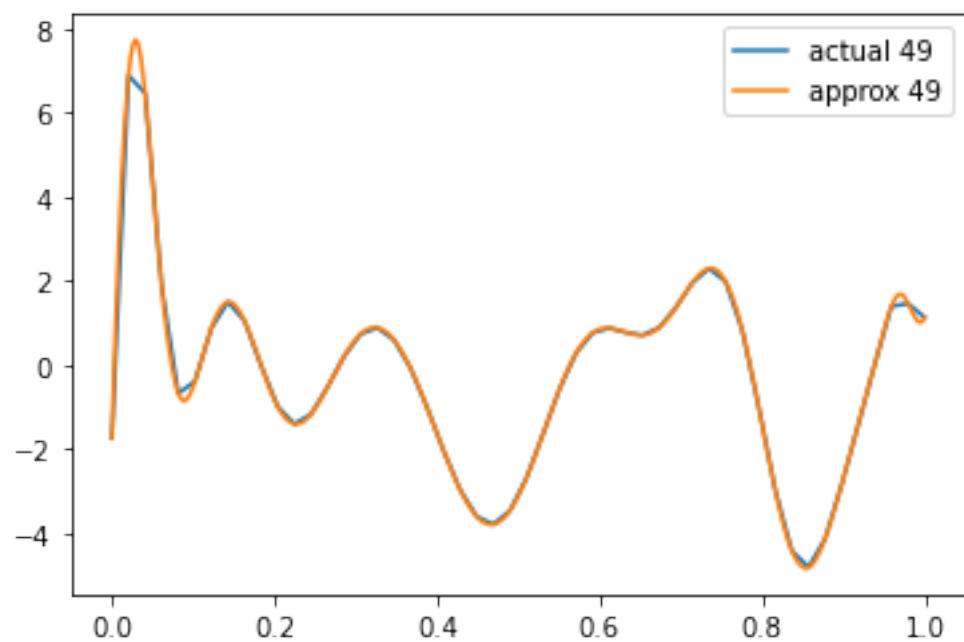
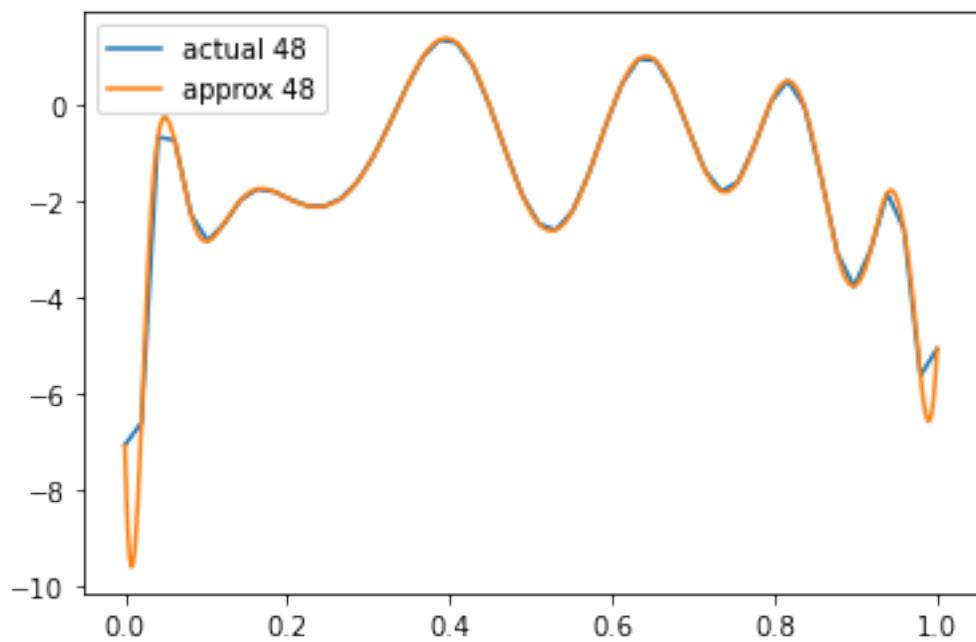


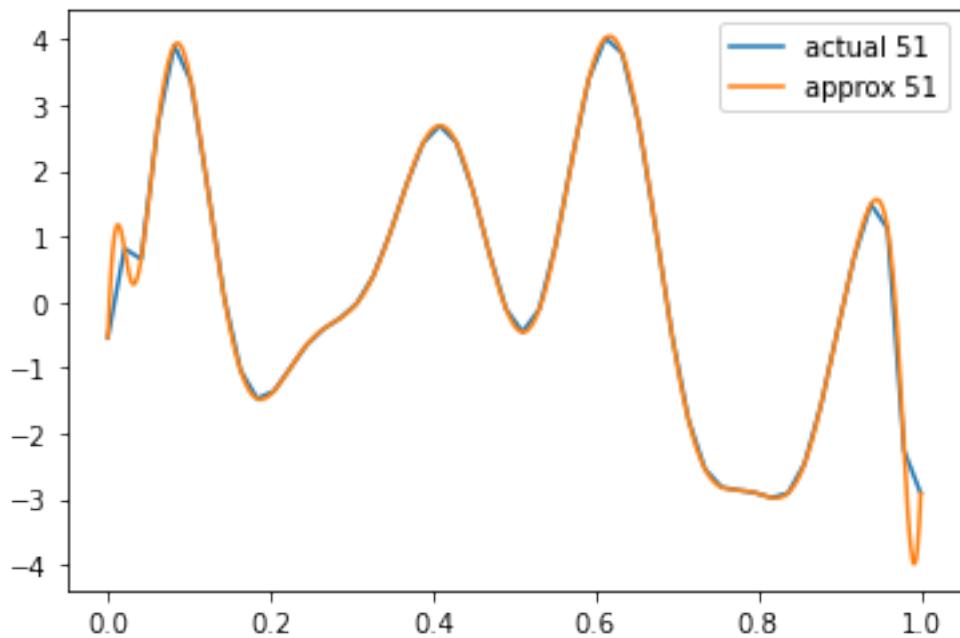
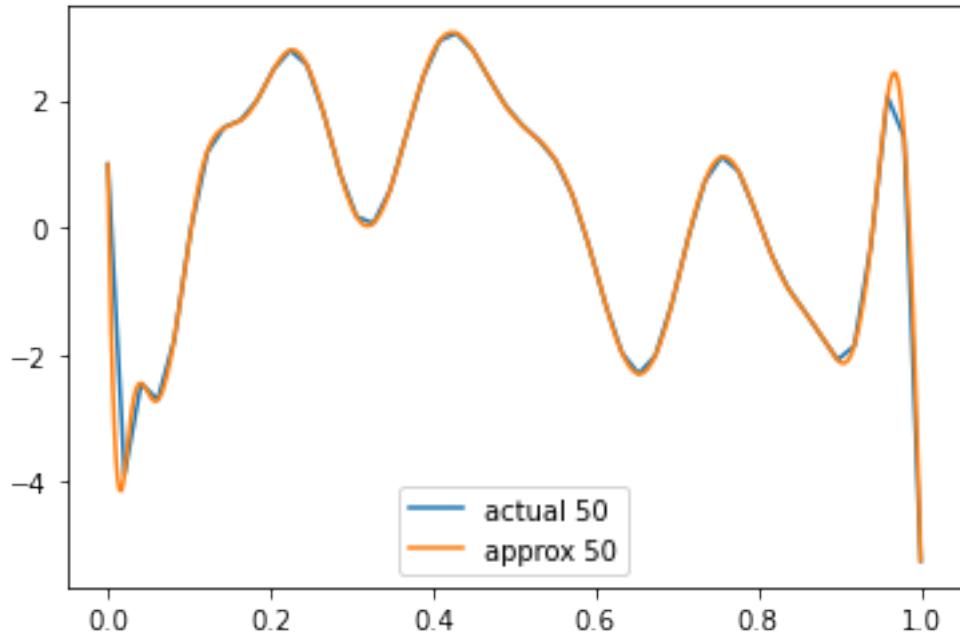


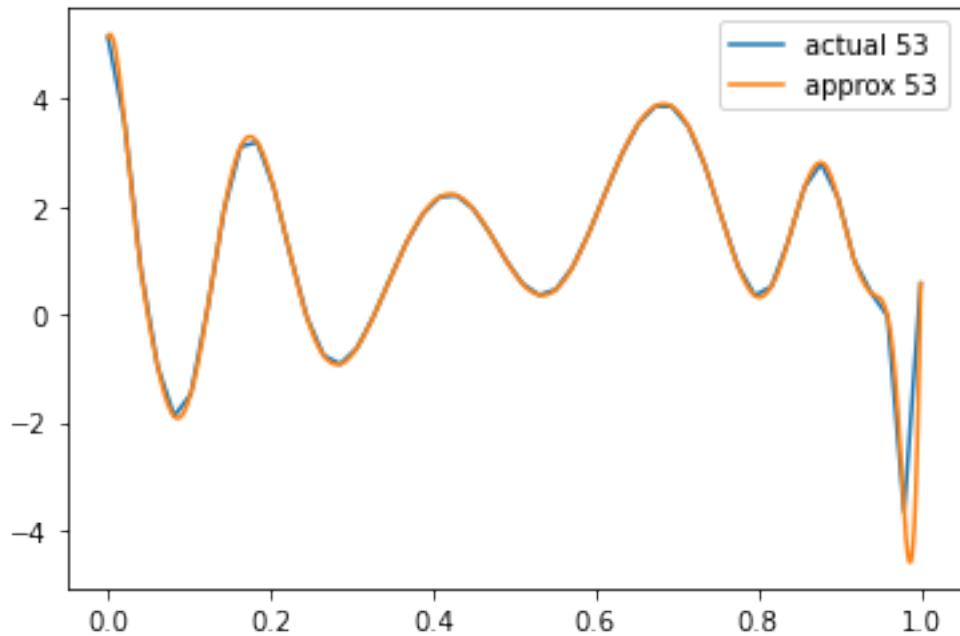
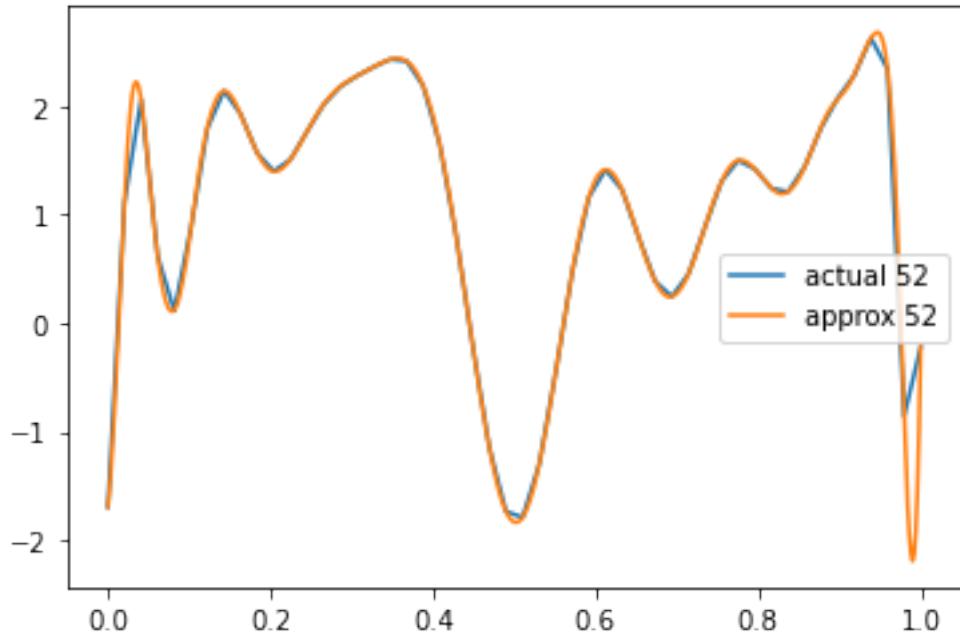












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KeyboardInterrupt                               Traceback (most recent call last)
c:\Users\Diego\Desktop\Master\TFM\tambor\template\simulacionesjup.ipynb Cell 13
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↪template/simulacionesjup.ipynb#X15sZmlsZQ%3D%3D?line=37'>38</a> lfterm = np.
↪dot((1/m)*X, betaT)
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↪template/simulacionesjup.ipynb#X15sZmlsZQ%3D%3D?line=39'>40</a> y = alpha +_
↪lfterm + eps
---> <a href='vscode-notebook-cell:/c%3A/Users/Diego/Desktop/Master/TFM/tambor/
↪template/simulacionesjup.ipynb#X15sZmlsZQ%3D%3D?line=41'>42</a> y_hat,_
↪thetasim, betagorro = cp_sof_fit(X=X, y=y, k=35, initial_grid=T,_
↪newgrid_size=501, derivative_order=0, sign='+', sign_threshold=0.0, plot=False)
    <a href='vscode-notebook-cell:/c%3A/Users/Diego/Desktop/Master/TFM/tambor/
↪template/simulacionesjup.ipynb#X15sZmlsZQ%3D%3D?line=43'>44</a> # Store fitted
↪values in matrix
    <a href='vscode-notebook-cell:/c%3A/Users/Diego/Desktop/Master/TFM/tambor/
↪template/simulacionesjup.ipynb#X15sZmlsZQ%3D%3D?line=44'>45</a>
↪fitted_means_matrix[i,:] = betagorro.reshape((501,))

File c:\Users\Diego\Desktop\Master\TFM\tambor\template\Functions.py:406, in_
↪cp_sof_fit(X, y, k, initial_grid, newgrid_size, derivative_order, sign,_
↪sign_threshold, plot)
    403 bspline = BsplineBasis(deg=3, xsample=initial_grid, n_int=k)
    404 bspline.get_matrix_B()
--> 406 M, Bstar, D, S = simpson_spline_matrices(X = X, k = k, initial_grid =
↪initial_grid, newgrid_size= newgrid_size)
    408 obj_matrices = create_obj_mat(Bstar, M, y, D )
    410 lambda_ = choose_lambda_int(obj_matrices, 1e-12)

File c:\Users\Diego\Desktop\Master\TFM\tambor\template\Functions.py:246, in_
↪simpson_spline_matrices(X, k, initial_grid, newgrid_size)
    244         plt.plot(T2, a_sol_reshaped @ phistar.T, label=f'approx {i+1}')
    245         plt.legend()
--> 246         plt.show()
    252 # M
    254 M = a_matrix @ phistar.T @ W

File c:\Users\Diego\anaconda3\lib\site-packages\matplotlib\pyplot.py:368, in_
↪show(*args, **kwargs)
    324 """
    325 Display all open figures.
    326
(...):
    365 explicitly there.
    366 """
    367 _warn_if_gui_out_of_main_thread()
--> 368 return _backend_mod.show(*args, **kwargs)

File c:\Users\Diego\anaconda3\lib\site-packages\matplotlib_inline\backend_inline.
↪py:41, in show(close, block)
    39 try:

```

```

    40     for figure_manager in Gcf.get_all_fig_managers():
--> 41         display(
    42             figure_manager.canvas.figure,
    43             metadata=_fetch_figure_metadata(figure_manager.canvas.figure)
    44         )
    45     finally:
    46         show._to_draw = []

File c:\Users\Diego\anaconda3\lib\site-packages\IPython\core\display_functions.py:298, in display(include, exclude, metadata, transient, display_id, raw, clear, *objs, **kwargs)
    296     publish_display_data(data=obj, metadata=metadata, **kwargs)
    297 else:
--> 298     format_dict, md_dict = format(obj, include=include, exclude=exclude)
    299     if not format_dict:
    300         # nothing to display (e.g. _ipython_display_ took over)
    301         continue

File c:\Users\Diego\anaconda3\lib\site-packages\IPython\core\formatters.py:178, in DisplayFormatter.format(self, obj, include, exclude)
    176 md = None
    177 try:
--> 178     data = formatter(obj)
    179 except:
    180     # FIXME: log the exception
    181     raise

File c:\Users\Diego\anaconda3\lib\site-packages\decorator.py:232, in decorate.<locals>.fun(*args, **kw)
    230 if not kwsyntax:
    231     args, kw = fix(args, kw, sig)
--> 232 return caller(func, *(extras + args), **kw)

File c:\Users\Diego\anaconda3\lib\site-packages\IPython\core\formatters.py:222, in catch_format_error(method, self, *args, **kwargs)
    220 """show traceback on failed format call"""
    221 try:
--> 222     r = method(self, *args, **kwargs)
    223 except NotImplementedError:
    224     # don't warn on Not Implemented Errors
    225     return self._check_return(None, args[0])

File c:\Users\Diego\anaconda3\lib\site-packages\IPython\core\formatters.py:339, in BaseFormatter.__call__(self, obj)
    337     pass
    338 else:
--> 339     return printer(obj)
    340 # Finally look for special method names

```

```

341 method = get_real_method(obj, self.print_method)

File c:\Users\Diego\anaconda3\lib\site-packages\IPython\core\pylabtools.py:151,
  in print_figure(fig, fmt, bbox_inches, base64, **kwargs)
  148     from matplotlib.backend_bases import FigureCanvasBase
  149     FigureCanvasBase(fig)
--> 151 fig.canvas.print_figure(bytes_io, **kw)
  152 data = bytes_io.getvalue()
  153 if fmt == 'svg':

File c:\Users\Diego\anaconda3\lib\site-packages\matplotlib\backend_bases.py:
  2319, in FigureCanvasBase.print_figure(self, filename, dpi, facecolor, edgecolor, orientation, format, bbox_inches, pad_inches, bbox_extra_artists, backend, **kwargs)
  2315 try:
  2316     # _get_renderer may change the figure dpi (as vector formats
  2317     # force the figure dpi to 72), so we need to set it again here.
  2318     with cbook._setattr_cm(self.figure, dpi=dpi):
-> 2319         result = print_method(
  2320             filename,
  2321             facecolor=facecolor,
  2322             edgecolor=edgecolor,
  2323             orientation=orientation,
  2324             bbox_inches_restore=_bbox_inches_restore,
  2325             **kwargs)
  2326 finally:
  2327     if bbox_inches and restore_bbox:

File c:\Users\Diego\anaconda3\lib\site-packages\matplotlib\backend_bases.py:
  1648, in _check_savefig_extra_args.<locals>.wrapper(*args, **kwargs)
  1640     _api.warn_deprecated(
  1641         '3.3', name=name, removal='3.6',
  1642         message='%(name)s() got unexpected keyword argument "%'
  1643             + arg + '" which is no longer supported as of '
  1644             '%(since)s and will become an error'
  1645             '%(removal)s')
  1646     kwargs.pop(arg)
-> 1648 return func(*args, **kwargs)

File c:\Users\Diego\anaconda3\lib\site-packages\matplotlib\_api\deprecation.py:
  412, in delete_parameter.<locals>.wrapper(*inner_args, **inner_kwargs)
  402     deprecation_addendum = (
  403         f"If any parameter follows {name!r}, they should be passed as "
  404         f"keyword, not positionally.")
  405     warn_deprecated(
  406         since,
  407         name=repr(name),
  (...)
```

```

    410             else deprecation_addendum,
    411             **kwargs)
--> 412 return func(*inner_args, **inner_kwargs)

File c:\Users\Diego\anaconda3\lib\site-packages\matplotlib\backends\backend_agg
  ↪py:540, in FigureCanvasAgg.print_png(self, filename_or_obj, metadata, pil_kw
  ↪args)
    490 @_check_savefig_extra_args
    491 @_api.delete_parameter("3.5", "args")
    492 def print_png(self, filename_or_obj, *args,
    493                 metadata=None, pil_kwarg
  ↪s=None):
    494     """
    495     Write the figure to a PNG file.
    496
(...)

  538         *metadata*, including the default 'Software' key.
  539     """
--> 540     FigureCanvasAgg.draw(self)
  541     mpl.image.imsave(
  542         filename_or_obj, self.buffer_rgba(), format="png",
  ↪origin="upper",
  543         dpi=self.figure.dpi, metadata=metadata, pil_kwarg
  ↪s=pil_kwarg
  ↪s)

File c:\Users\Diego\anaconda3\lib\site-packages\matplotlib\backends\backend_agg
  ↪py:436, in FigureCanvasAgg.draw(self)
    432 # Acquire a lock on the shared font cache.
    433 with RendererAgg.lock, \
    434     (self.toolbar._wait_cursor_for_draw_cm() if self.toolbar
    435      else nullcontext()):
--> 436     self.figure.draw(self.renderer)
    437     # A GUI class may be need to update a window using this draw, so
    438     # don't forget to call the superclass.
    439     super().draw()

File c:\Users\Diego\anaconda3\lib\site-packages\matplotlib\artist.py:73, in
  ↪_finalize_rasterization.<locals>.draw_wrapper(artist, renderer, *args, **
  ↪kwargs)
    71 @_wraps(draw)
    72 def draw_wrapper(artist, renderer, *args, **kwargs):
---> 73     result = draw(artist, renderer, *args, **kwargs)
    74     if renderer._rasterizing:
    75         renderer.stop_rasterizing()

File c:\Users\Diego\anaconda3\lib\site-packages\matplotlib\artist.py:50, in
  ↪allow_rasterization.<locals>.draw_wrapper(artist, renderer)
    47     if artist.get_agg_filter() is not None:
    48         renderer.start_filter()
---> 50     return draw(artist, renderer)

```

```

51     finally:
52         if artist.get_agg_filter() is not None:

File c:\Users\Diego\anaconda3\lib\site-packages\matplotlib\figure.py:2810, in __Figure.draw(self, renderer)
2807     # ValueError can occur when resizing a window.
2809 self.patch.draw(renderer)
-> 2810 mimage._draw_list_compositing_images(
2811     renderer, self, artists, self.suppressComposite)
2813 for sfig in self.subfigs:
2814     sfig.draw(renderer)

File c:\Users\Diego\anaconda3\lib\site-packages\matplotlib\image.py:132, in __draw_list_compositing_images(renderer, parent, artists, suppress_composite)
130 if not_composite or not has_images:
131     for a in artists:
--> 132         a.draw(renderer)
133 else:
134     # Composite any adjacent images together
135     image_group = []

File c:\Users\Diego\anaconda3\lib\site-packages\matplotlib\artist.py:50, in allow_rasterization.<locals>.draw_wrapper(artist, renderer)
47     if artist.get_agg_filter() is not None:
48         renderer.start_filter()
---> 50     return draw(artist, renderer)
51 finally:
52     if artist.get_agg_filter() is not None:

File c:\Users\Diego\anaconda3\lib\site-packages\matplotlib\axes\_base.py:3082, in _AxesBase.draw(self, renderer)
3079     a.draw(renderer)
3080     renderer.stop_rasterizing()
-> 3082 mimage._draw_list_compositing_images(
3083     renderer, self, artists, self.figure.suppressComposite)
3085 renderer.close_group('axes')
3086 self.stale = False

File c:\Users\Diego\anaconda3\lib\site-packages\matplotlib\image.py:132, in __draw_list_compositing_images(renderer, parent, artists, suppress_composite)
130 if not_composite or not has_images:
131     for a in artists:
--> 132         a.draw(renderer)
133 else:
134     # Composite any adjacent images together
135     image_group = []

```

```

File c:\Users\Diego\anaconda3\lib\site-packages\matplotlib\artist.py:50, in __call__(self, renderer, *args, **kwargs)
    47     if artist.get_agg_filter() is not None:
    48         renderer.start_filter()
--> 50     return draw(artist, renderer)
    51 finally:
    52     if artist.get_agg_filter() is not None:

File c:\Users\Diego\anaconda3\lib\site-packages\matplotlib\axis.py:1159, in Axis._draw(self, renderer, *args, **kwargs)
    1156 renderer.open_group(__name__, gid=self.get_gid())
    1158 ticks_to_draw = self._update_ticks()
-> 1159 ticklabelBoxes, ticklabelBoxes2 = self._get_tick_bboxes(ticks_to_draw,
    1160                                         renderer)
    1162 for tick in ticks_to_draw:
    1163     tick.draw(renderer)

File c:\Users\Diego\anaconda3\lib\site-packages\matplotlib\axis.py:1085, in Axis._get_tick_bboxes(self, ticks, renderer)
    1083 def _get_tick_bboxes(self, ticks, renderer):
    1084     """Return lists of bboxes for ticks' label1's and label2's."""
-> 1085     return ([tick.label1.get_window_extent(renderer),
    1086             for tick in ticks if tick.label1.get_visible()],
    1087             [tick.label2.get_window_extent(renderer)
    1088             for tick in ticks if tick.label2.get_visible()])

File c:\Users\Diego\anaconda3\lib\site-packages\matplotlib\axis.py:1085, in <listcomp>(.0)
    1083 def _get_tick_bboxes(self, ticks, renderer):
    1084     """Return lists of bboxes for ticks' label1's and label2's."""
-> 1085     return ([tick.label1.get_window_extent(renderer),
    1086             for tick in ticks if tick.label1.get_visible()],
    1087             [tick.label2.get_window_extent(renderer)
    1088             for tick in ticks if tick.label2.get_visible()])

File c:\Users\Diego\anaconda3\lib\site-packages\matplotlib\text.py:910, in Text.get_window_extent(self, renderer, dpi)
    907     raise RuntimeError('Cannot get window extent w/o renderer')
    909 with cbook._setattr_cm(self.figure, dpi=dpi):
--> 910     bbox, info, descent = self._get_layout(self._renderer)
    911     x, y = self.get_unitless_position()
    912     x, y = self.get_transform().transform((x, y))

File c:\Users\Diego\anaconda3\lib\site-packages\matplotlib\text.py:309, in Text._get_layout(self, renderer)
    306 ys = []
    308 # Full vertical extent of font, including ascenders and descenders:
--> 309 _, lp_h, lp_d = renderer.get_text_width_height_descent()

```

```

310     "lp", self._fontproperties,
311     ismath="TeX" if self.get_usetex() else False)
312 min_dy = (lp_h - lp_d) * self._linespacing
314 for i, line in enumerate(lines):

File c:\Users\Diego\anaconda3\lib\site-packages\matplotlib\backends\backend_agg
pyx:270, in RendererAgg.get_text_width_height_descent(self, s, prop, ismath)
268 flags = get_hinting_flag()
269 font = self._get_agg_font(prop)
--> 270 font.set_text(s, 0.0, flags=flags)
271 w, h = font.get_width_height() # width and height of unrotated string
272 d = font.get_descent()

```

KeyboardInterrupt:

```

[ ]: plt.plot(T2, betaT2, label = 'True beta')
plt.plot(T2,mean_fitted_vals, color= 'green', label= 'nosotros')
plt.plot(T2,mean_lower_ci, linestyle='dashed', color='lightgreen')
plt.plot(T2,mean_upper_ci, linestyle='dashed', color='lightgreen')

plt.plot(T,me, color='red', label = 'Ellos')
plt.plot(T,low, linestyle='dashed', color='lightpink')
plt.plot(T,up, linestyle='dashed', color='lightpink')
# Plot a horizontal line at y=0
plt.axhline(0, color='black')
plt.legend()
plt.show()
print('Times', time_unconstrained)

```