Step 0: Import & Reading the data

In [22]:
```
import numpy as np
import pandas as pd
import seaborn as sns
import matplotlib.pyplot as plt
%matplotlib inline

plt.style.use('ggplot')
pd.set_option('display.max_columns', 200) # set số cột tối đa mà python có thể đọc được
```

In [110…
```
df = pd.read_csv('C:\\Users\\PC\\Desktop\\DATA ANALYST\\PORTFOLIO PROJECT\\exploratory d
coaster_db.csv')
```

Step 1: Data Understanding

In [8]:
```
# Dataframe shape
# head and tail
# dtypes
# describe
```

In [111…
```
df.shape
```

Out[111]:
```
(1087, 56)
```

In [23]:
```
df.head(5)
```

Out[23]:

	coaster_name	Length	Speed	Location	Status	Opening date	Type	Manufacturer	Height restriction	Model	He
0	Switchback Railway	600 ft (180 m)	6 mph (9.7 km/h)	Coney Island	Removed	June 16, 1884	Wood	LaMarcus Adna Thompson	NaN	Lift Packed	(1
1	Flip Flap Railway	NaN	NaN	Sea Lion Park	Removed	1895	Wood	Lina Beecher	NaN	NaN	
2	Switchback Railway (Euclid Beach Park)	NaN	NaN	Cleveland, Ohio, United States	Closed	NaN	Other	NaN	NaN	NaN	
3	Loop the Loop (Coney Island)	NaN	NaN	Other	Removed	1901	Steel	Edwin Prescott	NaN	NaN	

4	Loop the Loop (Young's Pier)	NaN	NaN	Other	Removed	1901	Steel	Edwin Prescott	NaN	NaN

In [24]:
```
df.columns
```

Out[24]:
```
Index(['coaster_name', 'Length', 'Speed', 'Location', 'Status', 'Opening date',
       'Type', 'Manufacturer', 'Height restriction', 'Model', 'Height',
       'Inversions', 'Lift/launch system', 'Cost', 'Trains', 'Park section',
       'Duration', 'Capacity', 'G-force', 'Designer', 'Max vertical angle',
       'Drop', 'Soft opening date', 'Fast Lane available', 'Replaced',
       'Track layout', 'Fastrack available', 'Soft opening date.1',
       'Closing date', 'Opened', 'Replaced by', 'Website',
       'Flash Pass Available', 'Must transfer from wheelchair', 'Theme',
       'Single rider line available', 'Restraint Style',
       'Flash Pass available', 'Acceleration', 'Restraints', 'Name',
       'year_introduced', 'latitude', 'longitude', 'Type_Main',
       'opening_date_clean', 'speed1', 'speed2', 'speed1_value', 'speed1_unit',
       'speed_mph', 'height_value', 'height_unit', 'height_ft',
       'Inversions_clean', 'Gforce_clean'],
      dtype='object')
```

In [26]:
```
df.dtypes
```

Out[26]:
```
coaster_name                  object
Length                        object
Speed                         object
Location                      object
Status                        object
Opening date                  object
Type                          object
Manufacturer                  object
Height restriction            object
Model                         object
Height                        object
Inversions                   float64
Lift/launch system            object
Cost                          object
Trains                        object
Park section                  object
Duration                      object
Capacity                      object
G-force                       object
Designer                      object
Max vertical angle            object
Drop                          object
Soft opening date             object
Fast Lane available           object
Replaced                      object
Track layout                  object
Fastrack available            object
Soft opening date.1           object
Closing date                  object
Opened                        object
Replaced by                   object
Website                       object
Flash Pass Available          object
Must transfer from wheelchair object
Theme                         object
Single rider line available   object
Restraint Style               object
Flash Pass available          object
Acceleration                  object
Restraints                    object
Name                          object
```

```
year_introduced                  int64
latitude                       float64
longitude                      float64
Type_Main                       object
opening_date_clean              object
speed1                          object
speed2                          object
speed1_value                   float64
speed1_unit                     object
speed_mph                      float64
height_value                   float64
height_unit                     object
height_ft                      float64
Inversions_clean                 int64
Gforce_clean                   float64
dtype: object
```

In [29]:
```
df.describe()
```

Out[29]:

	Inversions	year_introduced	latitude	longitude	speed1_value	speed_mph	height_value	height_ft
count	932.000000	1087.000000	812.000000	812.000000	937.000000	937.000000	965.000000	171.000000
mean	1.547210	1994.986201	38.373484	-41.595373	53.850374	48.617289	89.575171	101.996491
std	2.114073	23.475248	15.516596	72.285227	23.385518	16.678031	136.246444	67.329092
min	0.000000	1884.000000	-48.261700	-123.035700	5.000000	5.000000	4.000000	13.100000
25%	0.000000	1989.000000	35.031050	-84.552200	40.000000	37.300000	44.000000	51.800000
50%	0.000000	2000.000000	40.289800	-76.653600	50.000000	49.700000	79.000000	91.200000
75%	3.000000	2010.000000	44.799600	2.778100	63.000000	58.000000	113.000000	131.200000
max	14.000000	2022.000000	63.230900	153.426500	240.000000	149.100000	3937.000000	377.300000

Step 2: Data Preparation

In [ ]:
```
# Dropping irrelevant columns and rows
# Identifying duplicated columns
# Renaming Columns
# Feature Creation
```

In [42]:
```
df_new = df[['coaster_name',
   #'Length', 'Speed',
       'Location', 'Status',
   # 'Opening date','Type',
         'Manufacturer',
   #'Height restriction', 'Model', 'Height',
       # 'Inversions', 'Lift/launch system', 'Cost', 'Trains', 'Park section',
       # 'Duration', 'Capacity', 'G-force', 'Designer', 'Max vertical angle',
       # 'Drop', 'Soft opening date', 'Fast Lane available', 'Replaced',
       # 'Track layout', 'Fastrack available', 'Soft opening date.1',
       #'Closing date', 'Opened', 'Replaced by', 'Website',
       # 'Flash Pass Available', 'Must transfer from wheelchair', 'Theme',
       # 'Single rider line available', 'Restraint Style',
       # 'Flash Pass available', 'Acceleration', 'Restraints', 'Name',
       'year_introduced', 'latitude', 'longitude', 'Type_Main',
       'opening_date_clean',
       # 'speed1', 'speed2', 'speed1_value', 'speed1_unit',
       'speed_mph',
       # 'height_value', 'height_unit',
```

```
        'height_ft',
        'Inversions_clean', 'Gforce_clean']].copy()
```

In [50]:
```
df_new['opening_date_clean'] = pd.to_datetime(df_new['opening_date_clean'])
df_new['opening_date_clean']
```

Out[50]:
```
0      1884-06-16
1      1895-01-01
2             NaT
3      1901-01-01
4      1901-01-01
          ...
1082          NaT
1083   2022-01-01
1084   2016-06-16
1085          NaT
1086   2022-01-01
Name: opening_date_clean, Length: 1087, dtype: datetime64[ns]
```

In [100…
```
df_new = df_new.rename(columns={
    'coaster_name': 'Coaster_name',
    'year_introduced' : 'Year_introduced',
    'latitude' : 'Latitude',
    'longitude' : 'Longitude',
    'Type_Main' : 'Type_main',
    'opening_date_clean' : 'Opening_date',
    'speed_mph' : 'Speed_mph',
    'height_ft' : 'Height_ft',
    'Inversions_clean' : 'Inversions',
    'Gforce_clean' : 'Gforce'

})
df_new.head(5)
```

Out[100]:

	Coaster_name	Location	Status	Manufacturer	Year_introduced	Latitude	Longitude	Type_main	Opening_
0	Switchback Railway	Coney Island	Removed	LaMarcus Adna Thompson	1884	40.5740	-73.9780	Wood	
1	Flip Flap Railway	Sea Lion Park	Removed	Lina Beecher	1895	40.5780	-73.9790	Wood	
2	Switchback Railway (Euclid Beach Park)	Cleveland, Ohio, United States	Closed	NaN	1896	41.5800	-81.5700	Other	
3	Loop the Loop (Coney Island)	Other	Removed	Edwin Prescott	1901	40.5745	-73.9780	Steel	
4	Loop the Loop (Young's Pier)	Other	Removed	Edwin Prescott	1901	39.3538	-74.4342	Steel	

In [93]:
```
df_new.isna().sum()
```

Out[93]:
```
Coaster_name            0
Location                0
Status                213
Manufacturer           59
Year_introduced         0
Latitude              275
Longitude             275
Type_main               0
Opening_date_clean    250
Speed_mph             150
```

```
Height_ft              916
Inversions               0
Gforce                 725
dtype: int64
```

In [94]:
```
df_new.loc[df_new.duplicated()]
```

Out[94]:

Coaster_name	Location	Status	Manufacturer	Year_introduced	Latitude	Longitude	Type_main	Opening_date_

In [119…
```
df_new.loc[df_new.duplicated(subset=['Coaster_name'])]
```

Out[119]:

	Coaster_name	Location	Status	Manufacturer	Year_introduced	Latitude	Longitude	Type_main	C
43	Crystal Beach Cyclone	Crystal Beach Park	Removed	Traver Engineering	1927	42.8617	-79.0598	Wood	
60	Derby Racer	Revere Beach	Removed	Fred W. Pearce	1937	42.4200	-70.9860	Wood	
61	Blue Streak (Conneaut Lake)	Conneaut Lake Park	Closed	NaN	1938	41.6349	-80.3180	Wood	
167	Big Thunder Mountain Railroad	Other	NaN	Arrow Development (California and Florida)Dyna...	1980	NaN	NaN	Steel	
237	Thunder Run (Canada's Wonderland)	Canada's Wonderland	Operating	Mack Rides	1986	43.8427	-79.5423	Steel	
...	...	...	...	...	...	...	...	...	
1063	Lil' Devil Coaster	Six Flags Great Adventure	Operating	Zamperla	2021	40.1343	-74.4434	Steel	
1064	Little Dipper (Conneaut Lake Park)	Conneaut Lake Park	Operating	Allan Herschell Company	2021	41.6343	-80.3165	Steel	
1080	Iron Gwazi	Busch Gardens Tampa Bay	Under construction	Rocky Mountain Construction	2022	28.0339	-82.4231	Steel	
1082	American Dreier Looping	Other	NaN	Anton Schwarzkopf	2022	NaN	NaN	Steel	
1084	Tron Lightcycle Power Run	Other	NaN	Vekoma	2022	NaN	NaN	Steel	

97 rows × 13 columns

In [95]:
```
# checking an example of duplicate
df_new.query('Coaster_name == "Crystal Beach Cyclone"')
# we have some faults in Year_introduced' columns
# -> so we will check the data by 'Coaster_name', 'Location', 'Opening_date_clean' to fi
```

Out[95]:

	Coaster_name	Location	Status	Manufacturer	Year_introduced	Latitude	Longitude	Type_main	Opening_
39	Crystal Beach Cyclone	Crystal Beach	Removed	Traver Engineering	1926	42.8617	-79.0598	Wood	

		Park							
43	Crystal Beach Cyclone	Crystal Beach Park	Removed	Traver Engineering		1927	42.8617	-79.0598	Wood

In [121…
```
df_new = df_new.loc[~df_new.duplicated(subset = ['Coaster_name', 'Location', 'Opening_da
df_new.shape
```

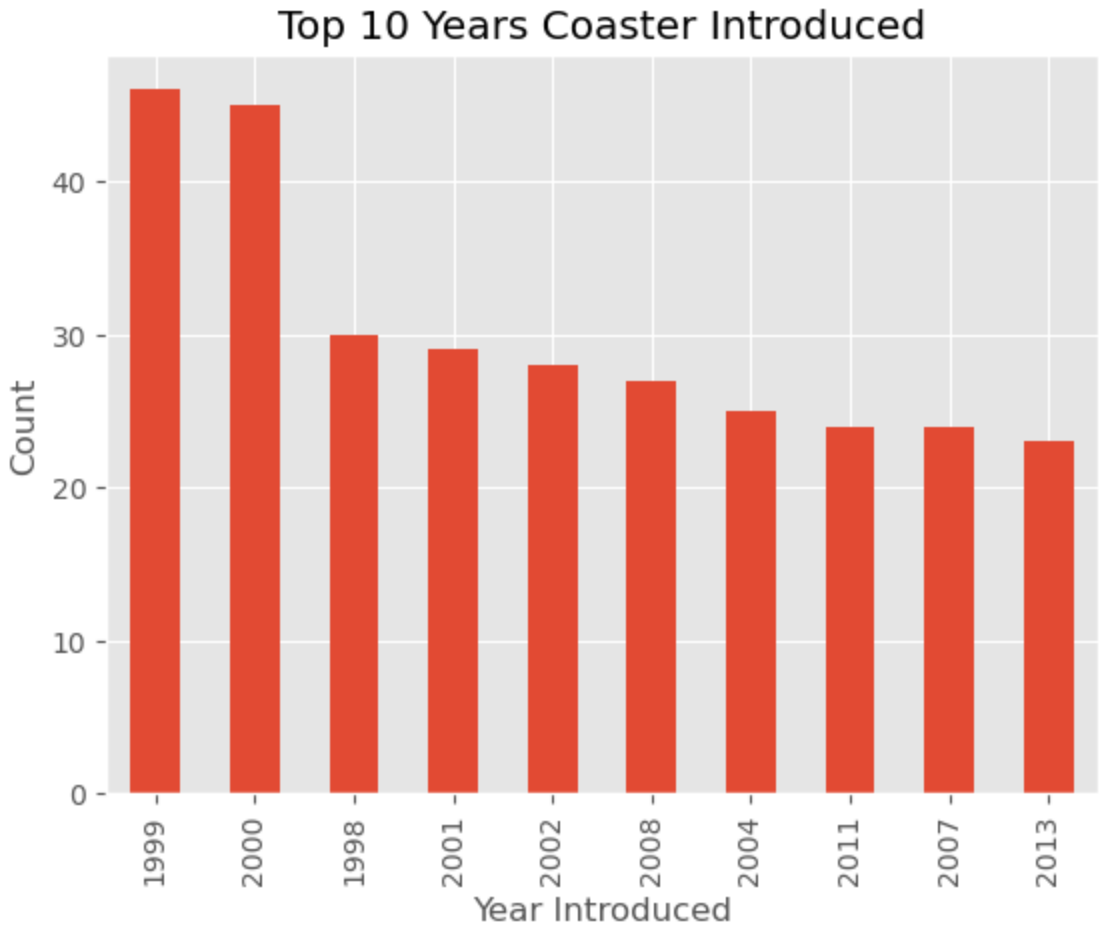
Out[121]:
```
(990, 13)
```

STEP 3: Feature Understanding

In [ ]:
```
# Plotting Feature Distributions
# Histogram
# KDE
# Boxplot
```

In [130…
```
year_intro = df_new['Year_introduced'].value_counts().head(10) \
            .plot(kind = 'bar', title = 'Top 10 Years Coaster Introduced')
year_intro.set_xlabel('Year Introduced')
year_intro.set_ylabel('Count')
```

Out[130]:
```
Text(0, 0.5, 'Count')
```

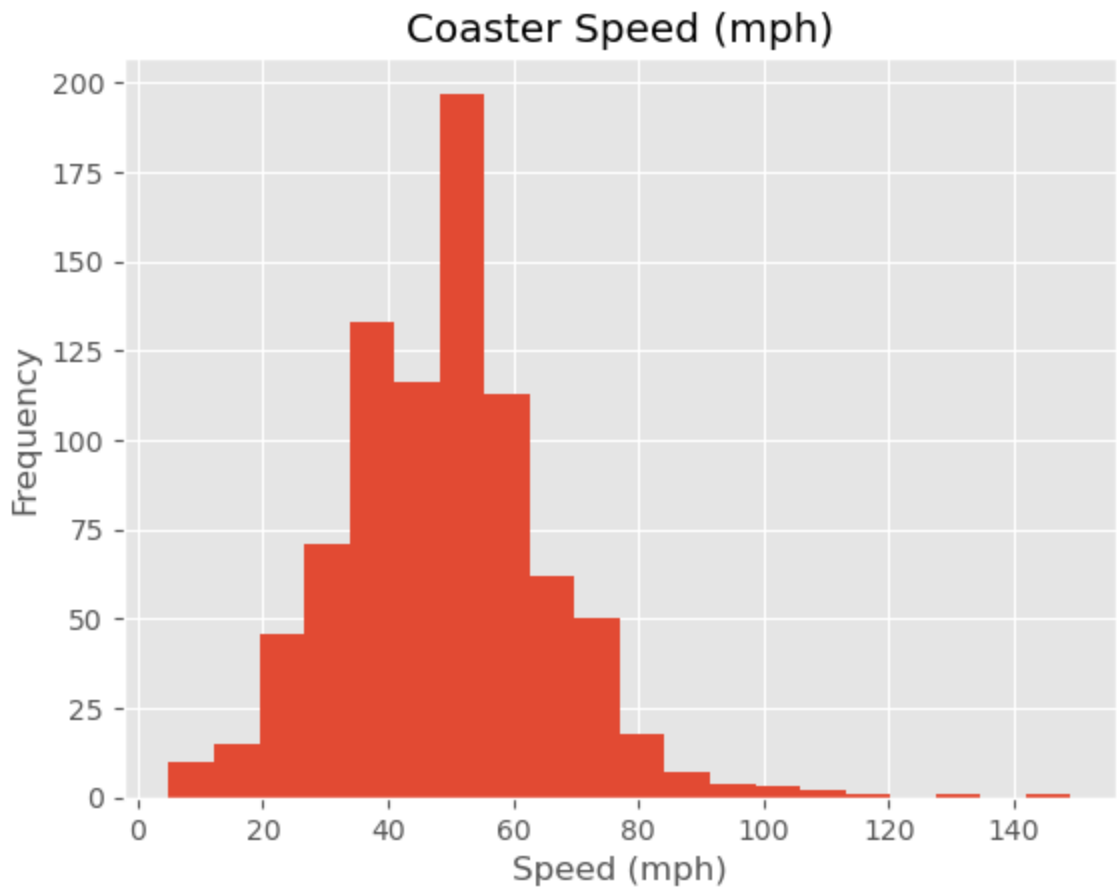


The largest number of roller coasters introduced is in 1999.

In [143…
```
Speed = df_new['Speed_mph'].plot(kind = 'hist', bins = 20, title = 'Coaster Speed (mph)'
Speed.set_xlabel('Speed (mph)')
```

```
Text(0.5, 0, 'Speed (mph)')
```

Out[143]:



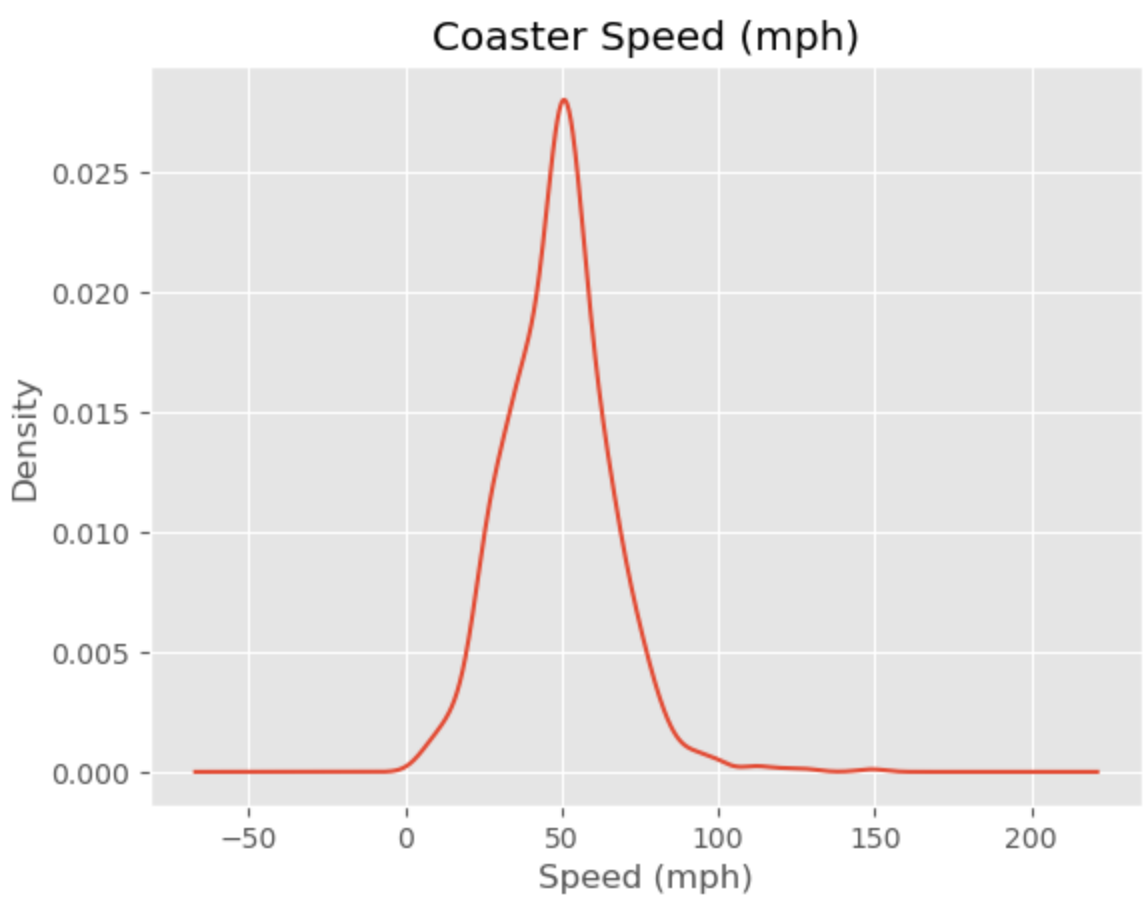
The majority of roller coasters have the speed from 50mph to 60 mph.

In [146…

```
Speed = df_new['Speed_mph'].plot(kind = 'kde', title = 'Coaster Speed (mph)')
Speed.set_xlabel('Speed (mph)')
```

Out[146]:

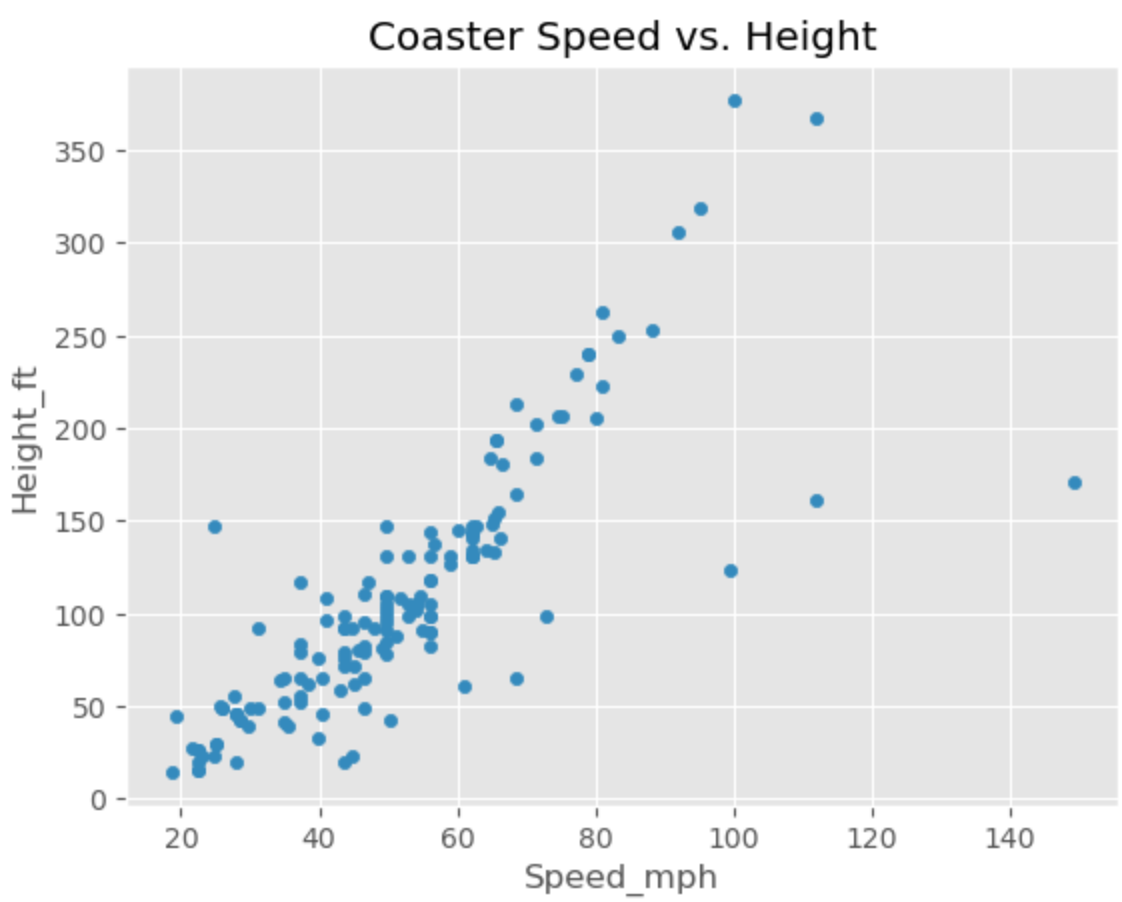
```
Text(0.5, 0, 'Speed (mph)')
```



STEP 4: Feature Relationships

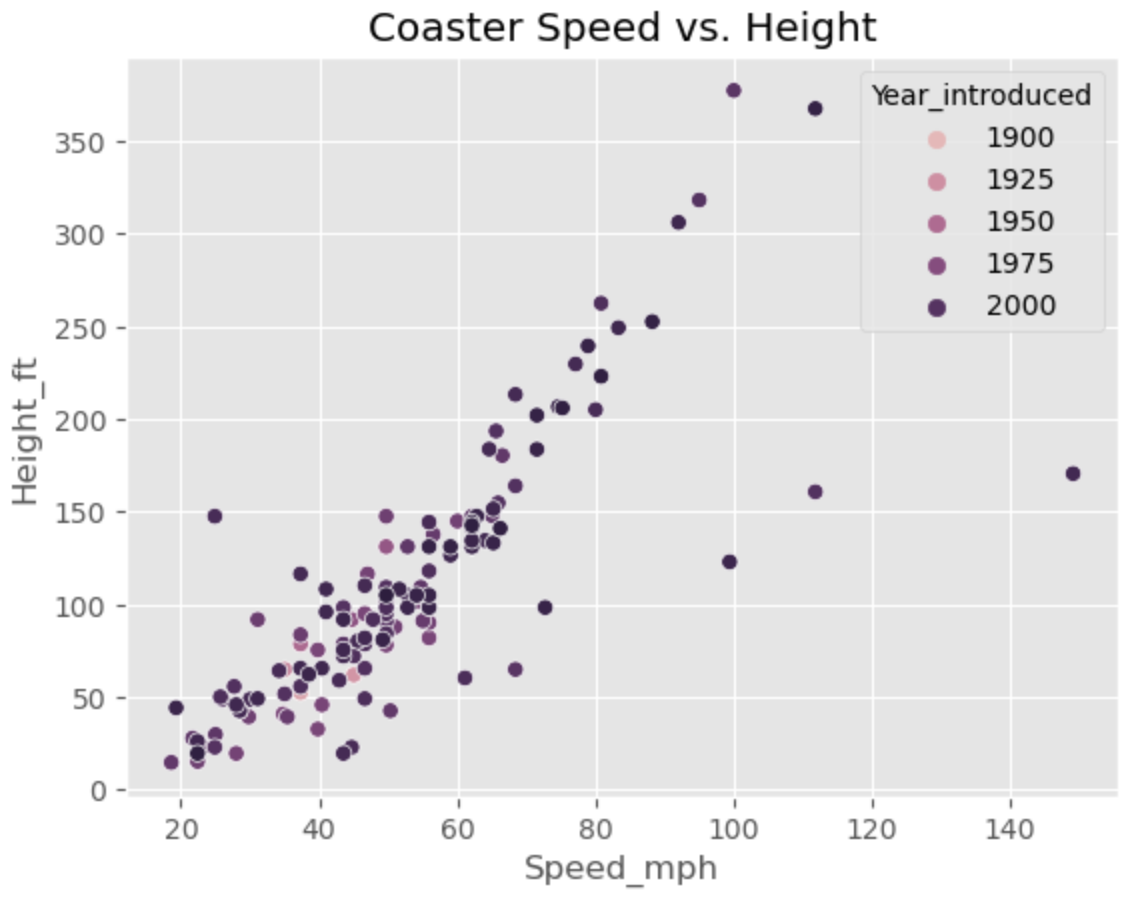
In [ ]:
```
# Scatterplot
# Heatmap Correlation
# Pairplot
# Groupby comparisons
```

In [148…
```
speed_vs_height = df_new.plot(kind = 'scatter', x='Speed_mph', y='Height_ft', title = 'C
plt.show()
```



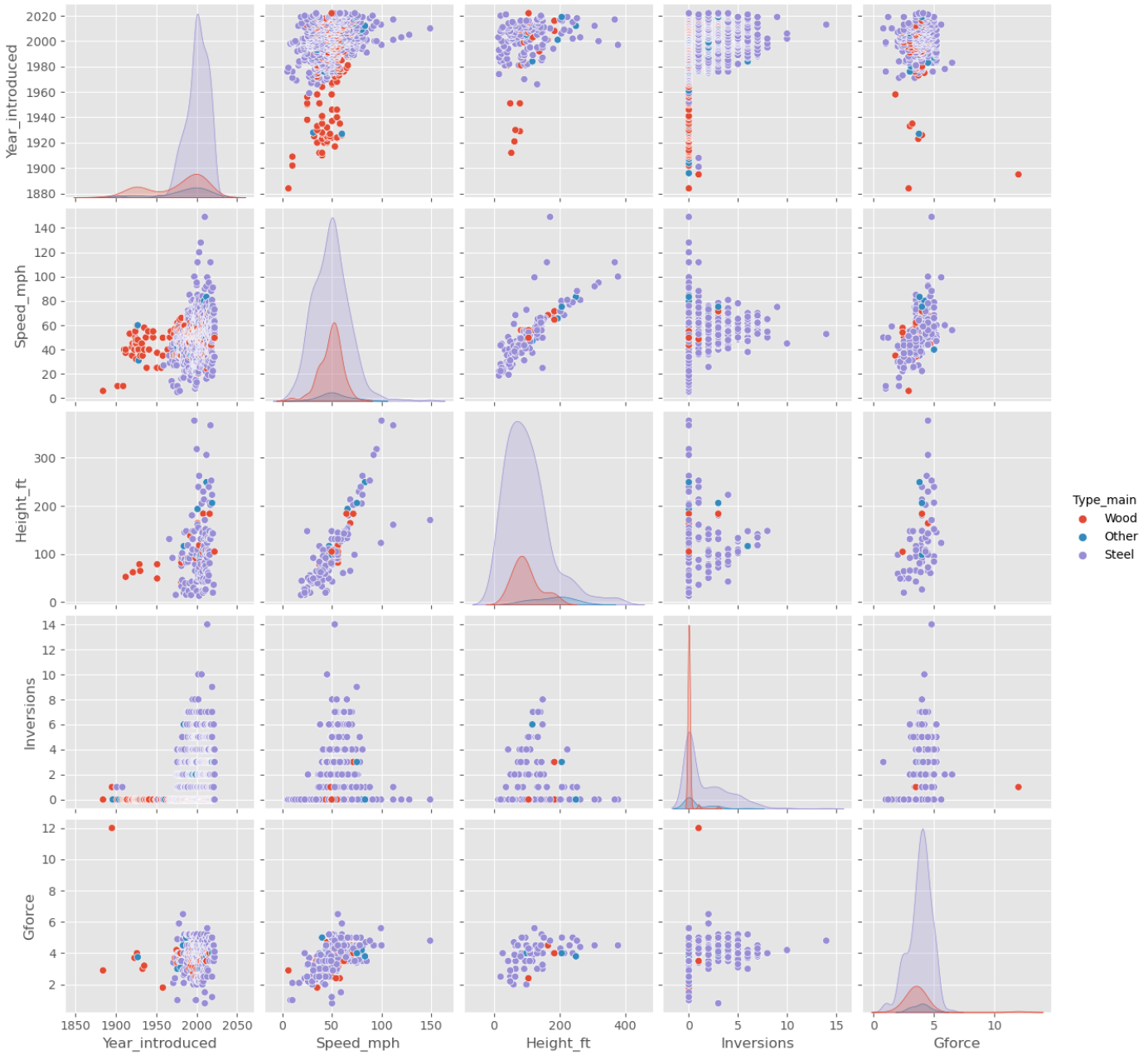
As we can see, we have a trend that the higher the roller coaster is, the faster the speed is.

In [155…
```
speed_vs_height = sns.scatterplot(x='Speed_mph', y='Height_ft', hue='Year_introduced', d
speed_vs_height.set_title('Coaster Speed vs. Height')
plt.show()
```



In [157…
```
sns.pairplot(df_new,
             vars=['Year_introduced','Speed_mph',
                   'Height_ft','Inversions','Gforce'],
             hue='Type_main')
plt.show()
```

```
C:\Users\PC\anaconda3\Lib\site-packages\seaborn\axisgrid.py:118: UserWarning: The figure layout has changed to tight
  self._figure.tight_layout(*args, **kwargs)
```



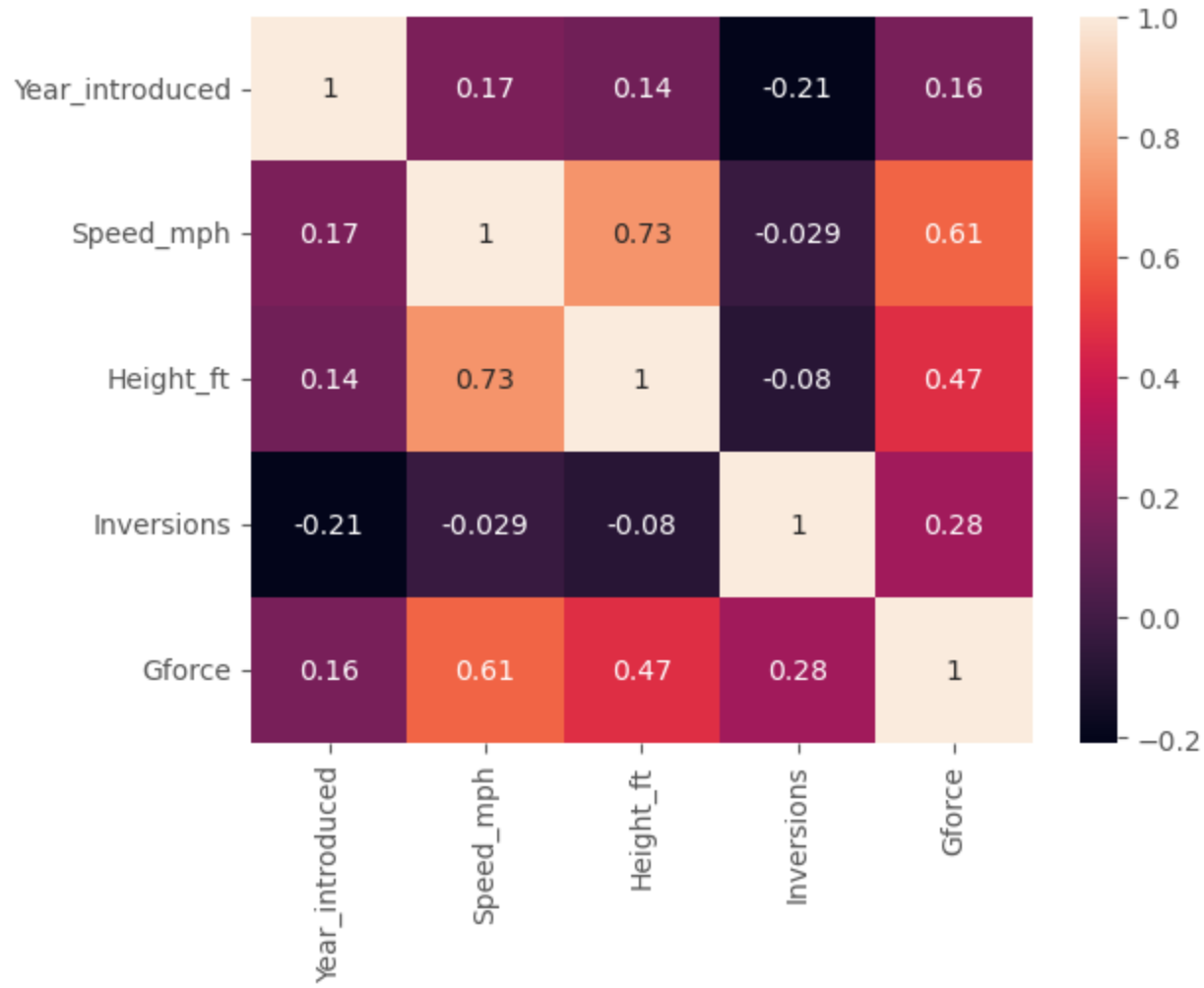
In [162…
```
df_new_corr = df_new[['Year_introduced','Speed_mph',
                      'Height_ft','Inversions','Gforce']].dropna().corr()
df_new_corr
```

Out[162]:

	Year_introduced	Speed_mph	Height_ft	Inversions	Gforce
Year_introduced	1.000000	0.171978	0.135413	-0.209887	0.160247
Speed_mph	0.171978	1.000000	0.733999	-0.028705	0.607383
Height_ft	0.135413	0.733999	1.000000	-0.079736	0.466482
Inversions	-0.209887	-0.028705	-0.079736	1.000000	0.275991
Gforce	0.160247	0.607383	0.466482	0.275991	1.000000

In [164…
```
sns.heatmap(df_new_corr, annot=True)
```

Out[164]:
```
<Axes: >
```



In [166…
```
# What are the location with fastest roller coaster (minimum of 10)?
ax = df_new.query('Location != "Other"') \
    .groupby('Location')['Speed_mph'] \
    .agg(['mean','count']) \
    .query('count >= 10') \
    .sort_values('mean')['mean'] \
    .plot(kind='barh', figsize=(12, 5), title='Average Coast Speed by Location')
ax.set_xlabel('Average Coaster Speed')
plt.show()
```