Matthew Wolf
Lab 12

Promblem 1

In [4]:
```
n((e^pi)+2*(5+2))
```

Out[4]:
```
37.1406926327793
```

Problem 2

X and Y intercepts

In [5]:
```
f(x) = (2*x^2-6*x-5)/(x-3)
solve(f == 0, x)
```

Out[5]:
```
[x == -1/2*sqrt(19) + 3/2, x == 1/2*sqrt(19) + 3/2]
```

Local Max and Min

In [8]:
```
solve( diff(f, x) == 0, x)
```

Out[8]:
```
[x == -1/2*I*sqrt(10) + 3, x == 1/2*I*sqrt(10) + 3]
```

In [9]:
```
f2 = diff(f, x, 2)
f2(0)
```

Out[9]:
```
10/27
```

Assymptotes

In [10]:
```
solve(1/f == 0, x)
```

Out[10]:
```
[x == 3]
```

In [11]:
```
limit(f, x =+infinity)
```

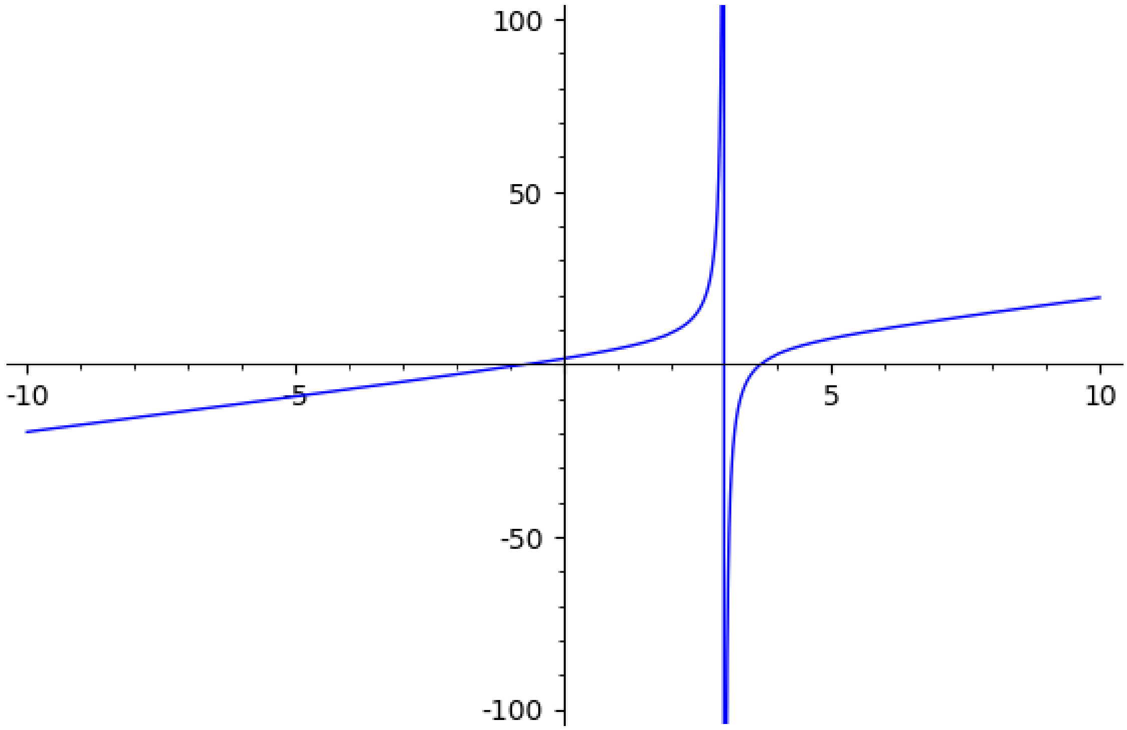
Out[11]:
```
x |--> +Infinity
```

In [12]:
```
limit(f, x=-infinity)
```

Out[12]:
```
x |--> -Infinity
```

Graph

In [22]:
```
f.plot(x, -10, 10).show(ymin = -100, ymax = 100)
```



Problem 3

In [26]:
```
def f(x): return cos(x)*e^(-x^2)
a, b = 1,5
n = 100
```

In [29]:

```
fx_n = [f(i).n() for i in x_n]
print(fx_n)
```

```
[0.198766110346413, 0.171635298059788, 0.146812316857729, 0.1242770868
15526, 0.103981396769993, 0.0858526106092449, 0.0697974983373062, 0.05
57060869632120, 0.0434554363981349, 0.0329132575783324, 0.023941303357
3896, 0.0163984767339922, 0.0101436151442419, 0.00503792334937608, 0.0
00947040460148846, -0.00225726149256947, -0.00469573957095704, -0.0064
8068578484398, -0.00771525285934562, -0.00849307050956210, -0.00889811
900283019, -0.00900482453883451, -0.00887834014607166, -0.008574976202
40622, -0.00814274613994744, -0.00762199518288655, -0.0070460828842369
1, -0.00644209357520464, -0.00583155243607461, -0.00523112857718936, -
0.00465331014356115, -0.00410703991294440, -0.00359830305652836, -0.00
313066161036370, -0.00270573272387713, -0.00232360988966206, -0.001983
22811418592, -0.00168267537472325, -0.00141945374765137, -0.0011906943
1943031, -0.000993330441696020, -0.000824234106310649, -0.000680320235
953846, -0.000558623550785691, -0.000456352419234044, -0.0003709237649
34813, -0.000299982712039365, -0.000241410232816423, -0.00019332163553
3923, -0.000154058313476336, -0.000122174780052744, -0.000096422649061
1852, -0.0000757328889135960, -0.0000591973879530777, -0.0000460506157
153645, -0.0000356519512259880, -0.0000274690720709682, -0.00002106265
40662000, -0.0000160725173904158, -0.0000122052672987625, -9.223412222
```

In [30]:

```
print("Left endpoints: ", fx_n[:-1])
print("Right endpoints: ", fx_n[1:])
```

```
Left endpoints:  [0.198766110346413, 0.171635298059788, 0.146812316857
729, 0.124277086815526, 0.103981396769993, 0.0858526106092449, 0.06979
74983373062, 0.0557060869632120, 0.0434554363981349, 0.032913257578332
4, 0.0239413033573896, 0.0163984767339922, 0.0101436151442419, 0.00503
792334937608, 0.000947040460148846, -0.00225726149256947, -0.004695739
57095704, -0.00648068578484398, -0.00771525285934562, -0.0084930705095
6210, -0.00889811900283019, -0.00900482453883451, -0.0088783401460716
6, -0.00857497620240622, -0.00814274613994744, -0.00762199518288655, -
0.00704608288423691, -0.00644209357520464, -0.00583155243607461, -0.00
523112857718936, -0.00465331014356115, -0.00410703991294440, -0.003598
30305652836, -0.00313066161036370, -0.00270573272387713, -0.0023236098
8966206, -0.00198322811418592, -0.00168267537472325, -0.00141945374765
137, -0.00119069431943031, -0.000993330441696020, -0.00082423410631064
9, -0.000680320235953846, -0.000558623550785691, -0.00045635241923404
4, -0.000370923764934813, -0.000299982712039365, -0.00024141023281642
3, -0.000193321635533923, -0.000154058313476336, -0.00012217478005274
4, -0.0000964226490611852, -0.0000757328889135960, -0.0000591973879530
777, -0.0000460506157153645, -0.0000356519512259880, -0.00002746907207
09682, -0.0000210626540662000, -0.0000160725173904158, -0.000012205267
2987625, -9.22341222260668e-6, -6.93589553680049e-6, -5.18994613146826
e-6, -3.86413407278593e-6, -2.86250834791475e-6, -2.10969161066775e-6,
-1.54680999477459e-6, -1.12814280976029e-6, -8.18385970530028e-7, -5.9
0433311257880e-7, -4.23590719808116e-7, -3.02148732202803e-7, -2.14249
451295721e-7, -1.50993141962738e-7, -1.05738457275419e-7, -7.355789907
80157e-8, -5.08168052031925e-8, -3.48499194603671e-8, -2.3714502359728
8e-8, -1.60030594316718e-8, -1.07021868159030e-8, -7.08684883626023e-
9, -4.64169496027120e-9, -3.00287354553088e-9, -1.91527937491887e-9, -
1.20134526757157e-9, -7.38410770162629e-10, -4.42420776654706e-10, -2.
56264099151123e-10, -1.41489961308327e-10, -7.24665900972302e-11, -3.2
2928681898483e-11, -9.95932445195542e-12, 1.60713538272926e-12, 6.8781
6737006145e-12, 8.62696715114811e-12, 8.53296582557051e-12, 7.58236485
766128e-12, 6.33023902267403e-12, 5.06971894392175e-12]
Right endpoints:  [0.171635298059788, 0.146812316857729, 0.12427708681
5526, 0.103981396769993, 0.0858526106092449, 0.0697974983373062, 0.055
7060869632120, 0.0434554363981349, 0.0329132575783324, 0.0239413033573
896, 0.0163984767339922, 0.0101436151442419, 0.00503792334937608, 0.00
0947040460148846, -0.00225726149256947, -0.00469573957095704, -0.00648
068578484398, -0.00771525285934562, -0.00849307050956210, -0.008898119
00283019, -0.00900482453883451, -0.00887834014607166, -0.0085749762024
0622, -0.00814274613994744, -0.00762199518288655, -0.0070460828842369
1, -0.00644209357520464, -0.00583155243607461, -0.00523112857718936, -
0.00465331014356115, -0.00410703991294440, -0.00359830305652836, -0.00
313066161036370, -0.00270573272387713, -0.00232360988966206, -0.001983
22811418592, -0.00168267537472325, -0.00141945374765137, -0.0011906943
1943031, -0.000993330441696020, -0.000824234106310649, -0.000680320235
953846, -0.000558623550785691, -0.000456352419234044, -0.0003709237649
34813, -0.000299982712039365, -0.000241410232816423, -0.00019332163553
3923, -0.000154058313476336, -0.000122174780052744, -0.000096422649061
1852, -0.0000757328889135960, -0.0000591973879530777, -0.0000460506157
153645, -0.0000356519512259880, -0.0000274690720709682, -0.00002106265
40662000, -0.0000160725173904158, -0.0000122052672987625, -9.223412222
60668e-6, -6.93589553680049e-6, -5.18994613146826e-6, -3.864134072785
3e-6, -2.86250834791475e-6, -2.10969161066775e-6, -1.54680999477459e-
6, -1.12814280976029e-6, -8.18385970530028e-7, -5.90433311257880e-7, -
4.23590719808116e-7, -3.02148732202803e-7, -2.14249451295721e-7, -1.50
993141962738e-7, -1.05738457275419e-7, -7.35578990780157e-8, -5.081680
52031925e-8, -3.48499194603671e-8, -2.37145023597288e-8, -1.6003059431
6718e-8, -1.07021868159030e-8, -7.08684883626023e-9, -4.64169496027120
e-9, -3.00287354553088e-9, -1.91527937491887e-9, -1.20134526757157e-9,
-7.38410770162629e-10, -4.42420776654706e-10, -2.56264099151123e-10, -
1.41489961308327e-10, -7.24665900972302e-11, -3.22928681898483e-11, -
9.95932445195542e-12, 1.60713538272926e-12, 6.87816737006145e-12, 8.62
696715114811e-12, 8.53296582557051e-12, 7.58236485766128e-12, 6.330239
02267403e-12, 5.06971894392175e-12, 3.93948450832630e-12]
```

In [31]:

```
L = (b-a)/n * sum(fx_n[:-1])
R = (b-a)/n * sum(fx_n[1:])
print("Left Approximation: ", L)
print("Right Approximation: ", R)
```

```
Left Approximation:  0.0380894635026723
Right Approximation:  0.0301388190889734
```