
Problem 1

a

Out[500]=

$$ct \rightarrow 1 - e^{-5t}$$

Out[501]=

$$\tau \rightarrow \frac{1}{5}$$

Out[502]=

$$tr \rightarrow 0.44$$

Out[503]=

$$ts \rightarrow \frac{4}{5}$$

b

Out[505]=

$$ct \rightarrow 1 - e^{-20t}$$

Out[506]=

$$\tau \rightarrow \frac{1}{20}$$

Out[508]=

$$tr \rightarrow 0.11$$

Out[509]=

$$ts \rightarrow \frac{1}{5}$$

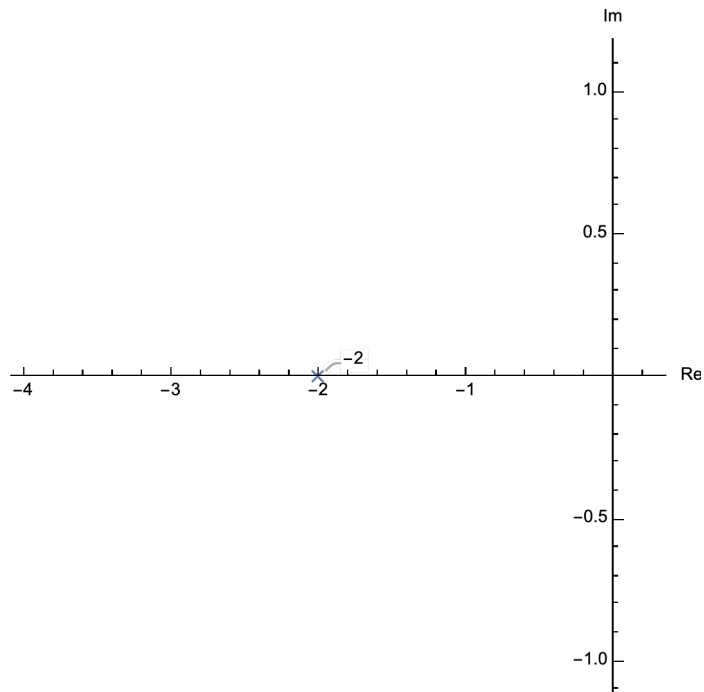
Problem 2

a

Out[514]=

$\{\{s \rightarrow -2\}\}$

Out[516]=



Out[518]=

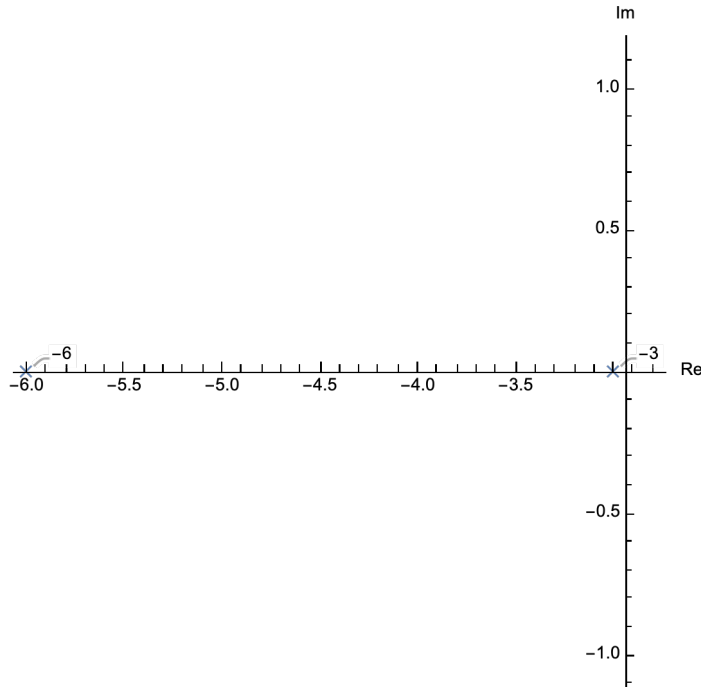
$1 - e^{-2t}$

b

Out[523]=

 $\{\{s \rightarrow -6\}, \{s \rightarrow -3\}\}$

Out[525]=



Out[527]=

$$\frac{5}{18} + \frac{5 e^{-6 t}}{18} - \frac{5 e^{-3 t}}{9}$$

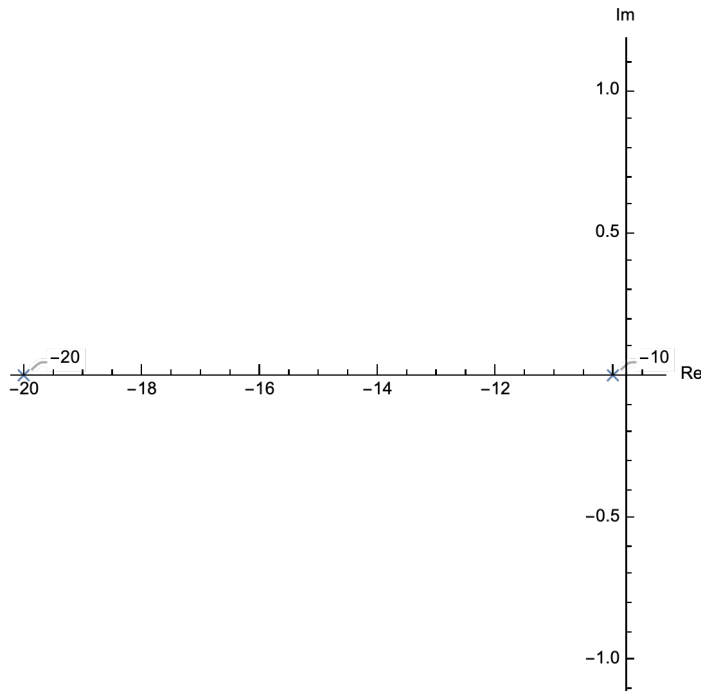
Overdamped

C

Out[532]=

 $\{\{s \rightarrow -20\}, \{s \rightarrow -10\}\}$

Out[534]=



Out[536]=

$$13 e^{-20 t} - 3 e^{-10 t}$$

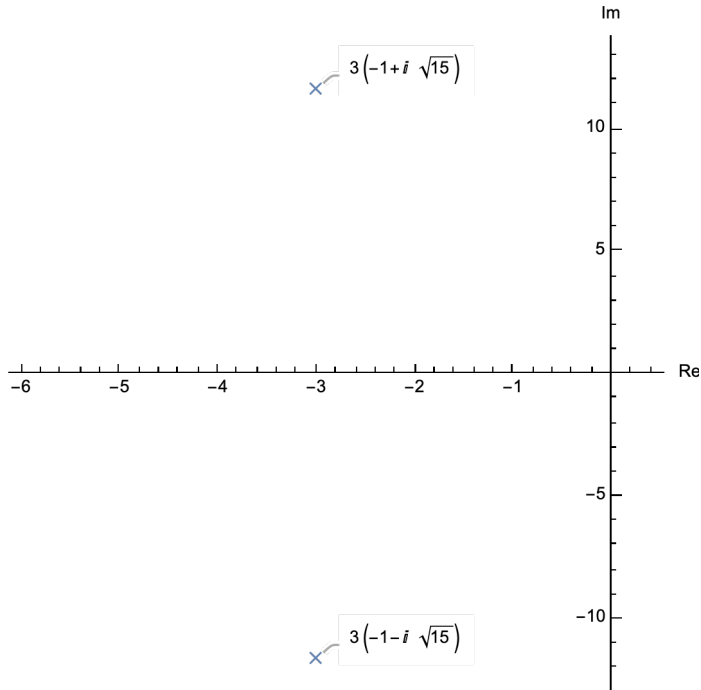
Overdamped

d

Out[541]=

$$\left\{ \left\{ s \rightarrow 3 \left(-1 - i \sqrt{15} \right) \right\}, \left\{ s \rightarrow 3 \left(-1 + i \sqrt{15} \right) \right\} \right\}$$

Out[543]=



Out[545]=

$$\frac{1}{108} e^{-3t} \left(15 e^{3t} - 15 \cos[3 \sqrt{15} t] - \sqrt{15} \sin[3 \sqrt{15} t] \right)$$

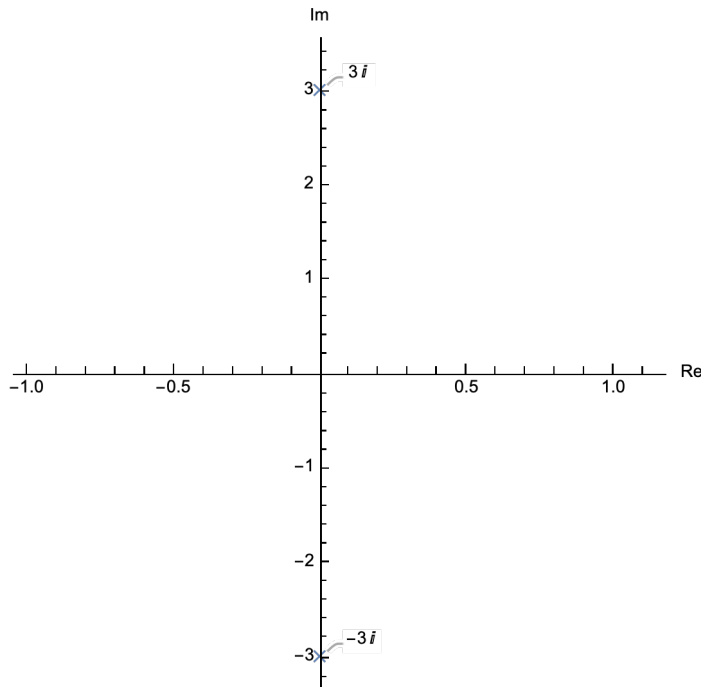
Underdamped

e

Out[550]=

 $\{\{s \rightarrow -3 i\}, \{s \rightarrow 3 i\}\}$

Out[552]=



Out[554]=

$$\frac{1}{9} (2 - 2 \cos[3 t] + 3 \sin[3 t])$$

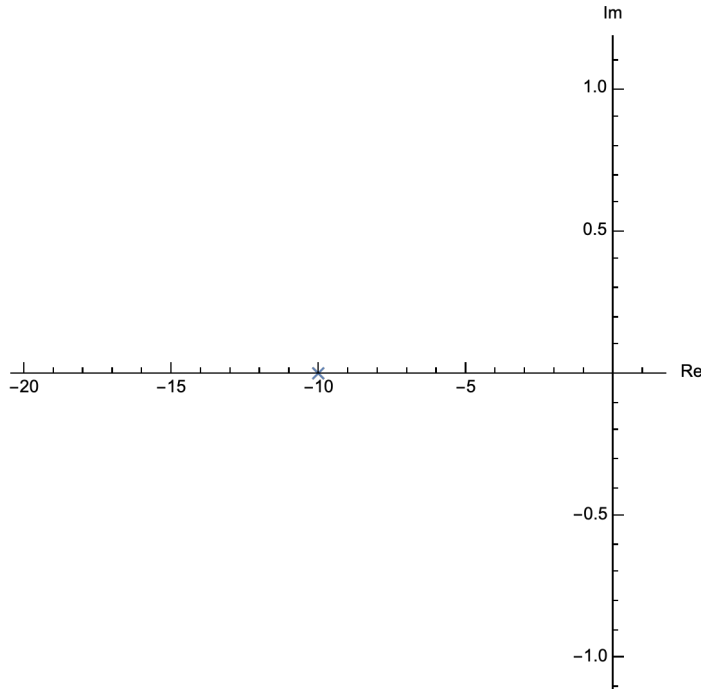
Undamped

f

Out[559]=

 $\{\{s \rightarrow -10\}, \{s \rightarrow -10\}\}$

Out[561]=



Out[563]=

$$\frac{1}{20} - \frac{e^{-10t}}{20} + \frac{1}{2} e^{-10t} t$$

Critically damped

Problem 3

Out[568]=

 $\{\{s \rightarrow -5.49165\}, \{s \rightarrow -0.317313\},$
 $\{s \rightarrow -0.095516 - 1.06705 i\}, \{s \rightarrow -0.095516 + 1.06705 i\}\}$

Problem 4

a

Out[575]=

$\omega n \rightarrow 4$

Out[577]=

$\zeta \rightarrow -\frac{3}{8}$

Out[579]=

$ts \rightarrow \frac{8}{3}$

Out[580]=

$tp \rightarrow 0.847225$

Out[581]=

$os \rightarrow 28.0597$

Out[586]=

$tr \rightarrow 0.356326$

b

Out[589]=

$0.2 \rightarrow 0.2$

Out[591]=

$0.05 \rightarrow 0.05$

Out[592]=

$ts \rightarrow 400.$

Out[593]=

$tp \rightarrow 15.7276$

Out[594]=

$os \rightarrow 85.4468$

Out[599]=

$tr \rightarrow 5.30139$

C

Out[601]=

$$\omega n \rightarrow 3240.37$$

Out[603]=

$$\zeta \rightarrow 0.246885$$

Out[605]=

$$ts \rightarrow 0.005$$

Out[606]=

$$tp \rightarrow 0.00100049$$

Out[607]=

$$os \rightarrow 44.9154$$

Out[612]=

$$tr \rightarrow 0.000387638$$

Problem 5

Out[615]=

$$\zeta \rightarrow 0.554916$$

Out[618]=

$$\omega n \rightarrow 7.2083$$

Out[620]=

$$\frac{51.9596}{51.9596 + 8. s + s^2}$$

Out[621]=

$$\frac{1}{1 + 0.153966 s + 0.0192457 s^2}$$

Problem 6

a

Out[631]=

$$gs \rightarrow \frac{0.934579}{1.79439 + 1.2549 s + 1. s^2}$$

b

Out[634]=
 $\omega n \rightarrow 1.33955$

Out[636]=
 $\zeta \rightarrow 0.468405$

Out[638]=
 $tp \rightarrow 2.65447$

Out[639]=
 $os \rightarrow 18.9087$

Out[640]=
 $ts \rightarrow 6.375$

Problem 7

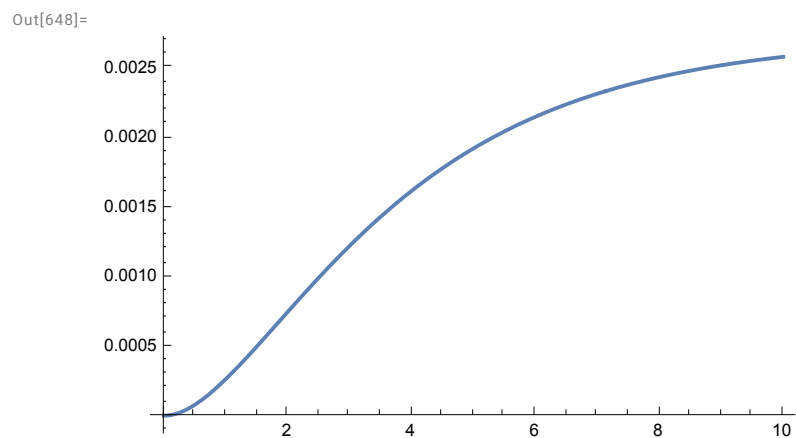
a

Out[643]=
 $\omega n \rightarrow 0.52915$

Out[645]=
 $\zeta \rightarrow 1.08665$

b

Out[646]=
 $\max \rightarrow 0.545$

c

d

Out[649]=

 $\{\{\text{percentIso} \rightarrow 366.972\}\}$

Problem 8

Out[656]=

 $\zeta \rightarrow 0.357857$

Out[658]=

 $\omega n \rightarrow 3.72588$

Out[660]=

 $j \rightarrow 0.375$

Out[662]=

 $k \rightarrow 5.20582$