M1324 ALVAREZ Step

1.

x	-8	-4	-6	3	10	16	21
y = f(x)	4	5	7	3	9	9	12

11/20/17
12/06/17
12/1/17

$y = f(-6) = 7$

$y = f(21) = 12$

1

2.

2.

x	-1	0	1	2	3
$f(x)$	4	6	4	-6	-6

find $f(0) = 6$

$y = 12 - 2x^2$ find if $x = 0$

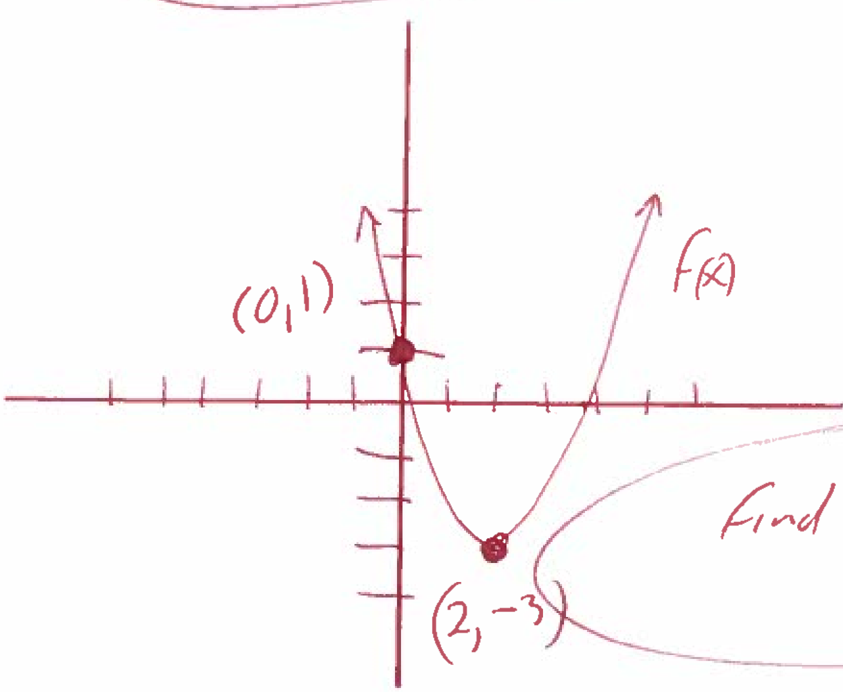
$y = 12 - 2(0)^2$

$y = 12 - 2(0)(0)$

$y = 12 - 2(0)$

$y = 12 - 0$

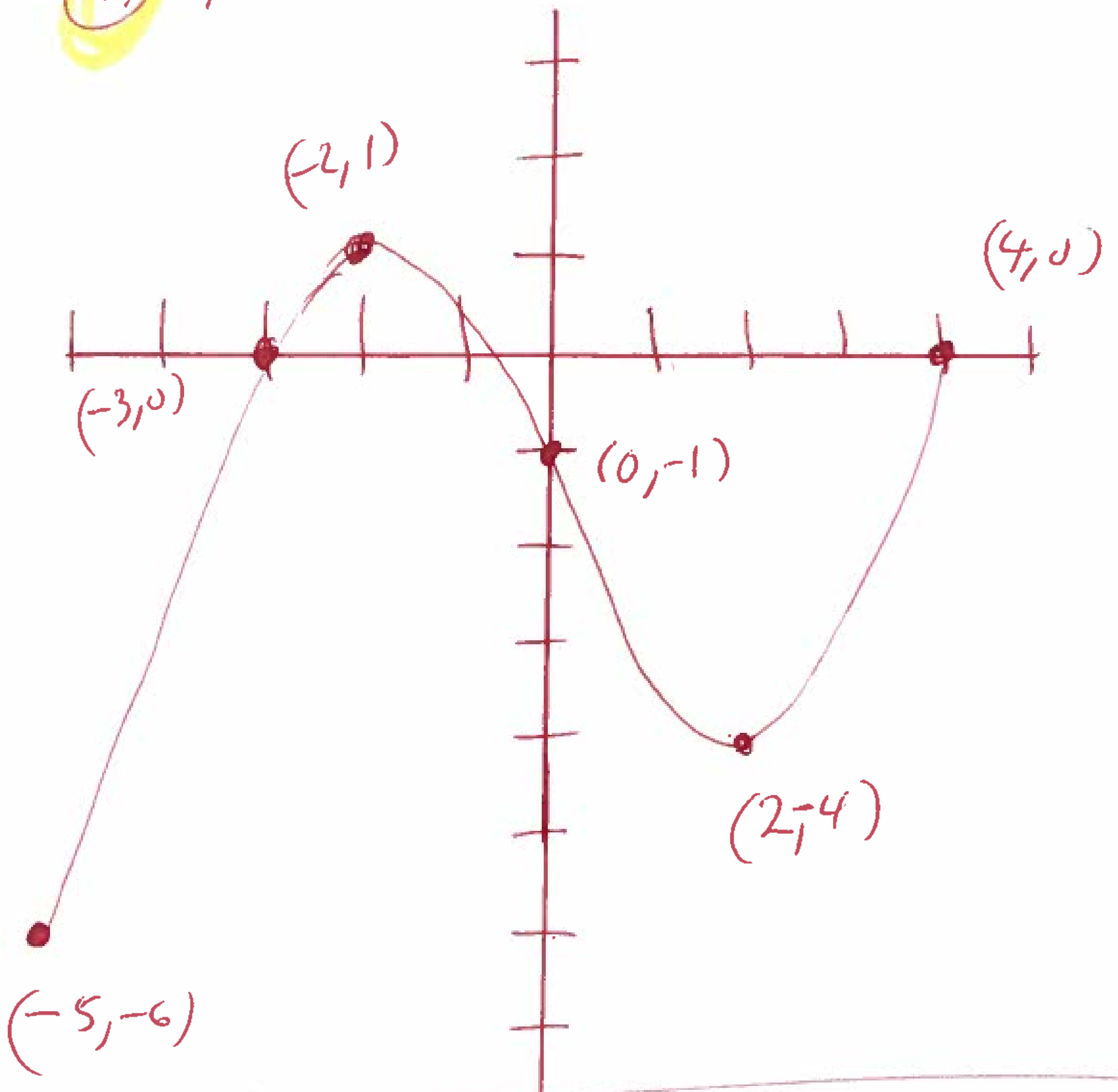
$y = 12$



find $f(0) = 1$

3. Find the domain and range.

3



$$\text{domain} = \begin{array}{cc} \text{left} & \text{right} \\ [-5, & 4] \end{array} = \left[\begin{array}{cc} \text{left graph}, & \text{right graph} \end{array}\right]$$

$$\text{range} = \begin{array}{cc} \text{bottom} & \text{top} \\ [-6, & 1] \end{array} = \left[\begin{array}{cc} \text{Bottom graph}, & \text{Top graph} \end{array}\right]$$

4. find the domain of the function 4.

domain formula

$y = f(x) = \sqrt{Ax+B}$

set $Ax+B \geq 0$

$y = \sqrt{2x-14}$

set $2x - 14 \geq 0$

$$2x - \cancel{14} + \cancel{14} \geq 0 + 14$$

$$2x \geq 14$$

$$\frac{\cancel{2}x}{\cancel{2}} \geq \frac{14}{2}$$

$$x \geq 7$$

$[7, \infty)$

5

t years	$P(t)$ Monthly Payment	$C(t)$ Total Cost
3	\$989.04	\$35,605.44
4	\$759.97	36,478.56
5	\$622.76	\$37365.60

find $P(5) = \$622.76$ Monthly Payment

find $C(4) = \$36478.56$ Total cost

find t if $C(t) = \$37365.60$ total cost

then $t = 5$

find $C(4) - C(3) =$ Total cost

\$36478.56 — \$35605.44 =

\$873.12

6 graph

$f(x) = 3x - 3$

$f(-2) = 3(-2) - 3$

$f(-2) = -6 - 3$

$f(-2) = -9$

$f(-1) = 3(-1) - 3$

$f(-1) = -3 - 3$

$f(-1) = -6$

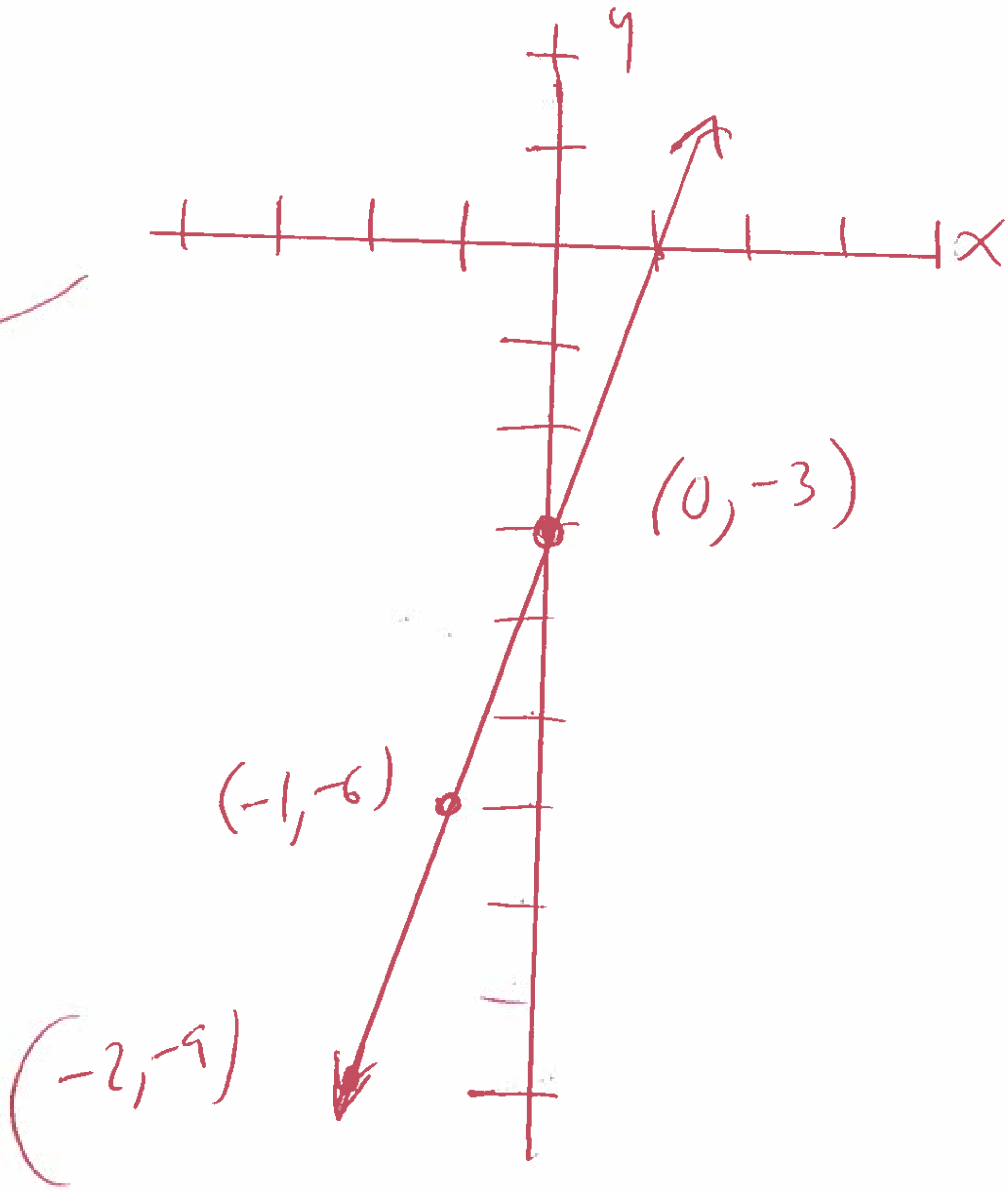
$f(0) = 3(0) - 3$

$f(0) = 0 - 3$

$f(0) = -3$

6

x	f(x)
-2	-9
-1	-6
0	-3



7. graph

$y = x^2 - 5$

$y = (-1)^2 - 5$

$y = (-1)(-1) - 5$

$y = 1 - 5$

$y = -4$

$y = (0)^2 - 5$

$y = (0)(0) - 5$

$y = 0 - 5$

$y = -5$

$y = (1)^2 - 5$

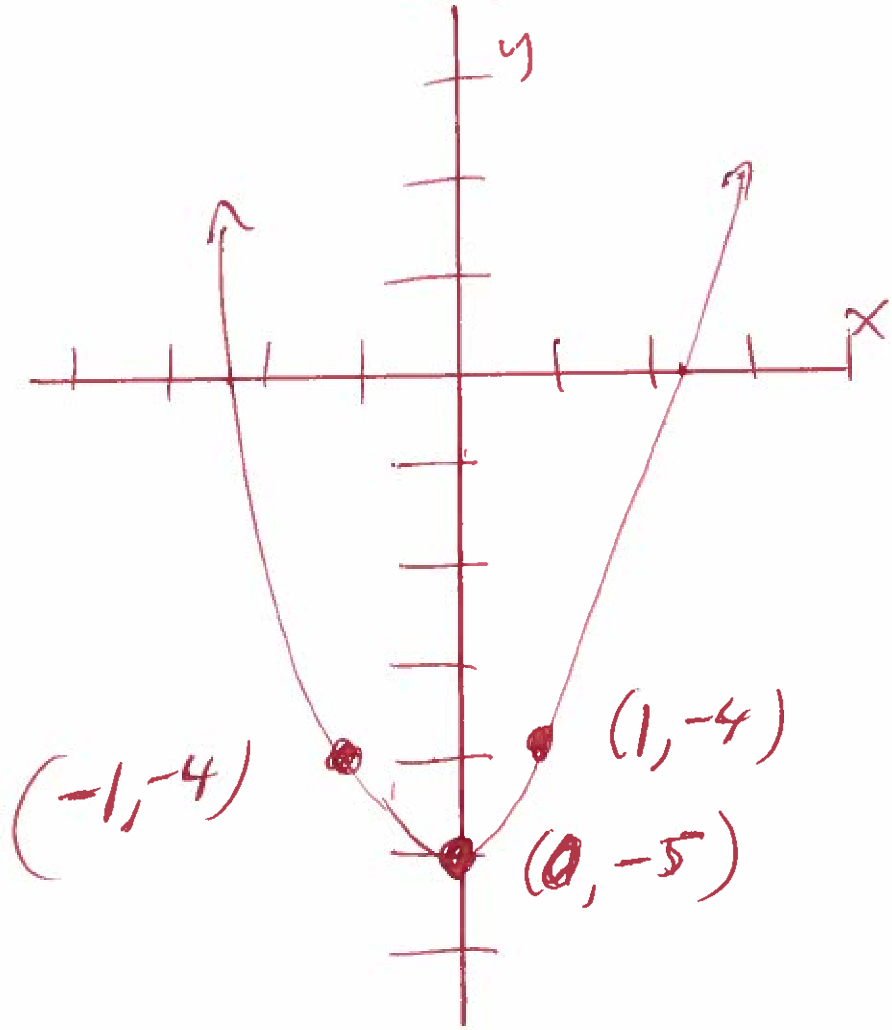
$y = (1)(1) - 5$

$y = 1 - 5$

$y = -4$

7

x	y
-1	-4
0	-5
1	-4



8. graph

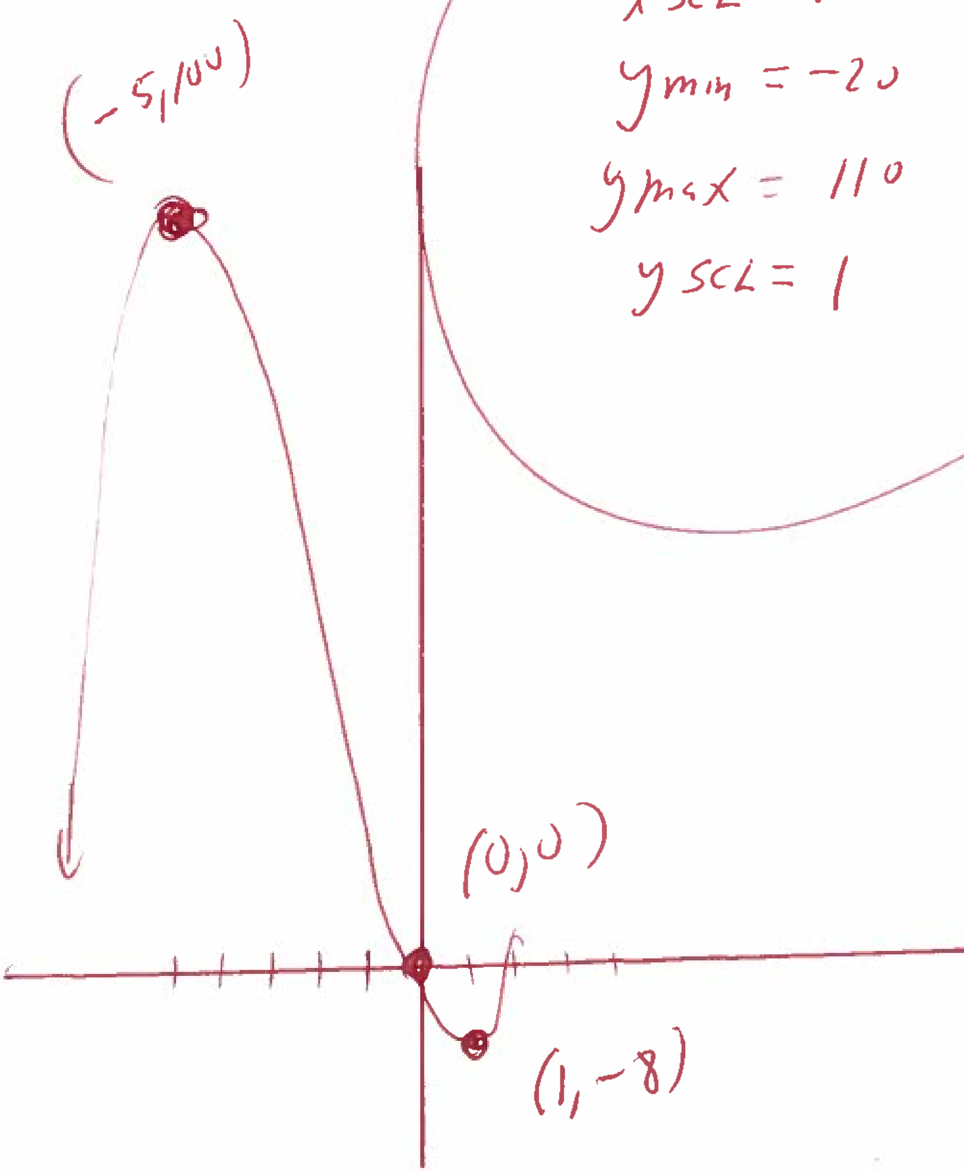
$y = x^3 + 6x^2 - 15x$

y = x^3 + 6x^2 — 15x

use graphing calculator

Y_1 = x^3 + 6x^2 — 15x

Xmin = −12
Xmax = 12
Xscl = 1
Ymin = −20
Ymax = 110
Yscl = 1

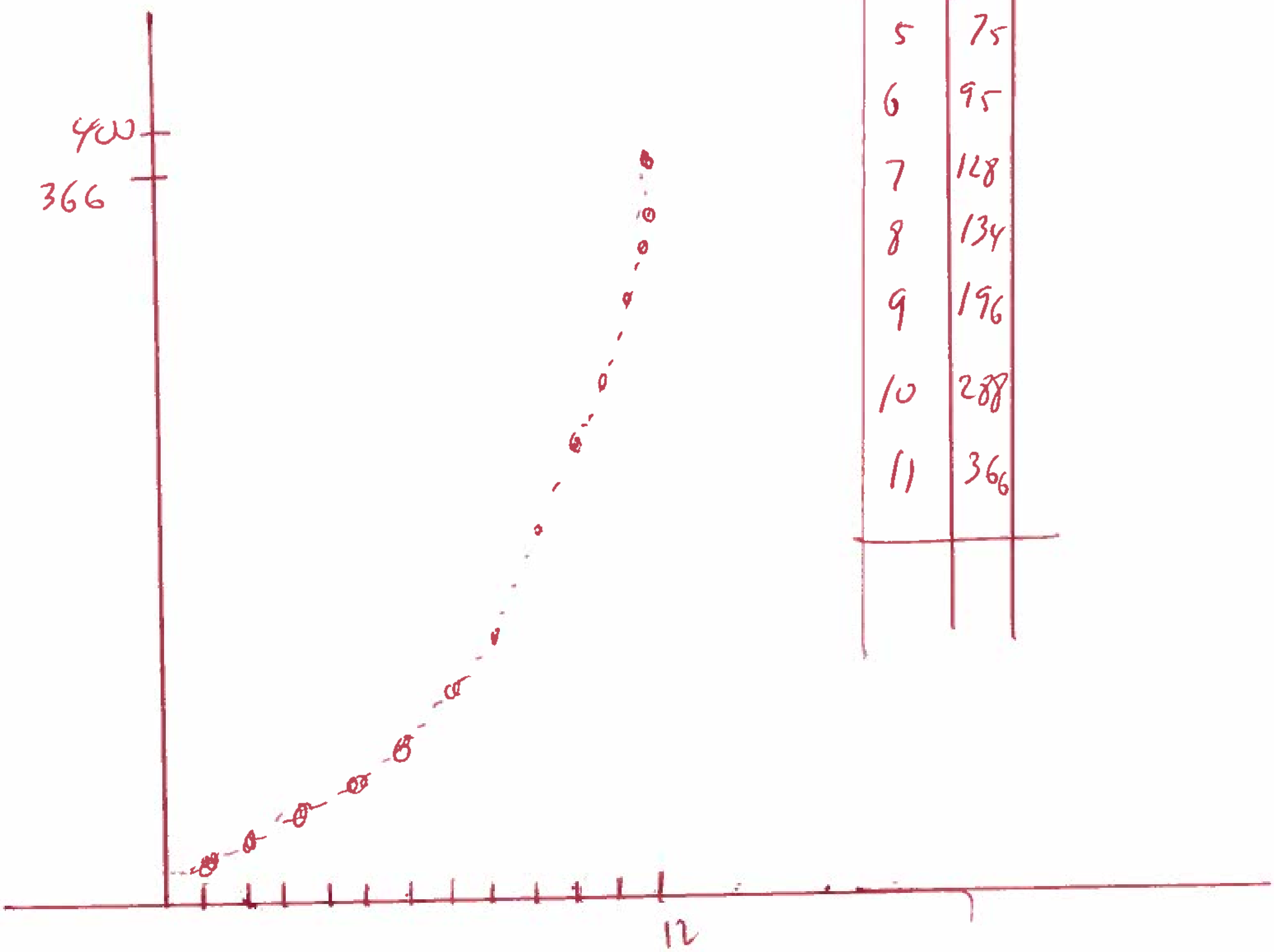


8

9. graph

9

x	y
0	13
1	24
2	35
3	47
4	59
5	75
6	95
7	128
8	134
9	196
10	288
11	366



10. $f(x) = x^2 - 6x$

10

Find $f(30) = (30)^2 - 6(30)$

$f(30) = (30)(30) - 6(30)$

$f(30) = 900 - 180$

$f(30) = 720$ millions

$f(30)$ means add 30 YEARS to

$$\begin{array}{r} 1990 \\ +\ 30 \\ \hline 2020 \end{array}$$

YEAR

11. find the slope, if it exists, of the line containing the pair of points. 11.

$(-15, -4)$ and $(-19, -6)$

$x_1 \quad y_1 \qquad x_2 \quad y_2$

$$m = \frac{y_1 - y_2}{x_1 - x_2}$$

Slope formula

$$m = \frac{(-4) - (-6)}{(-15) - (-19)}$$

$$m = \frac{-4 + 6}{-15 + 19}$$

$$m = \frac{2}{4}$$

$$m = \frac{\cancel{2}(1)}{\cancel{2}(2)}$$

$$m = \frac{1}{2}$$

Slope

12. use the intercepts to graph the equation

$2x+3y=6$

12

find the x-intercept let $y=0$

$2x+3(0)=6$

$2x+0=6$

$2x=6$

$\frac{2x}{2}=\frac{6}{2}$

$x=3$ $(3,0)$

find the y-intercept let $x=0$

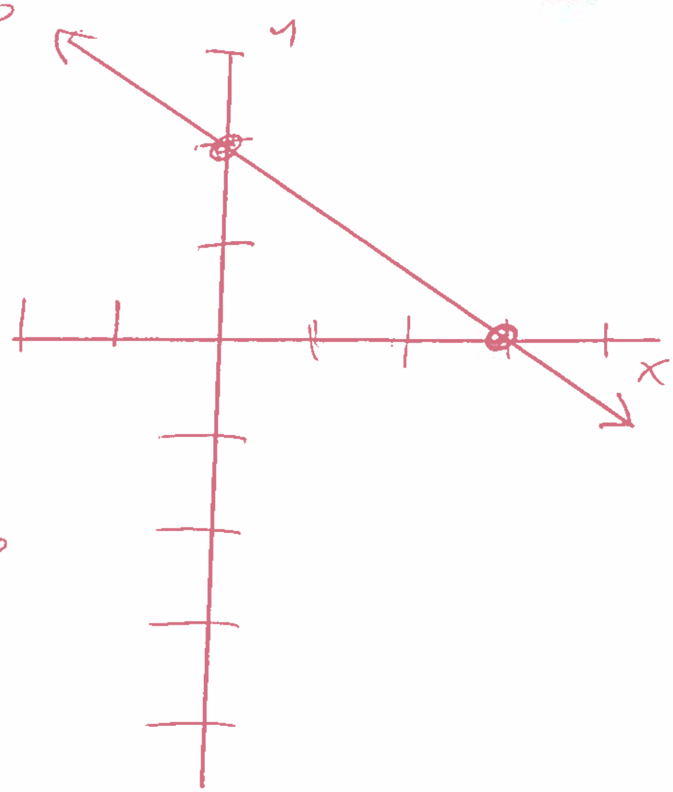
$2(0)+3y=6$

$0+3y=6$

$3y=6$

$\frac{3y}{3}=\frac{6}{3}$

$y=2$ $(0,2)$



OR

$2x+3y=6$ Solve for y

$\cancel{2x}+3y-\cancel{2x}=6-2x$

$3y=6-2x$

$\frac{3y}{3}=\frac{6}{3}-\frac{2}{3}x$

$y=2-\frac{2}{3}x$

$y=-\frac{2}{3}x+2$

$y=mx+b$

$y=-\frac{2}{3}(0)+2$

$y=0+2$

$y=2$

$y=-\frac{2}{\cancel{3}}(\cancel{3})+2$

$y=-2+2$

$y=0$

x	y
0	2
3	0

13. graph

13.

$y=3x+7$

$y=mx+b$

slope y-intercept

slope $= m = 3$

y-intercept $= 7$

x	y
0	7
1	10

$y=3(0)+7$

$y=0+7$

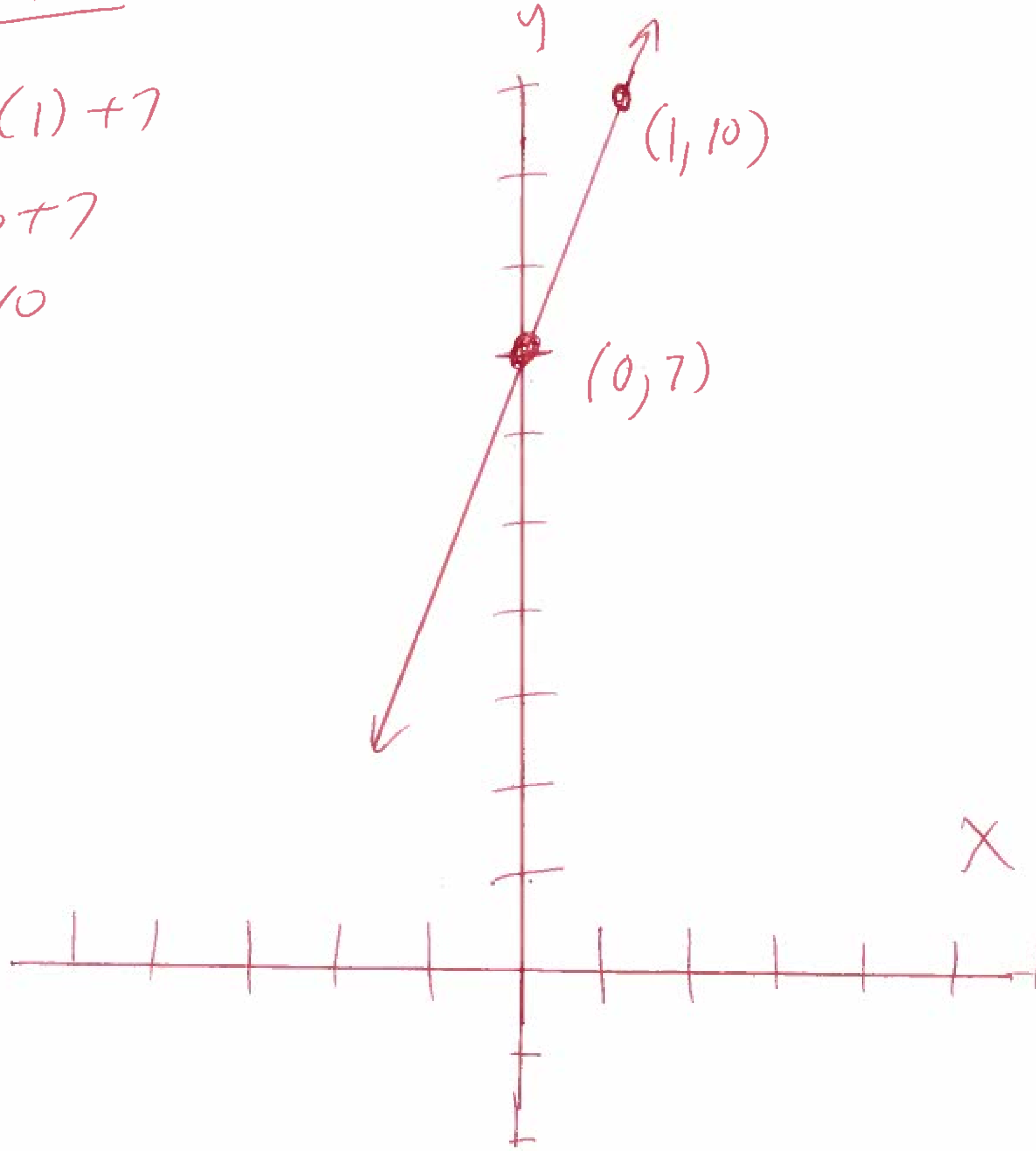
$y=7$

(0,7)

$y=3(1)+7$

$y=3+7$

$y=10$



14

14 find the rate of change

$y = 6x - 5$ $y = mx + b$

Slope y-intercept

rate of change $m = 6$

15. If a linear function has the points $(-6,-8)$ and $(7,9)$ on its graph, what is the rate of change of the function?

$x_1 \quad y_1 \qquad x_2 \quad y_2$

15c

$$m = \frac{y_1 - y_2}{x_1 - x_2}$$

$$m = \frac{(-8)-(9)}{(-6)-(7)}$$

$$m = \frac{-8-9}{-6-7}$$

$$m = \frac{-17}{-13}$$

$$m = \frac{17}{13}$$ rate of change

16. Find the equation of the line

point $(7,-7)$ with slope $= -\frac{6}{7} = m$

$x_1 \quad y_1$

$y - y_1 = m(x - x_1)$

$y - (-7) = -\frac{6}{7}(x - (7))$

$y + 7 = -\frac{6}{7}(x - 7)$

$y + 7 = -\frac{6}{7}x + \frac{42}{7}$

$y + 7 = -\frac{6}{7}x + 6$

$y + \cancel{7} - \cancel{7} = -\frac{6}{7}x + 6 - 7$

$y = -\frac{6}{7}x - 1$

16

17) for the function $y = x^2$; compute the average rate of change between $x = -5$ and $x = -2$ (17)

$$\frac{f(\text{BIG}) - f(\text{Little})}{\text{BIG} - \text{Little}} =$$

$$\frac{f(-2) - f(-5)}{(-2) - (-5)} =$$

$$\frac{(-2)^2 - (-5)^2}{(-2) - (-5)} =$$

$$\frac{(-2)(-2) - (-5)(-5)}{(-2) - (-5)} =$$

$$\frac{4 - 25}{-2 + 5} =$$

$$\frac{-21}{3} =$$

$$-7 =$$

18. $f(x) = 2x^2 + 5$

18

$$\frac{f(x+h) - f(x)}{h} =$$

$$\frac{(2(x+h)^2 + 5) - (2x^2 + 5)}{h} =$$

$$\frac{2(x+h)(x+h) + 5 - 2x^2 - 5}{h} =$$

$$\frac{2(x^2 + xh + xh + h^2) + 5 - 2x^2 - 5}{h} =$$

$$\frac{2(x^2 + 2xh + h^2) + 5 - 2x^2 - 5}{h} =$$

$$\frac{\cancel{2x^2} + 4xh + 2h^2 + \cancel{5} - \cancel{2x^2} - \cancel{5}}{h} =$$

$$\frac{4xh + 2h^2}{h} =$$

$$\frac{\cancel{h}(4x + 2h)}{\cancel{h}} =$$

$$4x + 2h =$$

19.

19

find the equation of the line through the two points (5, 0.14) and (10, 0.24)

$x_1 \quad y_1 \qquad x_2 \quad y_2$

$$y - y_1 = \frac{y_1 - y_2}{x_1 - x_2}(x - x_1)$$

$$y - (0.14) = \frac{(0.14) - (0.24)}{(5) - (10)}(x - (5))$$

$$y - 0.14 = \frac{0.14 - 0.24}{5 - 10}(x - 5)$$

$$y - 0.14 = \frac{-.10}{-5}(x - 5)$$

$$y - 0.14 = .02(x - 5)$$

$$y - 0.14 = .02x - .10$$

$$y - \cancel{0.14} + \cancel{0.14} = .02x - .10 + 0.14$$

$$y = .02x + .04$$

20. Find the equation of the line through the points $(0, 0)$ and $(9, 0.63)$ 20

$x_1 \quad y_1 \qquad x_2 \quad y_2$

$$y - y_1 = \frac{y_1 - y_2}{x_1 - x_2}(x - x_1)$$

$$y - (0) = \frac{(0) - (0.63)}{(0) - (9)}(x - (0))$$

$$y - 0 = \frac{0 - 0.63}{0 - 9}(x - 0)$$

$$y - 0 = \frac{-0.63}{-9}(x)$$

$$\boxed{y = 0.07x}$$

21. $5x - 9 = 15 + 11x$

$5x \cancel{- 9 + 9} = 15 + 11x + 9$

$5x = 11x + 24$

$5x - 11x = \cancel{11x} + 24 \cancel{- 11x}$

$-6x = 24$

$\frac{\cancel{-6}x}{\cancel{-6}} = \frac{24}{-6}$

$x = -4$

21.

22.

$5(x-7)=-3x-27$

$5x-35=-3x-27$

$5x-\cancel{35}+\cancel{35}=-3x-27+35$

$5x=-3x+8$

$5x+3x=-\cancel{3x}+8+\cancel{3x}$

$8x=8$

$\frac{8x}{8}=\frac{8}{8}$

$x=1$

22.

23

23

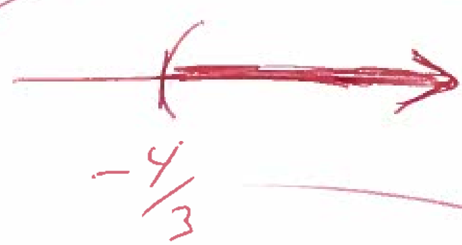
$$3x+2>-2$$

$$3x+\cancel{2}-\cancel{2}>-2-2$$

$$3x>-4$$

$$\frac{3x}{3}>\frac{-4}{3}$$

$$x>-\frac{4}{3}$$



$$\left(-\frac{4}{3},\ \infty\right)$$

24

24

$$-4(x-3) < -3$$

$$-4x+12 < -3$$

$$-4x+\cancel{12}-\cancel{12} < -3-12$$

$$-4x < -15$$

$$\frac{\cancel{-4}x}{\cancel{-4}} > \frac{-15}{-4}$$

divide by a negative and turn alligator around

$$x > \frac{15}{4}$$

$$\left(\frac{15}{4}, \infty\right)$$

25.

25

$$5.49t = 1.88t - 3.61$$

$$5.49t - 1.88t = \cancel{1.88t} - 3.61 - \cancel{1.88t}$$

$$3.61t = -3.61$$

$$\frac{3.61t}{3.61} = \frac{-3.61}{3.61}$$

$$t = -1$$

26.

$f(x) = 66 + 3.3x$

26.

Let $66 + 3.3x = 0$

$\cancel{66} + 3.3x - \cancel{66} = 0 - 66$

$3.3x = -66$

$$\frac{\cancel{3.3}x}{\cancel{3.3}} = \frac{-66}{3.3}$$

$x = -20$

27. Solve for t 27.

$$D = B(1+rt)$$

$$D = B + Brt$$

$$D - B = \cancel{B} + Brt - \cancel{B}$$

$$D - B = Brt$$

$$\frac{D-B}{Br} = \frac{\cancel{Br}t}{\cancel{Br}}$$

$$\frac{D-B}{Br} = t$$

28 Solve for n.

28

$$\frac{P}{2} + A = 9m - 2n$$

$$\frac{P}{2} + A - 9m = \cancel{9m} - 2n \cancel{- 9m}$$

$$\frac{P}{2} + A - 9m = -2n$$

$$-\frac{1}{2}\left(\frac{P}{2} + \frac{A}{1} - \frac{9m}{1}\right) = \cancel{-\frac{1}{2}}(\cancel{-2}n) \quad \text{Mult}$$

$$-\frac{1P}{4} - \frac{A}{2} + \frac{9m}{2} = n$$

$$-\frac{P}{4} - \frac{A}{2} + \frac{9m}{2} = n$$

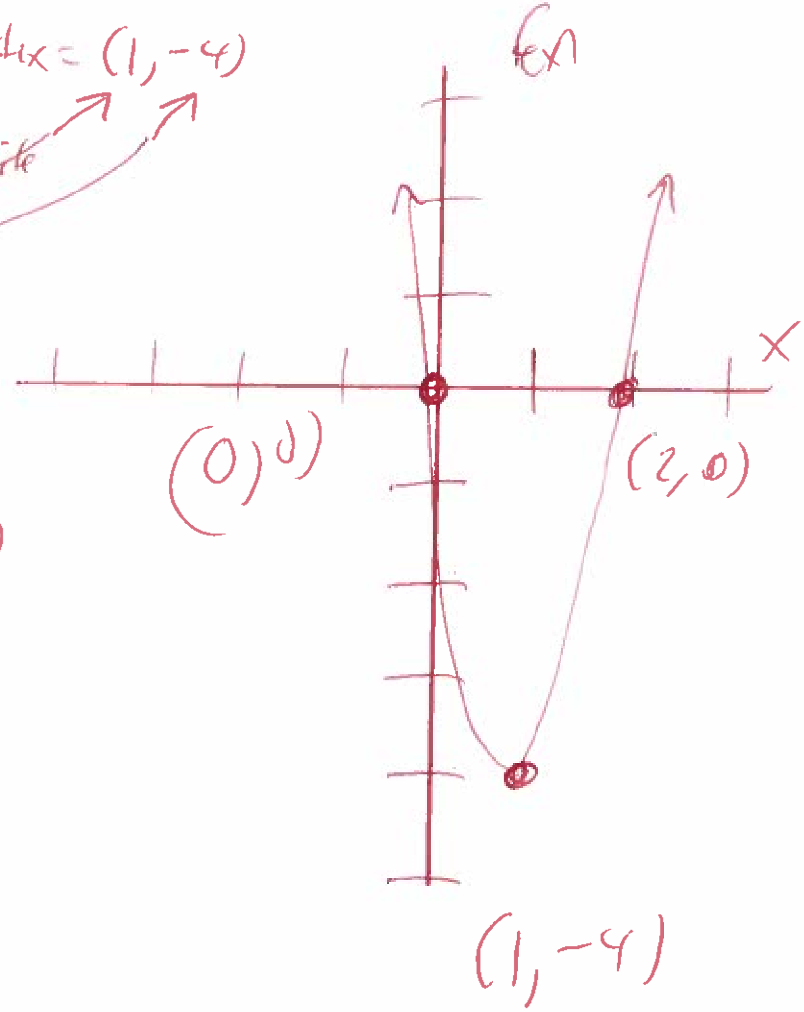
$$\frac{9m}{2} - \frac{P}{4} - \frac{A}{2} = n$$

29 Write the equation of the quadratic function whose graph is shown. 29.

use vertex = (1, -4)

$y = a(x+b)^2 + c$ opposite

$y = a(x-1)^2 - 4$



$y = a(x-1)^2 - 4$ use (0, 0)

$a(0-1)^2 - 4 = 0$

$a(-1)^2 - 4 = 0$

$a(-1)(-1) - 4 = 0$

$a(1) - 4 = 0$

$a - 4 = 0$

$a - \cancel{4} + \cancel{4} = 0 + 4$

$a = 4$

$$\boxed{y = 4(x-1)^2 - 4}$$

30. graph

30

$$f(x) = 2(x-1)^2 - 2$$

x	$f(x)$
0	0
1	-2
2	0

$f(0) = 2(0-1)^2 - 2$

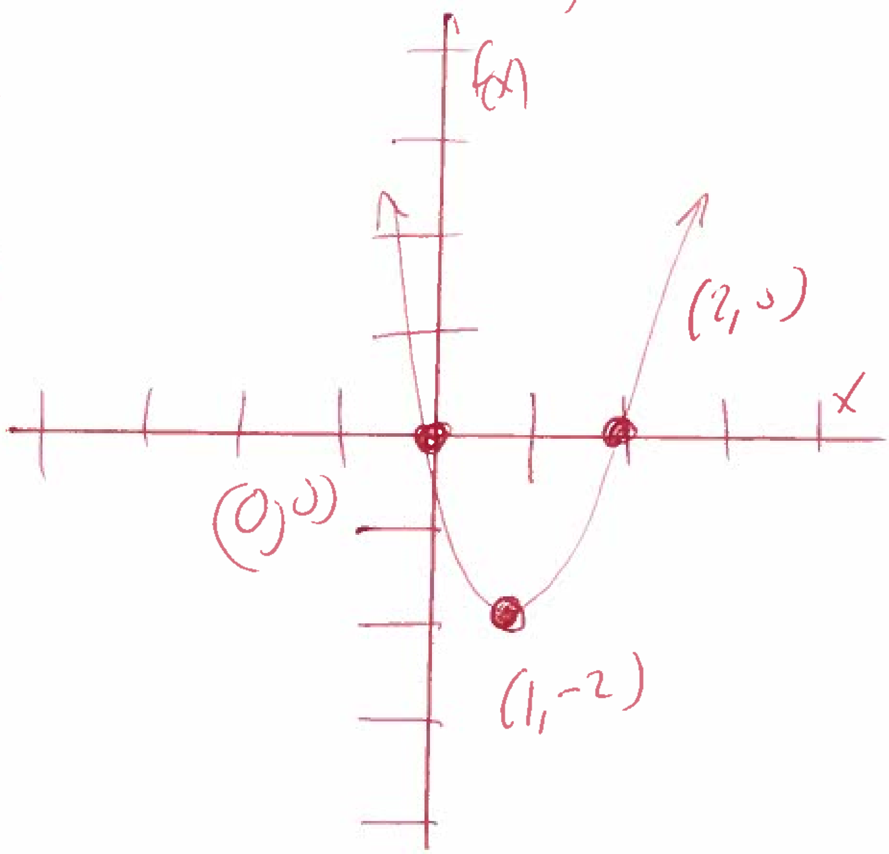
$f(0) = 2(-1)^2 - 2$

$f(0) = 2(-1)(-1) - 2$

$f(0) = 2(1) - 2$

$f(0) = 2 - 2$

$f(0) = 0$



$f(1) = 2(1-1)^2 - 2$

$f(1) = 2(0)^2 - 2$

$f(1) = 2(0)(0) - 2$

$f(1) = 2(0) - 2$

$f(1) = 0 - 2$

$f(1) = -2$

$f(2) = 2(2-1)^2 - 2$

$f(2) = 2(1)^2 - 2$

$f(2) = 2(1)(1) - 2$

$f(2) = 2(1) - 2$

$f(2) = 2 - 2$

$f(2) = 0$

31. graph

$y = 3x^2 + 12x - 23$

$a = 3, \quad b = 12, \quad c = -23$

$\text{Vertex} = \left(-\frac{b}{2a}, f\left(-\frac{b}{2a}\right)\right)$

$\text{Vertex} = \left(\frac{-(12)}{2(3)}, f\left(\frac{-(12)}{2(3)}\right)\right)$

$\text{Vertex} = \left(\frac{-12}{6}, f\left(\frac{-12}{6}\right)\right)$

$\text{Vertex} = (-2, f(-2))$

$\text{Vertex} = (-2, 3(-2)^2 + 12(-2) - 23)$

$\text{Vertex} = (-2, 3(-2)(-2) + 12(-2) - 23)$

$\text{Vertex} = (-2, 3(4) + 12(-2) - 23)$

$\text{Vertex} = (-2, 12 - 24 - 23)$

$\text{Vertex} = (-2, -12 - 23)$

$\text{Vertex} = (-2, -35)$

31

Use graphing calculator

$Y_1 = 3x^\wedge 2 + 12x - 23$

Xmin = -10

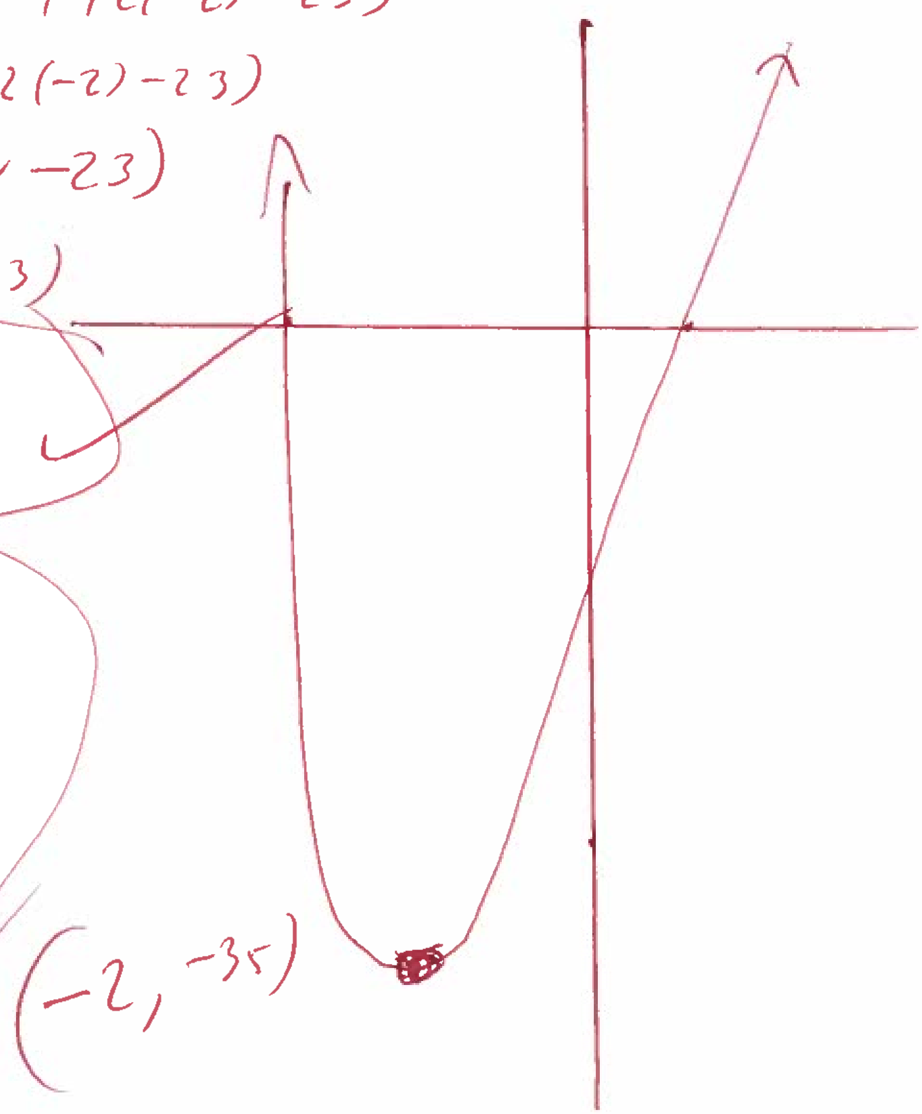
Xmax = 10

Xscl = 1

Ymin = -40

Ymax = 10

Yscl = 1



32. graph

$y = 1x^2 + 18x + 81$

$a = 1,\ b = 18,\ c = 81$

$\text{Vertex} = \left(-\frac{b}{2a},\ f\left(-\frac{b}{2a}\right)\right)$

$\text{Vertex} = \left(-\frac{(18)}{2(1)},\ f\left(-\frac{(18)}{2(1)}\right)\right)$

$\text{Vertex} = \left(\frac{-18}{2},\ f\left(\frac{-18}{2}\right)\right)$

$\text{Vertex} = (-9,\ f(-9))$

$\text{Vertex} = (-9,\ 1(-9)^2 + 18(-9) + 81)$

$\text{Vertex} = (-9,\ 1(-9)(-9) + 18(-9) + 81)$

$\text{Vertex} = (-9,\ 1(81) + 18(-9) + 81)$

$\text{Vertex} = (-9,\ 81 - 162 + 81)$

$\text{Vertex} = (-9,\ -81 + 81)$

$\text{Vertex} = (-9,\ 0)$

Use graphing calculator

$y_1 = x^2 + 18x + 81$

$x\min = -12$

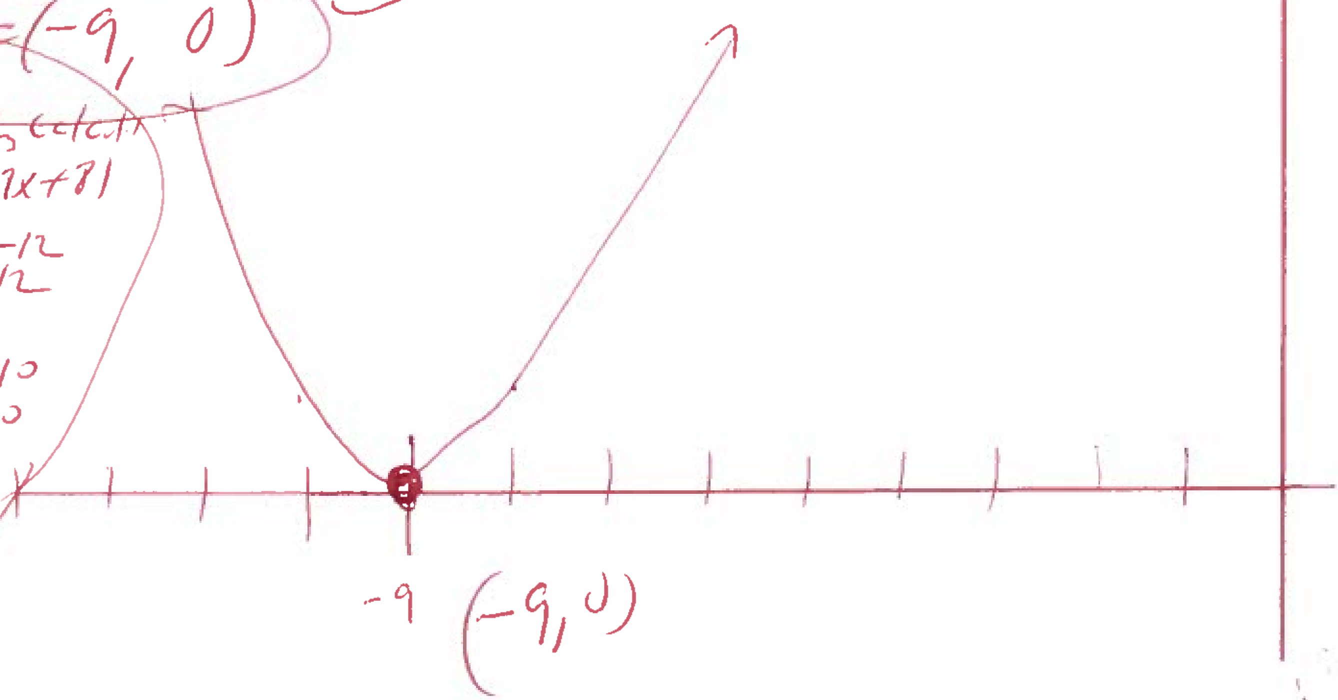
$x\max = 12$

$x\text{scl} = 1$

$y\min = -10$

$y\max = 10$

$y\text{scl} = 1$



32

33.

graph

$y = 2x^2 - 12x + 16$

$a=2,\ b=-12,\ c=16$

$\text{Vertex} = \left(-\frac{b}{2a},\ f\left(\frac{-b}{2a}\right)\right)$

$\text{Vertex} = \left(-\frac{(-12)}{2(2)},\ f\left(\frac{-(-12)}{2(2)}\right)\right)$

$\text{Vertex} = \left(\frac{12}{4},\ f\left(\frac{12}{4}\right)\right)$

$\text{Vertex} = (3,\ f(3))$

$\text{Vertex} = (3,\ 2(3)^2 - 12(3) + 16)$

$\text{Vertex} = (3,\ 2(3)(3) - 12(3) + 16)$

$\text{Vertex} = (3,\ 2(9) - 12(3) + 16)$

$\text{Vertex} = (3,\ 18 - 36 + 16)$

$\text{Vertex} = (3,\ -18 + 16)$

$\text{Vertex} = (3,\ -2)$

use graphing calculator

$y_1 = 2x^{\wedge}2 - 12x + 16$

$x\min = -12$

$x\max = 12$

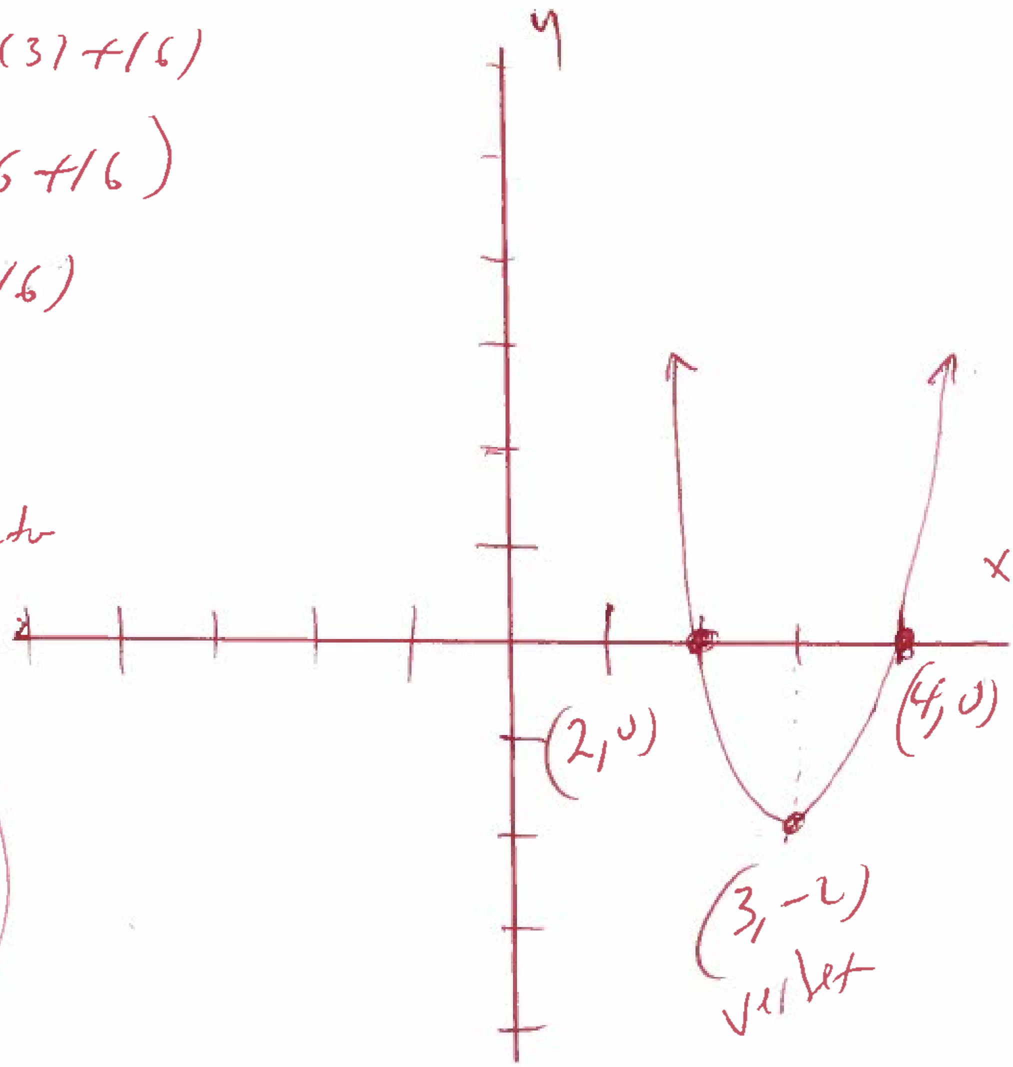
$x\text{scl} = 1$

$y\min = -10$

$y\max = 10$

$y\text{scl} = 1$

33.



37. find max

34

$A = x(1400 - x)$

$A = 1400x - x^2$

$A = -1x^2 + 1400x$

$a = -1, \quad b = 1400, \quad c = 0$

$\text{Vertex} = \left(\frac{-b}{2a}, f\left(\frac{-b}{2a}\right)\right)$

$\text{Vertex} = \left(\frac{-(1400)}{2(-1)}, f\left(\frac{-(1400)}{2(-1)}\right)\right)$

$\text{Vertex} = \left(\frac{-1400}{-2}, f\left(\frac{-1400}{-2}\right)\right)$

$\text{Vertex} = (700, f(700))$

$\text{Vertex} = (700, -1(700)^2 + 1400(700))$

$\text{Vertex} = (700, 490000)$

35

possible
8 · 1
2 · 4

35.

$$s^2 - 7s - 8 = 0$$

$$(s + 1)(s - 8) = 0$$

$$s + 1 = 0 \quad \text{OR} \quad s - 8 = 0$$

$$s + \cancel{1} - \cancel{1} = 0 - 1 \quad \text{OR} \quad s - \cancel{8} + \cancel{8} = 0 + 8$$

$$s = -1 \quad \text{OR} \quad s = 8$$

$$\{-1, 8\}$$

36

$$w^2 - 11w + 24 = 0$$

$$(w-3)(w-8) = 0$$

possibly

24 . 1

12 . 2

6 . 4

3 . 8

36

Let $w - 3 = 0$ or $w - 8 = 0$

$w - 3 + 3 = 0 + 3$ or $w - \cancel{8} + \cancel{8} = 0 + 8$

$w = 3$ or $w = 8$

$\{3, 8\}$

37.

37.

$4x^2 - 28x - 32 = 0$

$4(x^2 - 7x - 8) = 0$

$4(x+1)(x-8) = 0$

set $\cancel{4 \neq 0}$ OR $x+1=0$ OR $x-8=0$

$x+\cancel{1}-\cancel{1}=0-1$ OR $x-\cancel{8}+\cancel{8}=0+8$

$x=-1$ or $x=8$

$\{-1, 8\}$

38

$$5v^2 + 39v + 54 = 0$$

$$(5v + 9)(v + 6) = 0$$

5.1

54.1
27.2
6.9
18.3

38

Set $5v + 9 = 0$ <u>OR</u> $v + 6 = 0$

$5v + \cancel{9} - \cancel{9} = 0 - 9$ OR $v + \cancel{6} - \cancel{6} = 0 - 6$

$5v = -9$ OR $v = -6$

$\frac{\cancel{5}v}{\cancel{5}} = \frac{-9}{5}$ OR

$v = -9/5$

$$\left\{ -\frac{9}{5}, -6 \right\}$$

38. $4x^2+31x=-42$

possible

$4x^2+31x+42=0$ rewrite

4.1
2.2

42.1
21.2
6.7

39.

$(4x+7)(x+6)=0$

set $4x+7=0$ OR $x+6=0$

$4x+\cancel{7}-\cancel{7}=0-7$ OR $x+\cancel{6}-\cancel{6}=0-6$

$4x=-7$ OR $x=-6$

$\frac{4x}{4}=\frac{-7}{4}$

$x=-7/4$

$\left\{\frac{-7}{4}, -6\right\}$

(40) graph

$y = x^2 - 6x - 27$

find x-intercepts let $y=0$

$0 = x^2 - 6x - 27$

$0 = (x+3)(x-9)$

set $x+3=0$ OR $x-9=0$

$x+3-3=0-3$ OR $x-\cancel{9}+\cancel{9}=0+9$

$x=-3$ OR $x=9$ $(-3,0),(9,0)$

use graphing calculator

$y_1 = x^2 - 6x - 27$

xmin = -12
xmax = 12
xscl = 1
ymin = -40
ymax = 10
yscl = 1

$y = x^2 - 6x - 27$

$a=1,\ b=-6,\ c=-27$

Vertex $= \left(-\frac{b}{2a}, f\left(\frac{-b}{2a}\right)\right)$

Vertex $= \left(-\frac{(-6)}{2(1)}, f\left(\frac{-(-6)}{2(1)}\right)\right)$

Vertex $= \left(\frac{6}{2}, f\left(\frac{6}{2}\right)\right)$

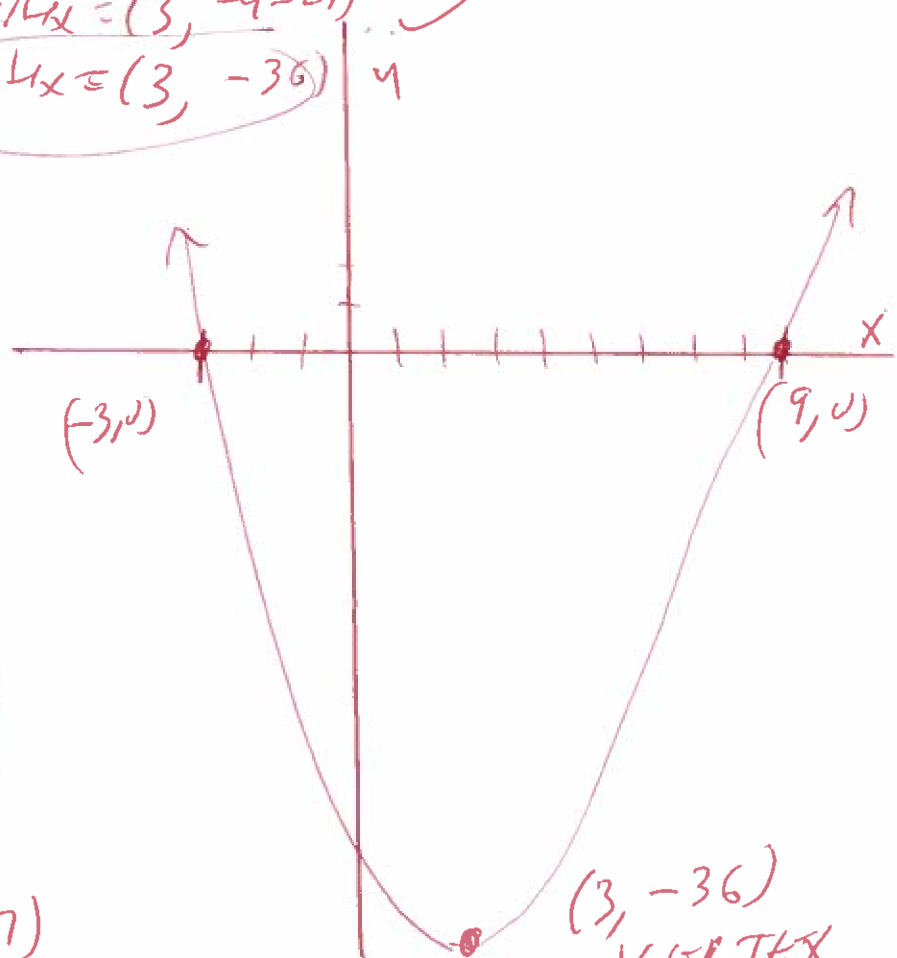
Vertex $= (3, f(3))$

Vertex $= (3, (3)^2 - 6(3) - 27)$

Vertex $= (3, 9-18-27)$

Vertex $= (3, -9-27)$

Vertex $= (3, -36)$



(40.)

41.

possible

3,1

16,1
8,2
4,4

41.

$3x^2+8x-16=0$

$(3x-4)(x+4)=0$

$3x-4=0$ or $x+4=0$

$3x-\cancel{4}+\cancel{4}=0+4$ OR $x+\cancel{4}-\cancel{4}=0-4$

$3x=4$ or $x=-4$

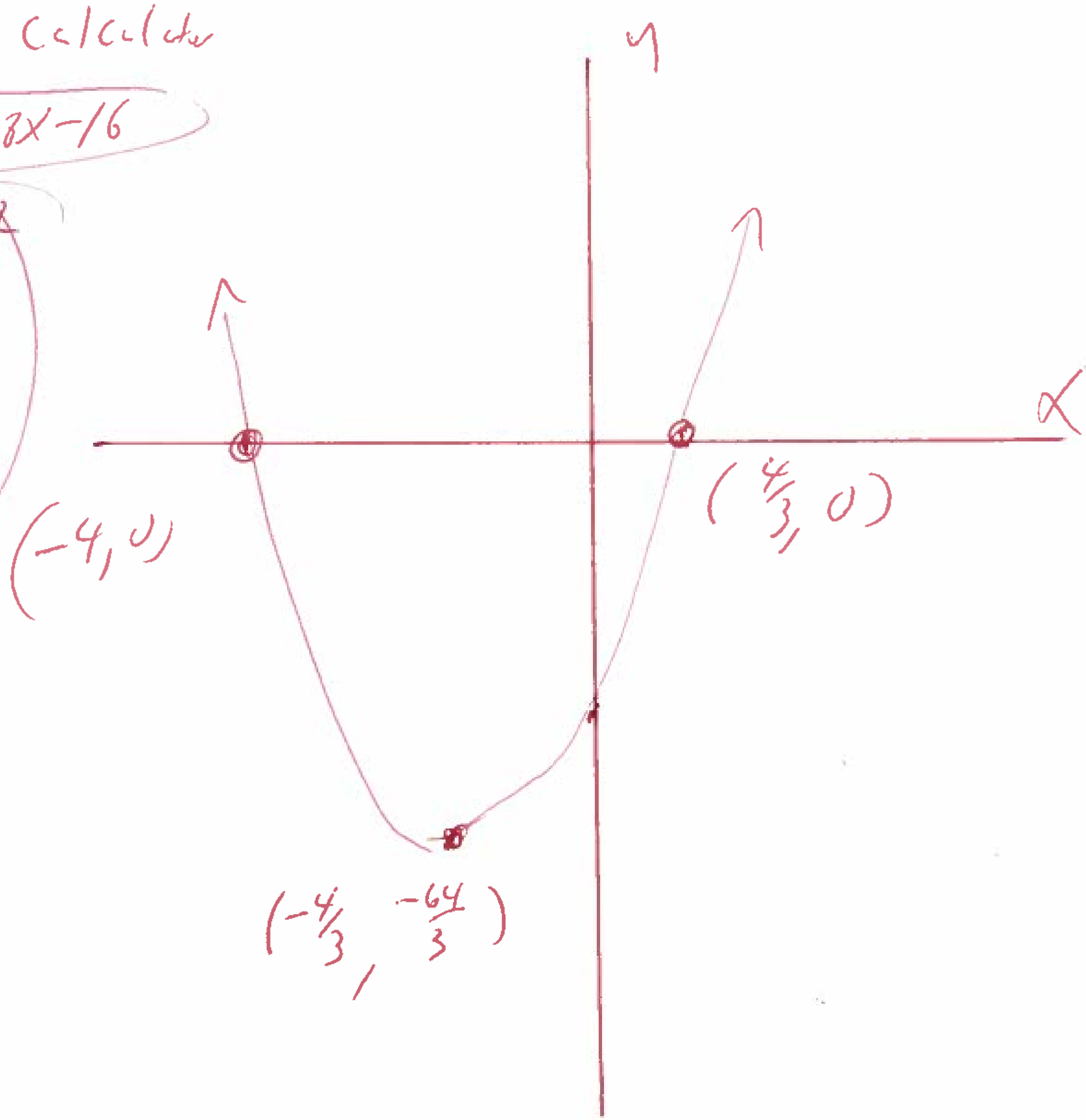
$\frac{3x}{3}=\frac{4}{3}$

$x=\frac{4}{3}$

use graphing calculator

$y_1=3x^2+8x-16$

xmin = -12
xmax = 12
xscl = 1
ymin = -30
ymax = 10
yscl = 1



42. Complete the square 42.

$x^2-13x+30=0$

$x^2-13x=-30$

$x^2-13x+(\frac{1}{2}(-13))^2=-30+(\frac{1}{2}(-\frac{13}{1}))^2$

$x^2-13x+(-\frac{13}{2})^2=-30+(-\frac{13}{2})^2$

$(x-\frac{13}{2})(x-\frac{13}{2})^2=-30+(-\frac{13}{2})(-\frac{13}{2})$

$(x-\frac{13}{2})^2=-30+\frac{169}{4}$

$(x-\frac{13}{2})^2=-\frac{30}{1}(\frac{4}{4})+\frac{169}{4}$

$(x-\frac{13}{2})^2=-\frac{120}{4}+\frac{169}{4}$

$(x-\frac{13}{2})^2=\frac{-120+169}{4}$

$(x-\frac{13}{2})^2=\frac{49}{4}$

$\sqrt{(x-\frac{13}{2})^2}=\pm\sqrt{\frac{49}{4}}$

$x-\frac{13}{2}=\pm\frac{7}{2}$

$x=\frac{13}{2}\pm\frac{7}{2}$

$x=\frac{13+7}{2}$ or $x=\frac{13-7}{2}$

$x=\frac{20}{2}$ OR $x=\frac{6}{2}$

$x=10$ OR $x=3$

$\{10, 3\}$

43. Use Quadratic formula 43.

$1x^2+3x-5=0$

$a=1,\ b=3,\ c=-5$

$$x=\frac{-b\pm\sqrt{b^2-4ac}}{2a}$$

$$x=\frac{-(3)\pm\sqrt{(3)^2-4(1)(-5)}}{2(1)}$$

$$x=\frac{-3\pm\sqrt{9+20}}{2}$$

$$x=\frac{-3\pm\sqrt{29}}{2}$$

$$x=\frac{-3-\sqrt{29}}{2} \quad \text{or} \quad x=\frac{-3+\sqrt{29}}{2}$$

44 use Quadratic formula

44.

$7p + 3p^2 = -2$

$3p^2 + 7p = -2$

$3p^2 + 7p + 2 = 0$

$a = 3, \quad b = 7, \quad b = 2$

$$p = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$p = \frac{-(7) \pm \sqrt{(7)^2 - 4(3)(2)}}{2(3)}$$

$$p = \frac{-7 \pm \sqrt{49 - 24}}{6}$$

$$x = \frac{-7 \pm \sqrt{25}}{6}$$

$$x = \frac{-7 \pm 5}{6}$$

$x = \frac{-7-5}{6}$ or $x = \frac{-7+5}{6}$

$x = \frac{-12}{6}$ or $x = \frac{-2}{6}$

$x = -2$ or $x = \frac{\cancel{2}(-1)}{\cancel{2}(3)}$

$x = -\frac{1}{3}$

$\{-2, -\frac{1}{3}\}$

45.

45.

$$6x^2+6x-36=0$$

$$6(x^2+x-6)=0$$

$$6(x-2)(x+3)=0$$

set ~~6=0~~ or $x-2=0$ or $x+3=0$

$x-2+2=0+2$ or $x+\cancel{3}\cancel{-3}=0-3$

$x=2$ or $x=-3$

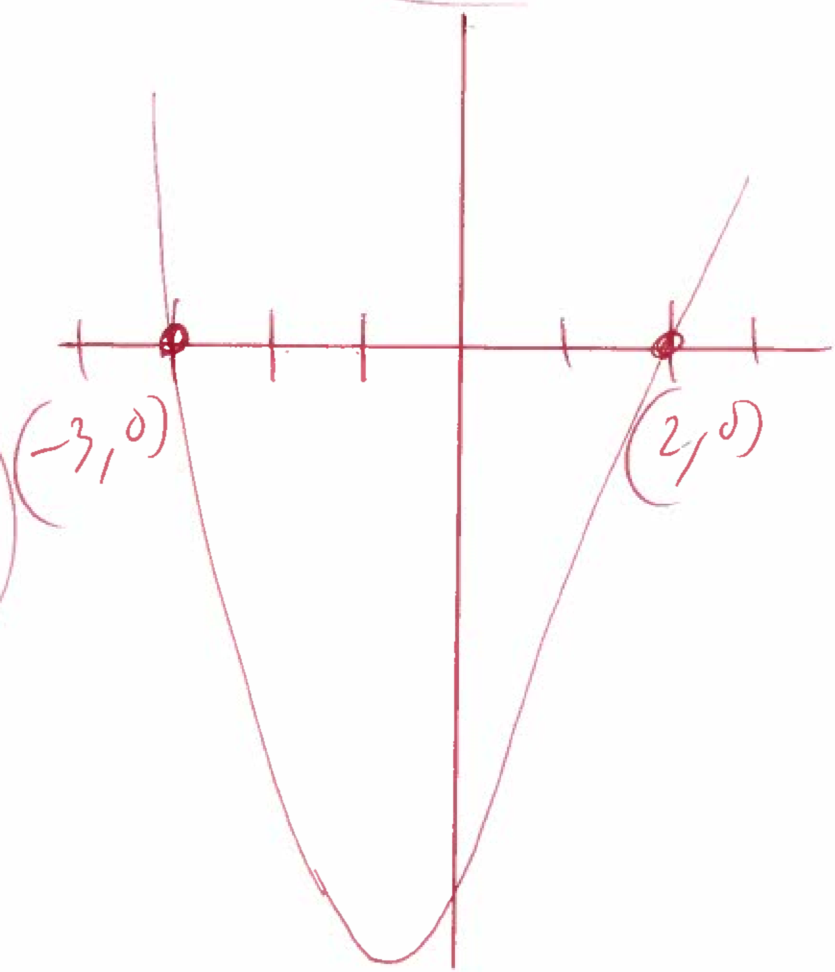
$\{-3,2\}$

OR

graph

$y=6x^2+6x-36$

Xmin = -12
Xmax = 12
Xscl = 1
ymin = -40
ymax = 10
yscl = 1



46 Use Quadratic Formula

46

$1x^2+12x+40=0$

$a=1,\ b=12,\ c=40$

$$x=\frac{-b\pm\sqrt{b^2-4ac}}{2a}$$

$$x=\frac{-(12)\pm\sqrt{(12)^2-4(1)(40)}}{2(1)}$$

$$x=\frac{-12\pm\sqrt{144-160}}{2}$$

$$x=\frac{-12\pm\sqrt{-16}}{2}$$

$$x=\frac{-12\pm 4i}{2}$$

$$\{-6-2i,\ -6+2i\}$$

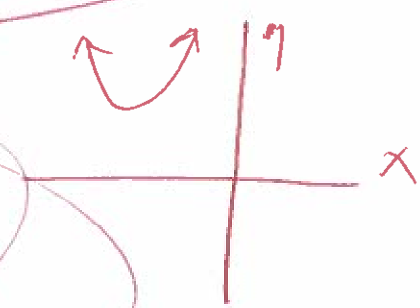
$x=-6\pm 2i$

$x=-6-2i$ or $x=-6+2i$

use graphing calcul

$y_1=x^2+12x+40$

Xmin = -12
Xmax = 12
Xscl = 1
Ymin = -10
Ymax = 10
Yscl = 1



47

47

$68 = 8 + 64t - 16t^2$

$16t^2 - 64t - 8 + 68 = 0$

$16t^2 - 64t + 60 = 0$

$\frac{16t^2}{4} - \frac{64t}{4} + \frac{60}{4} = \frac{0}{4}$

$4t^2 - 16t + 15 = 0$

$(2t - 3)(2t - 5) = 0$

$2t - 3 = 0$ OR $2t - 5 = 0$

$2t \cancel{-3} \cancel{+3} = 0 + 3$ OR $2t \cancel{-5} \cancel{+5} = 0 + 5$

$2t = 3$ OR $2t = 5$

$\frac{2t}{2} = \frac{3}{2}$ OR $\frac{\cancel{2}t}{\cancel{2}} = \frac{5}{2}$

$t = 3/2$ OR $t = 5/2$

48 48

$R = 755x$

$C = 22750 + 70x + x^2$

$P = R - C$

$P = (755x) - (22750 + 70x + x^2)$

$P = 755x - 22750 - 70x - x^2$

$P = -x^2 + 685x - 22750$

$P(x) = -x^2 + 685x - 22750$ Profit function

$P(27) = -(27)^2 + 685(27) - 22750$

$P(27) = -4984$ Loss

$P(41) = -(41)^2 + 685(41) - 22750$

$P(41) = 3654$ Profit

49. graph

$y = \sqrt{x} - 2$

$y = \sqrt{0} - 2$

$y = 0 - 2$

$y = -2$

$y = \sqrt{1} - 2$

$y = 1 - 2$

$y = -1$

$y = \sqrt{4} - 2$

$y = 2 - 2$

$y = 0$

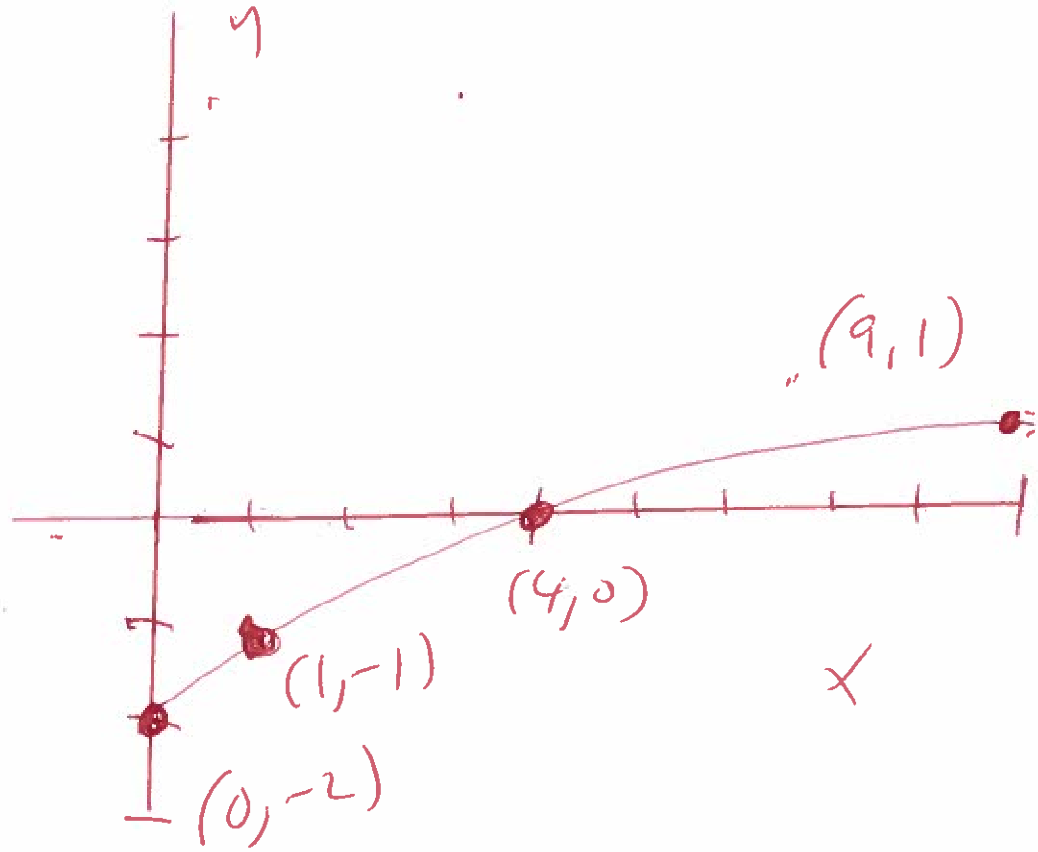
$y = \sqrt{9} - 2$

$y = 3 - 2$

$y = 1$

x	y
0	-2
1	-1
4	0
9	1

49.



50

50

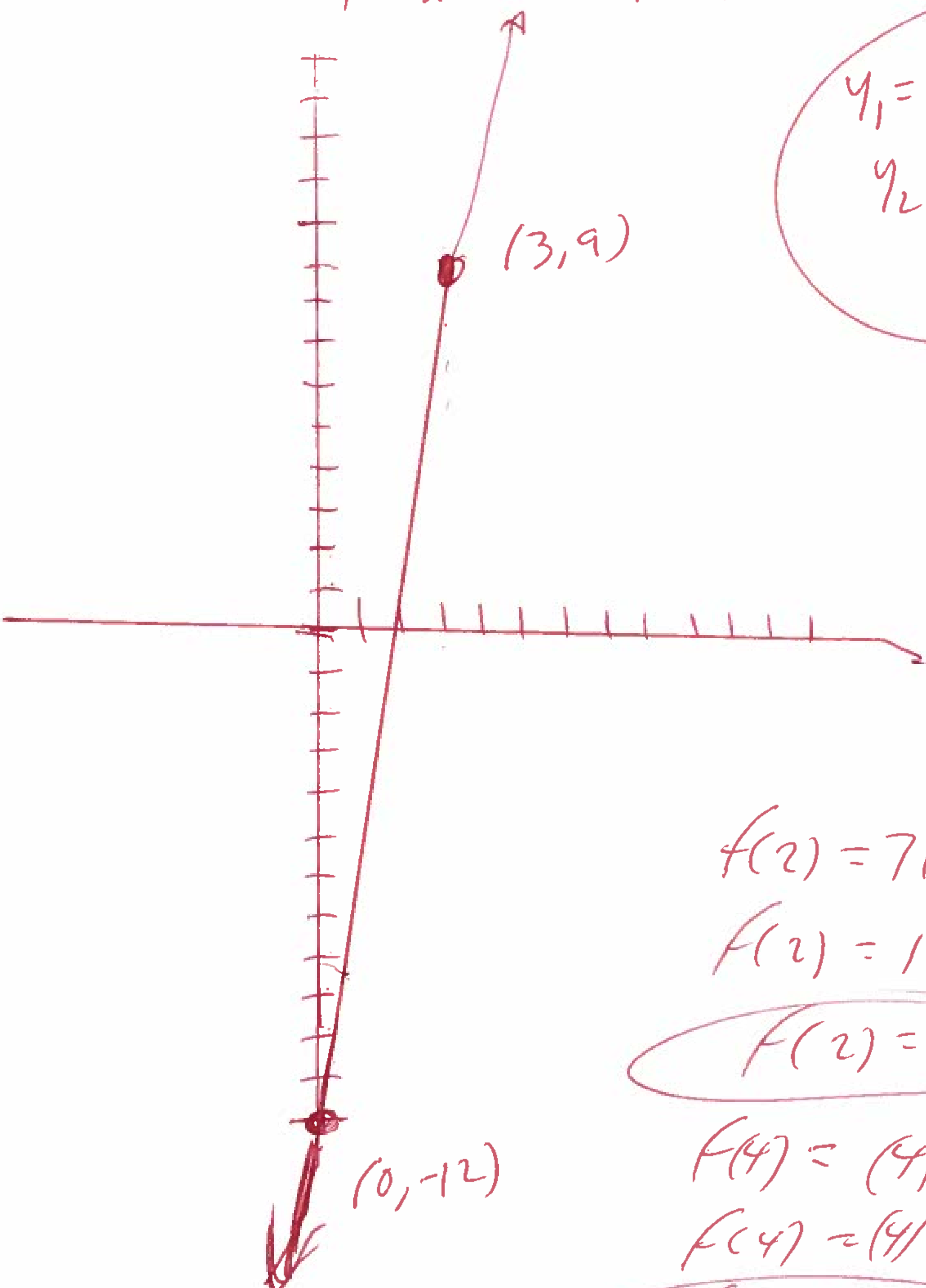
graph

$$f(x) = \begin{cases} 7x-12 & \text{if } x \le 3 \\ x^2 & \text{if } x > 3 \end{cases}$$

use graphing calculator

$y_1 = 7x-12 \div (x \le 3)$

$y_2 = x^2 \div (x > 3)$



$f(2) = 7(2)-12$

$f(2) = 14-12$

$f(2) = 2$

$f(4) = (4)^2$

$f(4) = (4)(4)$

$f(4) = 16$

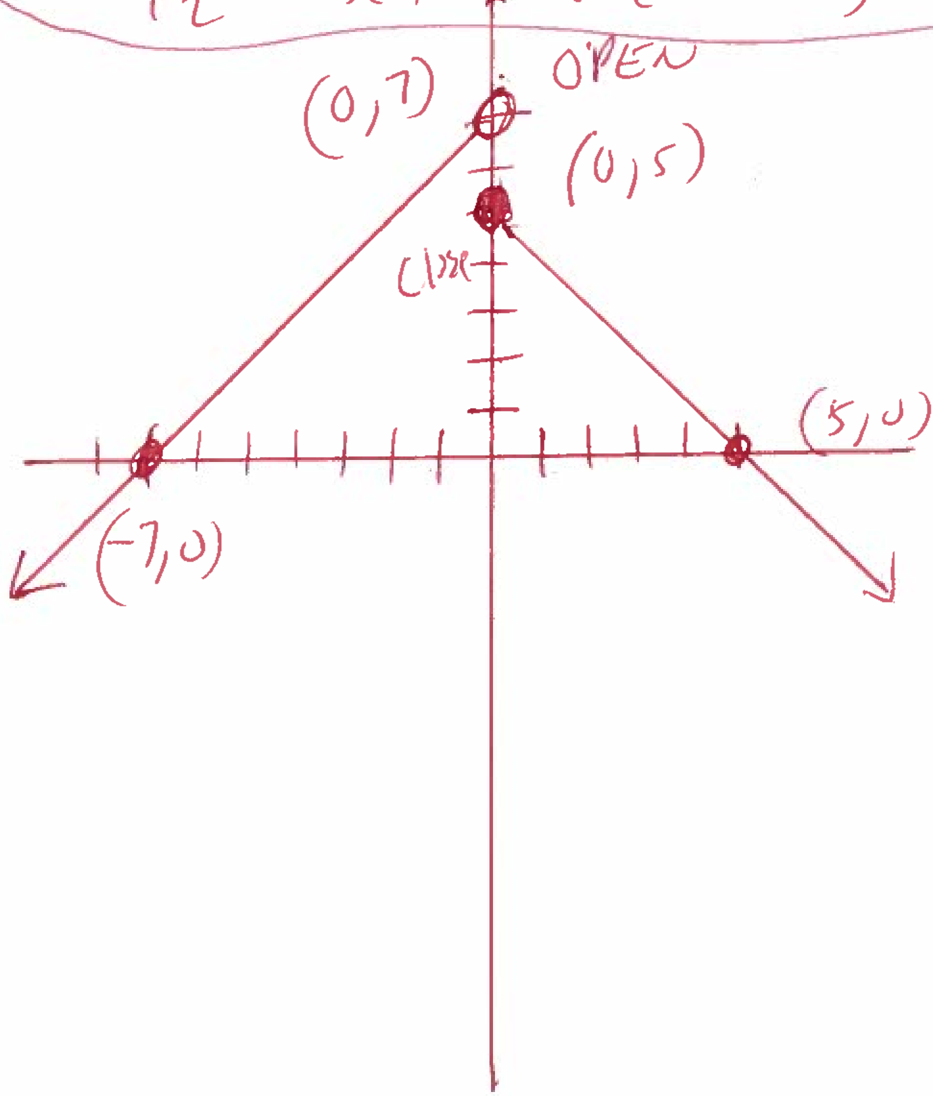
51. graph

$$f(x) = \begin{cases} -x+5 & \text{if } x \geq 0 \\ x+7 & \text{if } x < 0 \end{cases}$$

use graphing calculator

$y_1 = -x+5 \div (x \geq 0)$

$y_2 = x+7 \div (x < 0)$



51

52 $|x-5|=5$

formula
$|x|=a$
$x=-a$ or $x=a$

$x-5=-5$ <u>or</u> $x-5=5$

$x-\cancel{5}+\cancel{5}=-5+5$ OR $x-5+5=5+5$

$x=0$ or $x=10$

$\{0, 10\}$

52

53. A proposed income tax schedule is shown in the table below.

53

if your income is: over	but not over	your tax is		of the amount over
$0	$45,460	- - - - - - -	18%	$0
45,460	111,560	$8,182.80 +	28%	45,460
111,560	177,520	20,080.80 +	36%	111,560
177,520	224,220	31,953.60 +	39%	177,520
224,220	- - - - -	63,907.20 +	44.3%	224,220

(a) Write the piecewise-defined function T with input x that models the tax dollars owed as a function of x, the income, with 0

$$T(x) = \begin{cases} \boxed{0.18x} & \text{if } 0 < x \le 45{,}460 \\ \boxed{} & \text{if } 45{,}460 < x \le 111{,}560 \end{cases}$$

$8{,}182.80 + 0.28(x - 45460)$

(Simplify your answer. Use integers or decimals for any numbers in the expression. Do not include the $ symbol in your answer.)

(b) Use the function to find T(36,000).

T(36,000) = $ 6480.00 (Type an integer or a decimal.)

(c) Find the tax owed on an income of $63,000.

T(63,000) = $ 13094.00 (Type an integer or a decimal.)

(d) A friend tells you not to earn any money over $45,460 because it would raise your tax rate to 28% on all of your income. Test this statement by finding the tax on $45,460 and on $45,460 + $1.

T(45,460) = $ 8182.80 (Type an integer or a decimal.)

T(45,460 + 1) = $ 8183.08 (Type an integer or a decimal.)

Does earning more than $45,460 raise your income tax rate to 28% on all of your income?

○ Yes   ☒ No

$T(36000) = 0.18(36000) = 6480$

$T(63000) = 8182.80 + 0.28(63000 - 45460) = 13094.$

$T(45460) = 0.18(45460) = 8182.80$

$T(45460+1) = 8182.80 + 0.28(45460+1-45460) = 8183.08$

54. Graph

$y = |x-4| - 6$

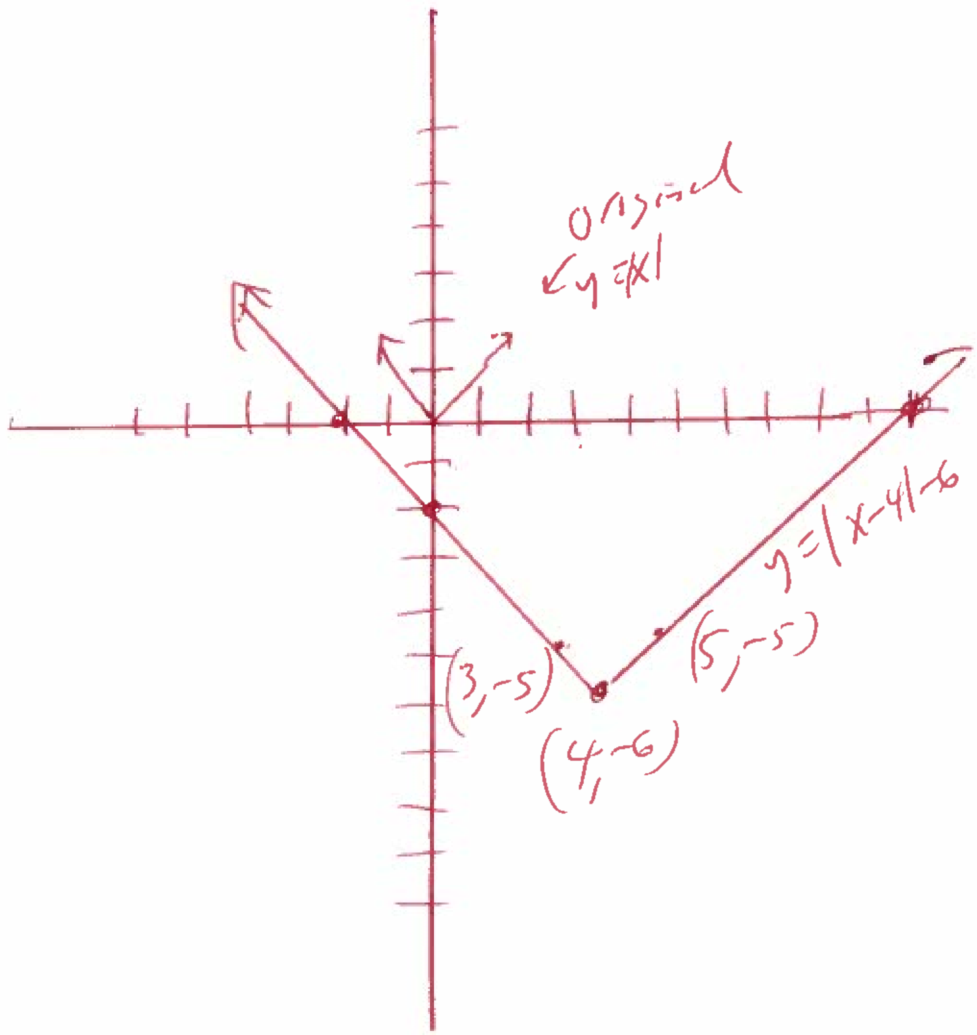
$y = |3-4| - 6$
$y = |-1| - 6$
$y = 1 - 6$
$y = -5$

$y = |4-4| - 6$
$y = |0| - 6$
$y = 0 - 6$
$y = -6$

$y = |5-4| - 6$
$y = |1| - 6$
$y = 1 - 6$
$y = -5$

54

x	y
3	-5
4	-6
5	-5



55. graph

$y = -x^2 + 1$

$y = -(-1)^2 + 1$

$y = -(-1)(-1) + 1$

$y = -(1) + 1$

$y = -1 + 1$

$y = 0$

$y = -(0)^2 + 1$

$y = -(0)(0) + 1$

$y = 0 + 1$

$y = 1$

$y = -(1)^2 + 1$

$y = -(1)(1) + 1$

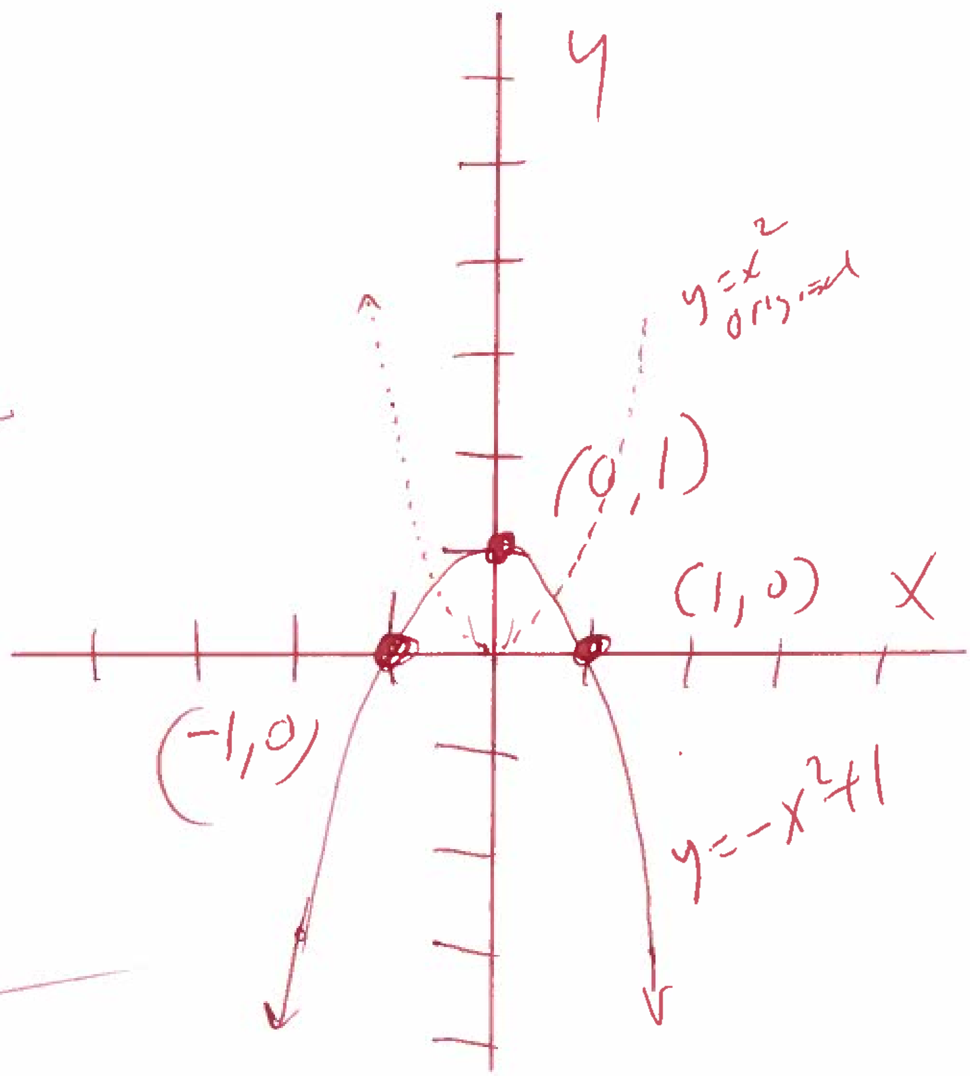
$y = -(1) + 1$

$y = -1 + 1$

$y = 0$

x	y
-1	0
0	1
1	0

55



56. determine the symmetries of the graph of the given relation. 56

$y = 2x^3$

$f(x) = y = 2x^3$

$f(-x) = 2(-x)^3$

$f(-x) = 2(-x)(-x)(-x)$

$f(-x) = 2(-x^3)$

$f(-x) = -2x^3$

$f(-x) = -1(2x^3)$

$f(-x) = -f(x)$

It is symmetric with respect to the origin.

57. determine algebraically whether the graph of the given equation is symmetric with respect to the x-axis, y axis, and/or the origin. Confirm graphically. 57.

$f(x) = y = \frac{2}{x}$

$f(x) = \frac{2}{x}$

$f(-x) = \frac{2}{(-x)}$

$f(-x) = -\frac{2}{x}$

$f(-x) = -(f(x))$

The graph is symmetric with respect to the origin

58. graph

$f(x) = |x| - 3$

58

$f(-x) = |-x| - 3$

$f(-x) = |x| - 3$

$f(-x) = f(x)$ function is even

x	f(x)
-1	-2
0	-3
1	-2

$f(x) = |x| - 3$

$f(-1) = |-1| - 3$

$f(-1) = |1| - 3$

$f(-1) = 1 - 3$

$f(-1) = -2$

$f(0) = |0| - 3$

$f(0) = (0) - 3$

$f(0) = 0 - 3$

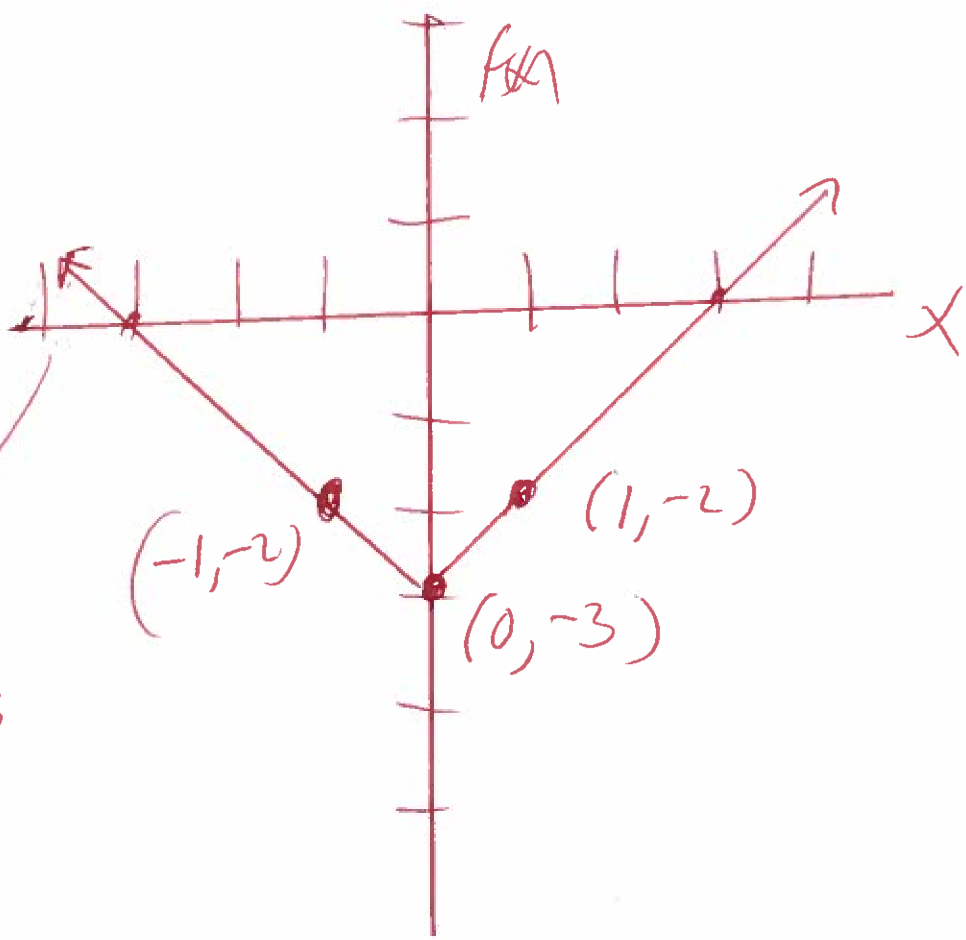
$f(0) = -3$

$f(1) = |1| - 3$

$f(1) = (1) - 3$

$f(1) = 1 - 3$

$f(1) = -2$



59. $f(x) = 4x^2 + 4$ and $g(x) = 5x - 2$

59.

$(f+g)(x) =$

$f(x) + g(x) =$

$(4x^2+4) + (5x-2) =$

$4x^2 + 4 + 5x - 2 =$

$4x^2 + 5x + 2 =$

$(f-g)(x) =$

$f(x) - g(x) =$

$(4x^2+4) - (5x-2) =$

$4x^2 + 4 - 5x + 2 =$

$4x^2 - 5x + 6 =$

$(f \cdot g)(x) =$

$f(x) \cdot g(x) =$

$(4x^2+4)(5x-2) =$

$20x^3 - 8x^2 + 20x - 8 =$

$\left(\frac{f}{g}\right)(x) =$

$\frac{f(x)}{g(x)} =$

$\frac{4x^2+4}{5x-2} =$

domain

Set $5x - 2 = 0$

$5x - 2 + 2 = 0 + 2$

$5x = 2$

$\frac{5x}{5} = \frac{2}{5}$

$x = \frac{2}{5}$

domain $\{x \mid x \neq \frac{2}{5}\}$

60 $f(x) = x^2 - 6x$ and $g(x) = 8 - x^3$

60!

$(f+g)(-1) =$

$f(-1) + g(-1) =$

$((-1)^2 - 6(-1)) + (8 - (-1)^3)$

$((-1)(-1) - 6(-1)) + (8 - (-1)(-1)(-1))$

$(1 + 6) + (8 + 1)$

$(7) + (9) =$

$16 =$

$(f \cdot g)(1) =$

$f(1) \cdot g(1) =$

$((1)^2 - 6(1))(8 - (1)^3) =$

$((1)(1) - 6(1))(8 - (1)(1)(1)) =$

$(1 - 6)(8 - 1) =$

$(-5)(7) =$

$-35 =$

$(g - f)(4) =$

$g(4) - f(4) =$

$(8 - (4)^3) - ((4)^2 - 6(4)) =$

$(8 - (4)(4)(4)) - ((4)(4) - 6(4)) =$

$(8 - 64) - (16 - 24)$

$(-56) - (-8) =$

$-56 + 8 =$

$-48 =$

$\left(\frac{g}{f}\right)(4) =$

$\frac{g(4)}{f(4)} =$

$\frac{8 - (4)^3}{(4)^2 - 6(4)} =$

$\frac{8 - (4)(4)(4)}{(4)(4) - 6(4)} =$

$\frac{8 - 64}{16 - 24} =$

$\frac{-56}{-8} =$

$7 =$

61. find $(f \circ g)(x)$ and $(g \circ f)(x)$ 61.

$f(x) = 8x - 8$ and $g(x) = 8 - 3x$

$(f \circ g)(x) =$

$f(g(x)) =$

$f(8 - 3x) =$

$8(8 - 3x) - 8 =$

$64 - 24x - 8 =$

$-24x + 56$

$(g \circ f)(x) =$

$g(f(x)) =$

$g(8x - 8) =$

$8 - 3(8x - 8) =$

$8 - 24x + 24 =$

$-24x + 32 =$

62. find $(f \circ g)(x)$ and $(g \circ f)(x)$ 62.

$f(x) = 7x - 7$ and $g(x) = \frac{x+7}{7}$

$(f \circ g)(x) =$

$f(g(x)) =$

$f\left(\frac{x+7}{7}\right) =$

$\cancel{7}\left(\frac{x+7}{\cancel{7}}\right) - 7 =$

$x + \cancel{7} - \cancel{7} =$

$x =$

$(g \circ f)(x) =$

$g(f(x)) =$

$g(7x-7) =$

$\frac{(7x-7)+7}{7} =$

$\frac{7x - \cancel{7} + \cancel{7}}{7} =$

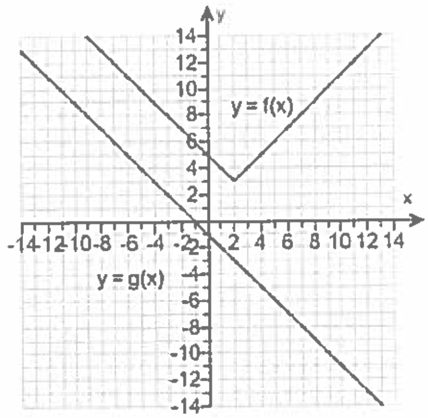
$\frac{7x}{7} =$

$x =$

63. Use the graph of f and g to evaluate the functions.

a. $(f+g)(8)$ b. $(f \circ g)(-5)$

c. $\left(\frac{f}{g}\right)(4)$ d. $(g \circ f)(-2)$



a. $(f+g)(8) =$ 0
(Simplify your answer.)

b. $(f \circ g)(-5) =$ 5
(Simplify your answer.)

c. $\left(\frac{f}{g}\right)(4) =$ -1
(Simplify your answer.)

d. $(g \circ f)(-2) =$ -8
(Simplify your answer.)

63

$(f+g)(8) = f(8) + g(8) = (9) + (-9) = 9 - 9 = 0$

$(f \circ g)(-5) = f(g(-5)) = f(4) = 5$

$\left(\frac{f}{g}\right)(4) = \frac{f(4)}{g(4)} = \frac{5}{-5} = -1$

$(g \circ f)(-2) = g(f(-2)) = g(7) = -8$

64 for the following function determine whether the function is one-to-one. 64

$\{(2,6),(5,6),(-9,3),(1,-8)\}$

No, not one to one function

Since $(2,6)$ $(5,6)$

two different ~~first~~ first numbers go to the same second number

65. determine whether the function is one-to-one. If it is find a formula for its inverse.

65

$f(x) = 5x - 6$

if $f(a) = f(b)$

$5(a) - 6 = 5(b) - 6$

$5a - 6 = 5b - 6$

$5a - \cancel{6} + \cancel{6} = 5b - \cancel{6} + \cancel{6}$

$5a = 5b$

$\frac{\cancel{5}a}{\cancel{5}} = \frac{\cancel{5}b}{\cancel{5}}$

then $a = b$

y is one-to-one

find inverse

$f(x) = 5x - 6$

$y = 5x - 6$

$x = 5y - 6$ inverse letters

$x + 6 = 5y \cancel{-6} \cancel{+6}$

$x + 6 = 5y$

$\frac{x+6}{5} = \frac{\cancel{5}y}{\cancel{5}}$

$\frac{x+6}{5} = y$

$f^{-1}(x) = \frac{x+6}{5}$

inverse

66 find the inverse

$y = g(x) = 6x + 4$

$y = 6x + 4$

$x = 6y + 4$ inverse letter

$x - 4 = 6y + \cancel{4} - \cancel{4}$

$x - 4 = 6y$

$\frac{x-4}{6} = \frac{6y}{6}$

$\frac{x-4}{6} = y$

$g^{-1}(x) = \frac{x-4}{6}$

66

67. graph $y = g(x) = \sqrt[3]{x+1}$ and $g^{-1}(x)$.

67.

$y = g(x) = \sqrt[3]{x+1}$

$y = \sqrt[3]{x+1}$

$x = \sqrt[3]{y+1}$

$(x)^3 = \left(\sqrt[3]{y+1}\right)^3$

$x^3 = y+1$

$x^3 - 1 = y + \cancel{1} \cancel{-1}$

$x^3 - 1 = y$

$g^{-1}(x) = x^3 - 1$

inverse

$g(x) = \sqrt[3]{x+1}$

$g(-9) = \sqrt[3]{-9+1} = \sqrt[3]{-8} = -2$

$g(-1) = \sqrt[3]{-1+1} = \sqrt[3]{0} = 0$

$g(0) = \sqrt[3]{0+1} = \sqrt[3]{1} = 1$

$g(7) = \sqrt[3]{7+1} = \sqrt[3]{8} = 2$

x	$g(x)$
-9	-2
-1	0
0	1
7	2

$g^{-1}(x) = x^3 - 1$

$g^{-1}(-2) = (-2)^3 - 1$

$g^{-1}(-2) = (-2)(-2)(-2) - 1$

$g^{-1}(-2) = -8 - 1$

$g^{-1}(-2) = -9$

$g^{-1}(0) = (0)^3 - 1$

$g^{-1}(0) = (0)(0)(0) - 1$

$g^{-1}(0) = 0 - 1$

$g^{-1}(0) = -1$

x	$g^{-1}(x)$
-2	-9
0	-1
1	0
2	7

$g^{-1}(1) = (1)^3 - 1$

$g^{-1}(1) = (1)(1)(1) - 1$

$g^{-1}(1) = 1 - 1$

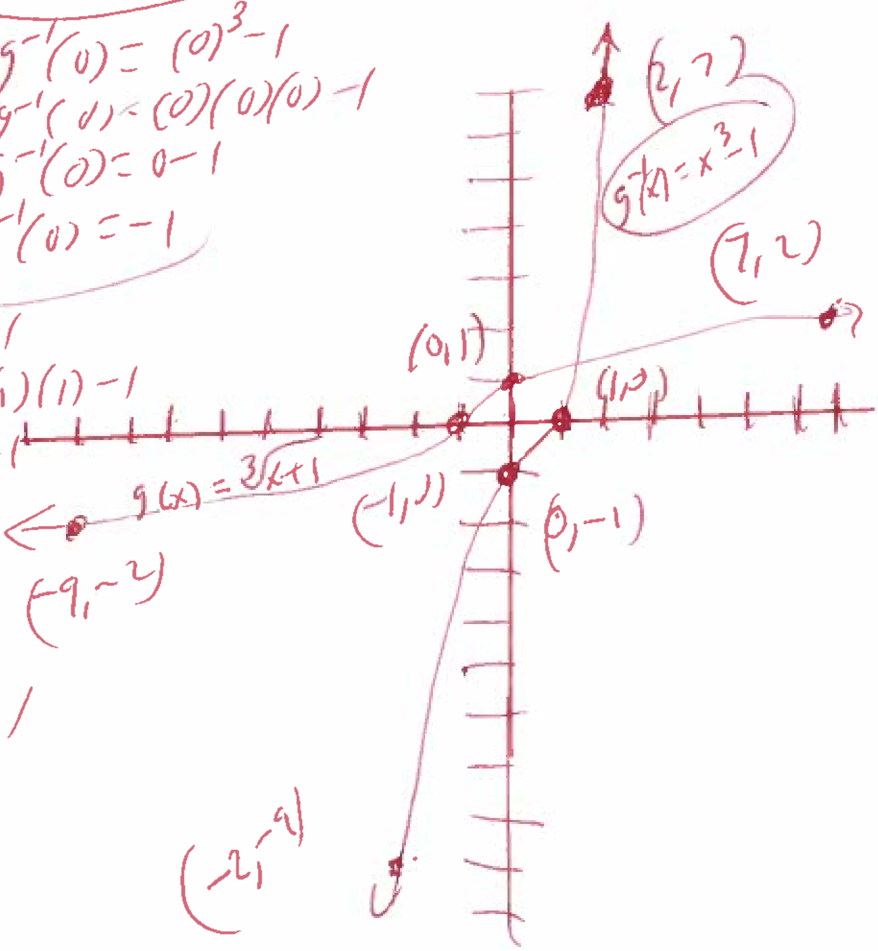
$g^{-1}(1) = 0$

$g^{-1}(2) = (2)^3 - 1$

$g^{-1}(2) = (2)(2)(2) - 1$

$g^{-1}(2) = 8 - 1$

$g^{-1}(2) = 7$



68. If we assign numbers to the letters of the alphabet as follows and assign 27 to a blank space, we can convert a message to a numerical sequence. We can "encode" a message by adding 2 to each number that represents a letter in a message. Thus, the message "GO FOR IT" can be encoded by using the numbers to represent the letters and further encoded by using the function C(x) = x + 2. The coded message would be 9 17 29 8 17 20 29 11 22.

A	B	C	D	E	F	G	H	I	J	K	L	M
1	2	3	4	5	6	7	8	9	10	11	12	13

N	O	P	Q	R	S	T	U	V	W	X	Y	Z
14	15	16	17	18	19	20	21	22	23	24	25	26

68.

$y = C(x) = x + 2$

$y = x + 2$

$x = y + 2$ rewrite inv variable

$x - 2 = y + 2 - 2$

$x - 2 = y$ decode

$C^{-1}(x) = x - 2$

21, 10, 7, 29, 25, 7, 16, 22, 29

22, 10, 7, 20, 7

$C^{-1}(21) = 21 - 2 = 19 = S$

$C^{-1}(10) = 10 - 2 = 8 = H$

$C^{-1}(7) = 7 - 2 = 5 = E$

$C^{-1}(29) = 29 - 2 = 27 =$ space

$C^{-1}(25) = 25 - 2 = 23 = W$

$C^{-1}(7) = 7 - 2 = 5 = E$

$C^{-1}(16) = 16 - 2 = 14 = N$

$C^{-1}(22) = 22 - 2 = 20 = T$

~~$C^{-1}(10) = 10 - 2 = 8$~~

~~$C^{-1}(7) = 7 - 2 = 5$~~

~~$C^{-1}(20) =$~~

$C^{-1}(29) = 29 - 2 = 27$ space

$C^{-1}(22) = 22 - 2 = 20 = T$

$C^{-1}(10) = 10 - 2 = 8 = H$

$C^{-1}(7) = 7 - 2 = 5 = E$

$C^{-1}(20) = 20 - 2 = 18 = R$

$C^{-1}(7) = 7 - 2 = 5 = E$

69

$-x^2+7x+8>0$

$-1(-x^2+7x+8) < -1(0)$ mult

69

$x^2-7x-8 < 0$

$(x+1)(x-8) < 0$

set $x+1=0$ or $x-8=0$

$x+1-1=0-1$ or $x-8+8=0+8$

$x=-1$ or $x=8$

$\boxed{-2}$ $\boxed{0}$ $\boxed{9}$

-1 8

Ck

$(x+1)(x-8)<0$

$(-2+1)(-2-8)<0$

$(-1)(-10)<0$

$10<0$ No

$-1<x<8$

$(x+1)(x-8)<0$

$(0+1)(0-8)<0$

$(1)(-8)<0$

$-8<0$ yes

$(-1,8)$

$(x+1)(x-8)<0$

$(9+1)(9-8)<0$

$(10)(1)<0$

$10<0$ NO

10

$2x^2-2x \geq 84$

$2x^2-2x-84 \geq 0$

$\frac{2x^2}{2}-\frac{2x}{2}-\frac{84}{2} \geq 0$

$x^2-x-42 \geq 0$

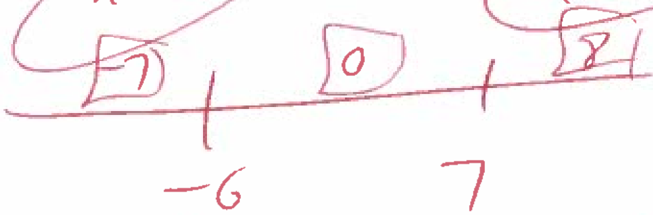
$(x+6)(x-7) \geq 0$

set $x+6=0$ OR $x-7=0$

$x+6-6=0-6$ OR $x-7+7=0+7$

$x=-6$ OR $x=7$

ck



$(x+6)(x-7) \geq 0$

$(-7+6)(-7-7) \geq 0$

$(-1)(-14) \geq 0$

$14 \geq 0$ yes

$(x+6)(x-7) \geq 0$

$(0+6)(0-7) \geq 0$

$(6)(-7) \geq 0$

$-42 \geq 0$ NO

$(x+6)(x-7) \geq 0$

$(8+6)(8-7) \geq 0$

$(14)(1) \geq 0$

$14 \geq 0$ yes

$(-\infty,-6] \cup [7,\infty)$

$x \leq -6$ OR $x \geq 7$

10

71.

71.

$x^2-2x<8$

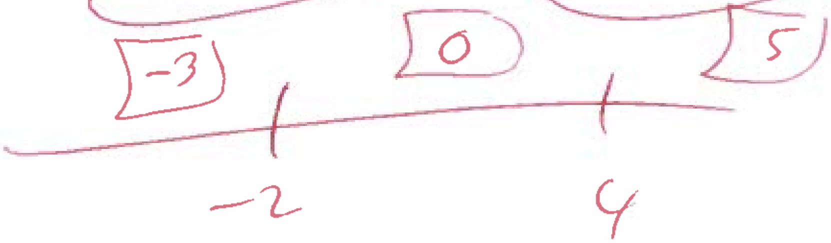
$x^2-2x-8\le 0$

$(x+2)(x-4)\le 0$

ln $x+2=0$ or $x-4=0$

$x+2-2=0-2$ or $x-\cancel{4}+\cancel{4}=0+4$

$x=-2$ or $x=4$



$(x+2)(x-4)\le 0$

$(-3+2)(-3-4)\le 0$

$(-1)(-7)\le 0$

$7\le 0$ no

$(x+2)(x-4)\le 0$

$(0+2)(0-4)\le 0$

$(2)(-4)\le 0$

$-8\le 0$ yes

$(x+2)(x-4)\le 0$

$(5+2)(5-4)\le 0$

$(7)(1)\le 0$

$7\le 0$ no

$-2\le x\le 4$

$[-2,4]$

72 $|5x-4| \le 9$

Formula
$|x| \le a$
$-a \le x \le a$

$-9 \le 5x-4 \le 9$

$-9+4 \le 5x-\cancel{4}+\cancel{4} \le 9+4$ 72.

$-5 \le 5x \le 13$

$\frac{-5}{5} \le \frac{\cancel{5}x}{\cancel{5}} \le \frac{13}{5}$

$-1 \le x \le \frac{13}{5}$

$\left[-1, \frac{3}{5}\right]$

73.

$|x-5|>6$

Formula

$|x|>a$

$x<-a$ OR $x>a$

73

$x-5<-6$ OR $x-5>6$

$x\cancel{-5}\cancel{+5}<-6+5$ OR $x\cancel{-5}\cancel{+5}>6+5$

$x<-1$ OR $x>11$

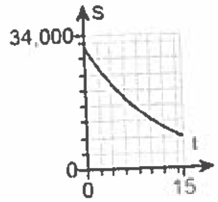
$(-\infty,-1)\cup(11,\infty)$

74. If $8000 is invested for t years at 9% interest compounded continuously, the future value is given by $S = 8000e^{0.09t}$ dollars. Complete parts (a) through (c).

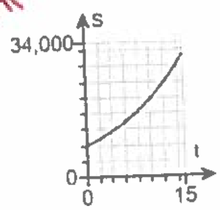
74

(a) Graph this function for $0 \le t \le 15$. Choose the correct graph below.

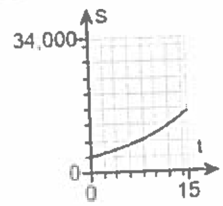
A.



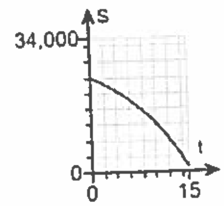
X B.



C.



D.



(b) Use the graph to estimate when the future value will be $24,000. Choose the correct answer below.

A. $t \approx 13.21$ years B. $t \approx 24.42$ years X C. $t \approx 12.21$ years D. $t \approx 11.21$ years

(c) Complete the following table.

t (Year)	S ($)
14	28,203.37

✓

(Round to the nearest whole number as needed.)

Complete the following table.

t (Year)	S ($)
10	19676.82
15	30859.40

✓ ✓

(Type an integer or decimal rounded to two decimal places as needed.)

$$\boxed{S(t) = 8000e^{0.09t}}$$

$$S(14) = 8000e^{\wedge}(0.09(14)) = 28203.3719$$

$$S(10) = 8000e^{\wedge}(0.09(10)) = 19676.82489$$

$$S(15) = 8000e^{\wedge}(0.09(15)) = 30859.40425$$

75

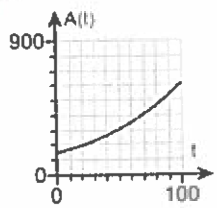
75. The amount of a radioactive isotope present at time t is given by $A(t) = 300\,e^{-0.02827t}$ grams, where t is the time in years that the isotope decays. The initial amount present is 300 grams. Complete parts **(a)** through **(c)**.

(a) How many grams remain after 35 years?

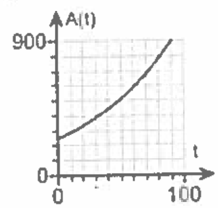
$\boxed{111.53}$ g (Type an integer or decimal rounded to two decimal places as needed.)

(b) Graph this function for $0 \le t \le 100$. Choose the correct graph below.

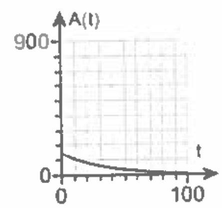
○ **A.**



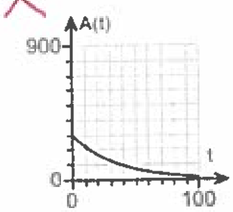
○ **B.**



○ **C.**



✗ **D.**



(c) If the half-life is the time it takes for half of the initial amount to decay, use graphical methods to estimate the half-life of this isotope. Choose the correct answer below.

○ **A.** about 44.52 years

○ **B.** about 9.52 years

✗ **C.** about 24.52 years

○ **D.** about 49.04 years

$$A(t) = 300\,e^{-0.02827t}$$

$$A(35) = 300\,e^{\wedge}(-0.02827(35))$$

$$= 111.5343343$$

76. Use the definition of a logarithmic function to write the logarithmic equation as an equation involving an exponent. 76

$$\log_2(A) = B$$

$$2^B = A$$

formula

$$\log_b y = x$$

$$b^x = y$$

77. Write the exponential equation $x = 8^y$ in logarithmic form

77

formula

$\log_b y = x$

$b^x = y$

$\log_8 x = y$

78. graph

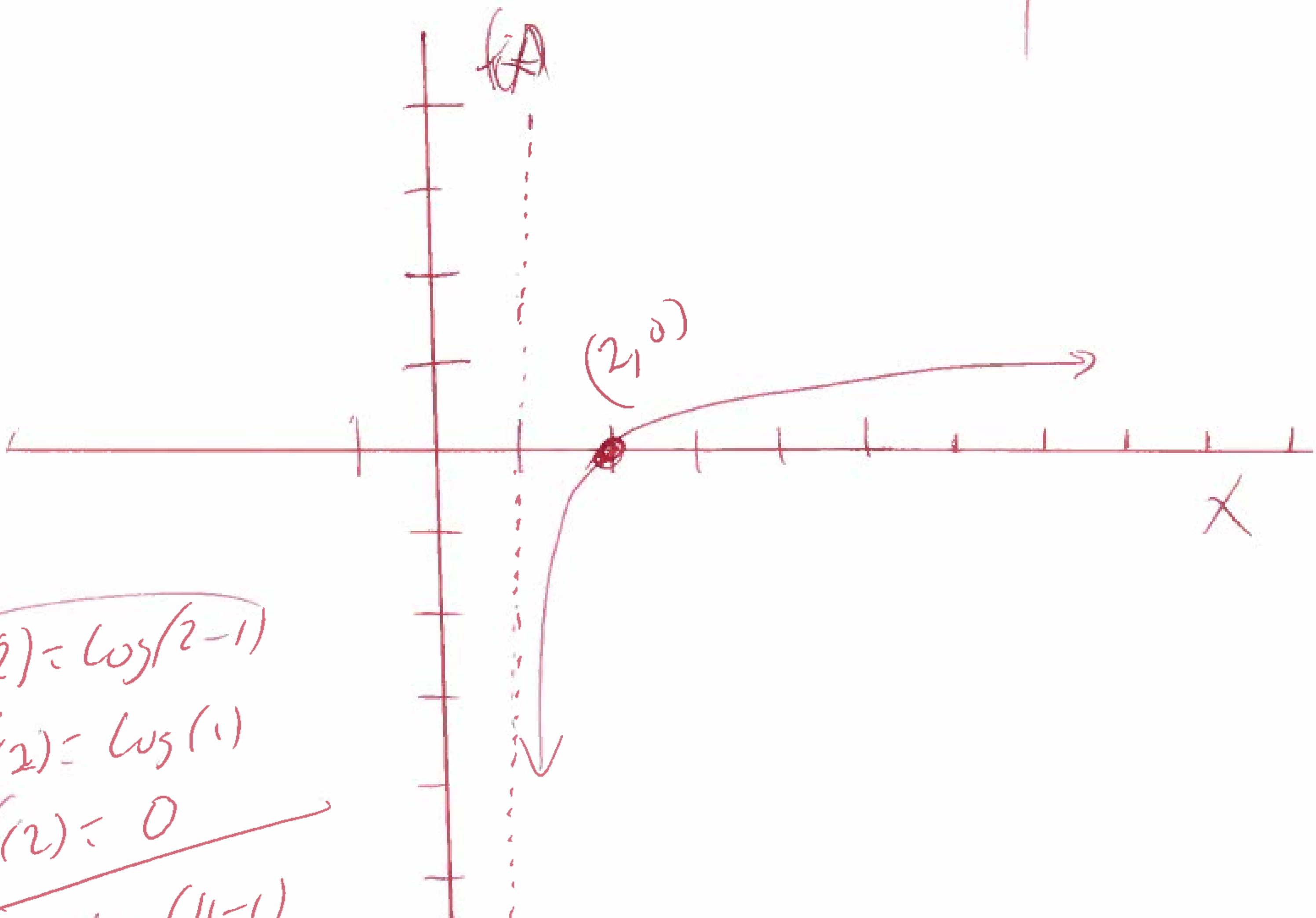
$f(x) = \log(x-1)$

domain $x-1 > 0$

$x - \cancel{1} + \cancel{1} > 0 + 1$

$x > 1$

x	$f(x)$
2	0
11	1



$f(2) = \log(2-1)$

$f(2) = \log(1)$

$f(2) = 0$

$f(11) = \log(11-1)$

$f(11) = \log(10)$

$f(11) = 1$

79. expand

$\log_2\left(\frac{\sqrt[6]{5x+1}}{5x^2}\right) =$

79

$\log_2(\sqrt[6]{5x+1}) - \log_2(5x^2) =$

$\log_2(5x+1)^{1/6} - \log_2(5x^2) =$

$\log_2(5x+1)^{1/6} - (\log_2(5) + \log_2(x^2)) =$

$\log_2(5x+1)^{1/6} - (\log_2(5) + 2\log_2(x)) =$

$\frac{1}{6}\log_2(5x+1) - (\log_2(5) + 2\log_2(x)) =$

$\frac{1}{6}\log_2(5x+1) - \log_2(5) - 2\log_2(x) =$

formula

$\log\left(\frac{A}{B}\right) = \log(A) - \log(B)$

$\log(A^N) = N\log(A)$

$\log(AB) = \log(A) + \log(B)$

80. Write as a single logarithm.

$5\log_4(x) + 9\log_4(z) =$

$\log_4(x^5) + \log_4(z^9) =$

$\log_4(x^5 z^9) =$

formula

$\log(A^N) = N\log(A)$

$\log(AB) = \log(A) + \log(B)$

8

81.

$8947 = e^{4x}$

$\ln(8947) = \ln(e^{4x})$

$\ln(8947) = 4x \ln(e)$

$\ln(8947) = 4x(1)$

$\ln(8947) = 4x$

$\frac{\ln(8947)}{4} = \frac{\cancel{4}x}{\cancel{4}}$

$\frac{\ln(8947)}{4} = x$

OR

$2.27476839 = x$

OR Round

$2.275 = x$

81

formulas

$\ln(A^N) = N \ln A$

$\ln(e) = 1$

82

$$5e^{9x} = 1915$$

$$\frac{\cancel{5}e^{9x}}{\cancel{5}} = \frac{1915}{5}$$

$$e^{9x} = 383$$

$$\ln(e^{9x}) = \ln(383)$$

$$9x \ln(e) = \ln(383)$$

$$9x\ (1) = \ln(383)$$

$$9x = \ln(383)$$

$$\frac{\cancel{9}x}{\cancel{9}} = \frac{\ln(383)}{9}$$

$$x = \frac{\ln(383)}{9}$$

OR

$$x = .6608927766$$

OR Round

$$x = .66$$

72

formulas

$$\ln(A^N) = N \ln A$$

$$\ln(e) = 1$$

83 $3^{-x+2} = 22$

$\ln(3^{-x+2}) = \ln(22)$

$(-x+2)\ln(3) = \ln(22)$

$\frac{(-x+2)\cancel{\ln(3)}}{\cancel{\ln(3)}} = \frac{\ln(22)}{\ln(3)}$

$-x+2 = \frac{\ln(22)}{\ln(3)}$

$-x + \cancel{2} \cancel{-2} = \frac{\ln(22)}{\ln(3)} - 2$

$-x = \frac{\ln(22)}{\ln(3)} - 2$

$-1(-x) = -1\left(\frac{\ln(22)}{\ln(3)} - 2\right)$

$x = \frac{-1\ln(22)}{\ln(3)} + 2$

OR

$x = -.8135880922$

OR

Round

$x = -0.8136$

83.

formulas

$\ln(A^N) = N\ln(A)$

$\ln(e) = 1$

84

$6 + \ln(8x) = 21 - 2\ln x$

$\ln(8x) + 2\ln x = 21 - 6$

$\ln(8x) + \ln(x^2) = 15$

$\ln(8x)(x^2) = 15$

$\ln(8x^3) = 15$

$\cancel{e}^{\cancel{\ln}(8x^3)} = e^{15}$

$8x^3 = e^{15}$

$\frac{\cancel{8}x^3}{\cancel{8}} = \frac{e^{15}}{8}$

$x^3 = \frac{e^{15}}{8}$

$\sqrt[3]{x^3} = \sqrt[3]{\frac{e^{15}}{2^3}}$

$x = \frac{e^5}{2^1}$ divide powers

$x = \frac{e^5}{2}$ or $x = 74.2065795$

84

formulas

$\ln(A) + \ln(B) = \ln(AB)$

$e^{\ln(A)} = A$

Round $x = 74.207$

or

85.

$2\log(x) - \log(10x-250) - 1 = 0$

$2\log(x) - \log(10x-250) = 1$

$\log(x^2) - \log(10x-250) = 1$

$\log\left(\frac{x^2}{10x-250}\right) = 1$

$\log_{10}\left(\frac{x^2}{10x-250}\right) = 1$

$10^1 = \frac{x^2}{10x-250}$

$\frac{10}{1} = \frac{x^2}{10x-250}$

$10(10x-250) = 1(x^2)$

$100x - 2500 = x^2$

$0 = x^2 - 100x + 2500$

$0 = (x-50)(x-50)$

$x-50=0$ or $x-50=0$

$x - \cancel{50} + \cancel{50} = 0+50$ OR $x - \cancel{50} + \cancel{50} = 0+50$

$x=50$ or $x=50$

CK

$2\log(50) - \log(10(50)-250) - 1 = 0$

$2\log(50) - \log(500-250) - 1 = 0$

$2\log(50) - \log(250) - 1 = 0$

Good Good

$\{50\}$

85

Formulas

$\log(A) - \log(B) = \log\left(\frac{A}{B}\right)$

$\log A^N = N\log A$

$\log_b y = x \rightarrow b^x = y$

86.

86

$\text{Log}(2x) + \text{Los}(5x) = \text{Los}(250)$

$\cancel{\text{Los}}(2x)(5x) = \cancel{\text{Los}}(250)$

formula

$\text{Log}(A) + \text{Log}(B) = \text{Log}\,AB$

$\text{Log}(A) = \text{Log}(B)$
$A = B$

$2x(5x) = 250$

$10x^2 = 250$

$\dfrac{\cancel{10}x^2}{\cancel{10}} = \dfrac{250}{10}$

$x^2 = 25$

$\sqrt{x^2} = \pm\sqrt{25}$

$x = \pm 5$

$\cancel{x = -5}$ OR $x = 5$

CK

$\text{Los}(2x) + \text{Los}(5x) = \text{Los}(250)$

$\text{Los}(2(-5)) + \text{Los}(5(-5)) = \text{Los}(250)$

$\text{Los}(\cancel{-10}) + \text{Los}(\cancel{-25}) = \text{Los}(250)$

BAD BAD

$\{5\}$

answer

CK $\text{Los}(2(5)) + \text{Los}(5(5)) = \text{Los}(250)$

$\text{Los}(10) + \text{Los}(25) = \text{Los}(250)$

Good Good

87

$$206000 = 103000\,e^{0.02t}$$

$$\frac{206000}{103000} = \frac{\cancel{103000}\,e^{0.02t}}{\cancel{103000}}$$

$$2 = e^{0.02t}$$

$$\ln(2) = \ln(e^{0.02t})$$

$$\ln(2) = 0.02t\ln(e)$$

$$\ln(2) = 0.02t\,(1)$$

$$\frac{\ln(2)}{0.02} = \frac{\cancel{0.02}t}{\cancel{0.02}}$$

$$\frac{\ln(2)}{0.02} = t$$

OR

$$34.65735903 = t$$

OR Round

$$34.66$$

87a

Formulas

$\ln(A^N) = N\ln A$

$\ln(e) = 1$

88.

$y = 100\left(1 - e^{-0.37(10-t)}\right)$

$31 = 100\left(1 - e^{-0.37(10-t)}\right)$

$\frac{31}{100} = \frac{\cancel{100}\left(1 - e^{-0.37(10-t)}\right)}{\cancel{100}}$

$.31 = 1 - e^{-0.37(10-t)}$

$.31 - 1 = 1 - e^{-0.37(10-t)} - 1$

$-.69 = -e^{-0.37(10-t)}$

$-1(-.69) = -1\left(-e^{-0.37(10-t)}\right)$

$.69 = e^{-0.37(10-t)}$

$\ln(.69) = \ln\left(e^{-0.37(10-t)}\right)$

$\ln(.69) = -0.37(10-t)\ln(e)$

$\ln(.69) = -0.37(10-t)(1)$

$\ln(.69) = -0.37(10-t)$

$\ln(.69) = -3.7 + 0.37t$

$\ln(.69) + 3.7 = \cancel{-3.7} + 0.37t + \cancel{3.7}$

$\ln(.69) + 3.7 = 0.37t$

$\frac{(\ln(.69) + 3.7)}{0.37} = \frac{0.37t}{0.37}$

$8.997125185 = t$

$9 = t$ ← Round

88.

formulas

$\ln(A^N) = N\ln(A)$

$\ln(e) = 1$

89

$$103{,}141.37 = 40{,}000\,(1+0.07)^{t}$$

$$\frac{103{,}141.37}{40{,}000} = \frac{\cancel{40{,}000}(1+0.07)^{t}}{\cancel{40{,}000}}$$

$$2.57853425 = (1+0.07)^{t}$$

$$2.57853425 = (1.07)^{t}$$

$$\ln(2.57853425) = \ln(1.07)^{t}$$

$$\ln(2.57853425) = t\ln(1.07)$$

$$\frac{\ln(2.57853425)}{\ln(1.07)} = \frac{t\,\cancel{\ln(1.07)}}{\cancel{\ln(1.07)}}$$

$$14.00000057 = t$$

OR Round

$$14 = t$$

89

formulas

$\ln(A^{N}) = N\ln(A)$

90. The "Rule of 72" is a simplified way to determine how long an investment will take to double, given a fixed annual rate of interest. By dividing 72 by the annual interest rate, investors can get a rough estimate of how many years it will take for the initial investment to double. Algebraically we know that the time it takes an investment to double is $\frac{\ln 2}{r}$, when the interest is compounded continuously and r is written as a decimal. Complete parts (a)-(b).

90

a) Complete the table to compare the exact time it takes for an investment to double to the "Rule of 72" time. (Round to two decimal places as needed.)

Annual Interest Rate	Rule of 72 Years	Exact Years
9%	8.00	7.70
10%	7.20	6.93
11%	6.55	6.30
12%	6.00	5.78
13%	5.54	5.33
14%	5.14	4.95
15%	4.80	4.62
16%	4.50	4.33
17%	4.24	4.08
18%	4.00	3.85

b) Compute the differences between the two sets of outputs. What conclusion can you reach about using the Rule of 72 estimate?

- ○ As interest rate increases, estimate gets apart from actual value.
- ☒ As interest rate increases, estimate gets closer to actual value.

$\frac{72}{9} = 8.00$

$\frac{72}{10} = 7.20$

$\frac{72}{11} = 6.55$

$\frac{72}{12} = 6.00$

$\frac{72}{13} = 5.54$

$\frac{72}{14} = 5.14$

$\frac{72}{15} = 4.80$

$\frac{72}{16} = 4.50$

$\frac{72}{17} = 4.24$

$\frac{72}{18} = 4.00$

$\frac{\ln(2)}{.09} = 7.70163534$

$\frac{\ln(2)}{.10} = 6.931471806$

$\frac{\ln(2)}{.11} = 6.301338005$

$\frac{\ln(2)}{.12} = 5.776226505$

$\frac{\ln(2)}{.13} = 5.331901389$

$\frac{\ln(2)}{.14} = 4.95105129$

$\frac{\ln(2)}{.15} = 4.620981204$

$\frac{\ln(2)}{.16} = 4.332169878$

$\frac{\ln(2)}{.17} = 4.077336356$

$\frac{\ln(2)}{.18} = 3.85081767$

91. Find the exponential function that models the data in the table below.

x	-4	-3	-2	-1	0	1	2	3
y	$\frac{3}{256}$	$\frac{3}{64}$	$\frac{3}{16}$	$\frac{3}{4}$	3	12	48	192

91

STAT, Edit, L1, L2, Stat, CALC, ExpReg, enter

$y = ab^x$

$a = 3$

$b = 4$

$y = 3(4)^x$

92

92. The table to the right gives the life expectancy for the birth years from 1920 and projected to 2020.

Use the table to answer parts (a)-(d) below.

use graphing calculator

Year	Life Span (years)	Year	Life Span (years)	Year	Life Span (years)
1920	54.1	1988	74.1	2001	77.2
1930	59.7	1989	75.2	2002	77.4
1940	62.9	1990	75.4	2003	77.5
1950	68.5	1992	75.9	2004	77.7
1960	69.7	1994	75.6	2005	77.8
1970	70.6	1996	76.2	2010	78.2
1975	72.5	1998	76.9	2015	78.7
1980	73.3	1999	76.9	2020	79.8
1987	75.1	2000	76.8		

a. Find the logarithmic function that models the data, with x equal to 0 in 1900.

y = 11.068 + 14.288 ln x
(Type integers or decimals rounded to the nearest thousandth as needed.)

b. Find the quadratic function that is the best fit for the data, with x = 0 in 1900. Round the quadratic coefficient to four decimal places and the other coefficients to three decimal places.

y = → $y = -0.0017x^2 + 0.476x + 46.566$
(Use integers or decimals for any numbers in the expression.)

c. Graph each of these functions on the same axes with the data points to determine visually which function is the better model for the data for the years 1920-2020. Choose the correct answer below.

- X The logarithmic model is better.
- ○ The quadratic model is better.

d. Evaluate both models for the birth year 2017.

The logarithmic model predicts that the life span of a person born in 2017 is 79.1 years.
(Type an integer or a decimal rounded to the nearest tenth as needed.)

The quadratic model predicts that the life span of a person born in 2017 is 79.0 years.
(Type an integer or a decimal rounded to the nearest tenth as needed.)

DATA

(20, 54.1) (88, 74.1) (101, 77.2)
(30, 59.7) (89, 75.2 (102, 77.4)
(40, 62.9) (90, 75.4) (103, 77.5)
(50, 68.5) (92, 75.9) (104, 77.7)
(60, 69.7) (94, 75.6) (105, 77.8)
(70, 70.6) (96, 76.2) (110, 78.2
(75, 72.5) (98, 76.9) (115, 78.7)
(80, 73.3) (99, 76.9) (120, 79.8)
(87, 75.1) (100, 76.8)

STAT, Edit, L1, L2, Stat, CALC, LnREG, enter

93

93. Average tuition and required fees at degree-granting institutions, for graduate and first professional fields of study, for the years 1988-89 through 2009-10 are given in the table. Use the table to answer parts (a) and (b) below.

Year	Current Dollars	Year	Current Dollars	Year	Current Dollars
1988 – 89	3765	1996 – 97	7129	2003 – 04	10,881
1989 – 90	4101	1997 – 98	7266	2004 – 05	11,004
1990 – 91	4408	1998 – 99	7651	2005 – 06	11,690
1991 – 92	5128	1999 – 2000	8079	2006 – 07	12,304
1992 – 93	5437	2000 – 01	8460	2007 – 08	12,844
1993 – 94	5966	2001 – 02	8814	2008 – 09	13,741
1994 – 95	6203	2002 – 03	9207	2009 – 10	14,789
1995 – 96	6716				

a. Find an exponential function of the form $y = a(b^x)$ to model the data, with x equal to the number of years from 1980 to the end of the academic year (1988-89 would be x = 9)

y = ☐ $\leftarrow$ $y = 2371.399(1.063)^x$

(Use integers or decimals for any numbers in the expression. Round to the nearest thousandth as needed.)

b. Use the model to estimate the tuition for 2014-15. Is this interpolation or extrapolation?

The model estimates that the tuition for 2014-15 will be \$ $\boxed{20{,}122}$ \$.

(Round to the nearest whole number as needed.)

Is this interpolation or extrapolation?

- [x] extrapolation
- [ ] interpolation

Use graphing Calculator

stat, Edit, L1, L2, STAT, CALC, ExpReg, enter

$y = ab^x$

$a = 2371.39927$

$b = 1.063202706$

$y = 2371.399(1.063)^x$

$y = 2371.399(1.063)^{35}$

$y = 20121.8955$

Round

$y = \$20122.$

Tuition in 2014 — 2015

Data

(9, 3765) (22, 8814)
(10, 4101) (23, 9207)
(11, 4408) (24, 10881)
(12, 5128) (25, 11004)
(13, 5437) (26, 11690)
(14, 5966) (27, 12304)
(15, 6203) (28, 12844)
(16, 6716) (29, 13741)
(17, 7129) (30, 14789)
(18, 7266)
(19, 7651)
(20, 8079)
(21, 8460)

Find

(35, \$20122)

94. Evaluate the following expression for $k = 4$ and $n = 7$.

94.

$$19000\left(1+\frac{0.11}{k}\right)^{kn} =$$

$$19000\left(1+\frac{0.11}{4}\right)^{4(7)} =$$

$$19000\left(1+\frac{0.11}{4}\right)^{28} =$$

use graphing calculator

$40611.10966 =$

OR Round

$40611.11 =$

95. If $14000 is invested at 6% interest compounded monthly, find the interest earned in 16 years.

Use graphing calculator

95.

$$A = P\left(1+\frac{r}{n}\right)^{nt}$$

$$A = 14000\left(1+\frac{.06}{12}\right)^{12(16)}$$

$$A = 14000\left(1+\frac{.06}{12}\right)^{192}$$

$$A = 36476.39357$$ Total

$$36476.39357 - 14000 =$$

$$22476.39357$$ Interest

96

$A = Pe^{rt}$

$P = 4000$

$r = 6\%$

$t = 4$

96

use graphing calculator

$A = 4000e^{.06(4)}$

$A = 4000e^{.24}$

2nd LN

$A = 4000e^{\wedge}(.24)$

$A = 5084.996601$ ✓

OR Round

$A = 5085.00$ ✓

97.

$$A = P\left(1+\frac{r}{n}\right)^{nt}$$

$P = 20000$

$r = 9\%$

$t = 7$

annually $= 1$

97.

$$A = 20{,}000\left(1+\frac{.09}{1}\right)^{1(7)}$$

$$A = 20{,}000(1+.09)^{7}$$

$$A = 36560.78242$$

OR Round

$$A = 36560.78$$

Use a graphing calculator

$$A = Pe^{rt}$$

$P = 20000$

$r = 9\%$

$t = 7$

Use a graphing calculator

$$A = 20000e^{.09(7)}$$

$$A = 20000e^{.63}$$

2ND LN

$$A = 20000e^{\wedge}(.63)$$

$$A = 37552.21159$$

OR Round

$$A = 37552.21$$

98. If money is invested at 10% interest, compounded quarterly, the future value of the investment doubles approximately every 7 years.

98

a. Use this information to complete the table below for an investment of $900 at 10% interest, compounded quarterly.

Years	0	7	14	21	28
Future Value ($)	900	?	?	?	?

Complete the following table.

Years	0	7	14	21	28
Future Value ($)	900	1800	3600	7200	14400

b. Create an exponential function, rounded to three decimal places, that models the discrete function defined by the table.

Choose the correct exponential function, rounded to three decimal places, that models the discrete function defined by the table.

- A. $y = 900(1.214)^x$
- B. $y = 900(1.511)^x$
- C. $y = 900(0.208)^x$
- D. $y = 900(1.104)^x$

c. Because the interest is compounded quarterly, this model must be interpreted discretely. Use the rounded function to find the value of the investment in 5 years and in $13\frac{1}{2}$ years.

The value of the investment in 5 years is $ 1476.01
(Round to the nearest cent as needed.)

The value of the investment in $13\frac{1}{2}$ years is $ 3422.35
(Round to the nearest cent as needed.)

99. A couple wants to buy a house and can afford to pay $1500 per month.
a. If they can get a loan for 40 years with interest at 9% per year on the unpaid balance and make monthly payments, how much can they pay for a house?
b. What is the total amount paid over the life of the loan?
c. What is the total interest paid on the loan?

99

a. They can pay $[ ] for a house. 194,461.35
(Simplify your answer. Round to the nearest cent as needed.)

b. The total amount paid over the life of the loan is $[ ]. 720,000.00
(Simplify your answer. Round to the nearest cent as needed.)

c. The total interest paid on the loan is $[ ]. 525,538.65
(Simplify your answer. Round to the nearest cent as needed.)

100. The spread of a highly contagious virus in a high school can be described by the logistic function

100

$$y = \frac{6400}{1 + 799e^{-0.6x}}$$

where x is the number of days after the virus is identified in the school and y is the total number of people who are infected by the virus.

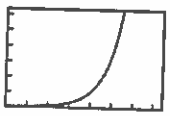
(a) Graph the function for $0 \le x \le 15$.

(b) How many students had the virus when it was first discovered?

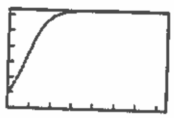
(c) What is the upper limit of the number infected by the virus during this period?

(a) Choose the correct graph below.

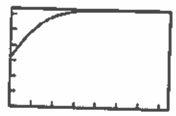
○ **A.**



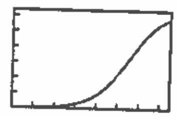
○ **B.**



○ **C.**



○ **D.**



[0,15] by [0,6400], Xscl = 2, Yscl = 1000

(b) The number of students who had the virus when it was first discovered is 8.

(c) The upper limit of the number infected by the virus during the period is 6400.

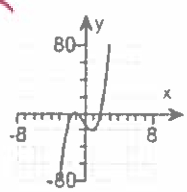
101. Match the polynomial function with its graph.

$$y = 5x^3 + 2x^2 - 15x - 12$$

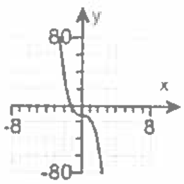
Choose the correct graph below.

101

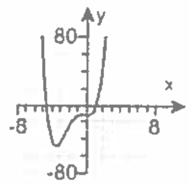
A.



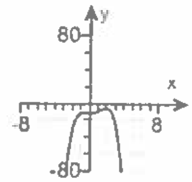
B.



C.



D.



102. Use the equation of the polynomial function $f(x) = 4x^3 - x$ to complete the following.

102

(a) State the degree and the leading coefficient.
(b) Describe the end behavior of the graph of the function.
(c) Support your answer by graphing the function.

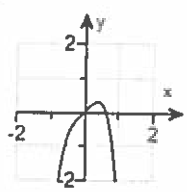
(a) The degree of the polynomial is 3 and the leading coefficient is 4.

(b) Describe the end behavior of the graph of the function.

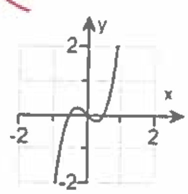
The curve opens (1) up to the right because the leading coefficient is (2) positive. Because the polynomial is (3) cubic the graph has end behaviors in the (4) opposite direction, so the other end opens (5) down to the left.

(c) Which of the following is the correct graph of the function $f(x) = 4x^3 - x$?

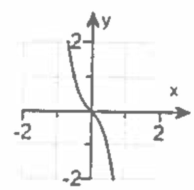
A.



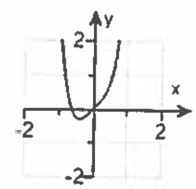
B.



C.



D.



(1) up / down

(2) positive / negative

(3) quartic, / cubic,

(4) opposite / same

(5) up / down

103

$(x+7)^2(x-9)(2x-5)=0$

103

Let $(x+7)^2=0$ or $x-9=0$ or $2x-5=0$

$\sqrt{(x+7)^2}=\sqrt{0}$ or $x-9+9=0+9$ or $2x-\cancel{5}+\cancel{5}=0+5$

$x+7=0$ or $x=9$ or $2x=5$

$x+7-7=0-7$

or $\frac{2x}{2}=\frac{5}{2}$

$x=-7$

$x=5/2$

$\{-7, 9, 5/2\}$

104. Solve by factoring

104

formula
$a^2 - b^2 = (a+b)(a-b)$

$$n^3 - 2n^2 - n + 2 = 0$$

$$(n^3 - 2n^2) + (-n+2) = 0$$

$$n^2(n-2) - 1(n-2) =$$

$$(n-2)(n^2 - 1) = 0$$

$$(n-2)(n^2 - 1^2) = 0$$

$$(n-2)(n+1)(n-1) = 0$$

Let $n-2=0$ or $n+1=0$ or $n-1=0$

$n-2+2=0+2$ or $n+1-1=0-1$ or $n-1+1=0+1$

$n=2$ or $n=-1$ or $n=1$

$$\{2, -1, 1\}$$

105

$$2x^3 - x^2 - 98x + 49 = 0$$

105

formula

$a^2 - b^2$

$(a+b)(a-b)$

$$(2x^3 - x^2) + (-98x + 49) = 0$$

$$x^2(2x-1) - 49(2x-1) = 0$$

$$(2x-1)(x^2-49) = 0$$

$$(2x-1)(x^2-7^2) = 0$$

$$(2x-1)(x+7)(x-7) = 0$$

set $2x-1=0$ or $x+7=0$ or $x-7=0$

$2x\cancel{-1}\cancel{+1}=0+1$ or $x\cancel{+7}-7=0-7$ or $x\cancel{-7}\cancel{+7}=0+7$

$2x=1$

$\frac{2x}{2} = \frac{1}{2}$ or $x=-7$ or $x=7$

$x=\frac{1}{2}$

$$\left\{\frac{1}{2}, -7, 7\right\}$$

106 $f(x) = x^3 - 3x^2 - 6x + 8$

possible
$\pm 8, \pm 4, \pm 2, \pm 1$

use synthetic division

106

$$\begin{array}{r|rrrr} 1 & 1 & -3 & -6 & 8 \\ & & 1 & -2 & -8 \\ \hline & 1 & -2 & -8 & 0 \end{array}$$

$x^2 - 2x - 8 = 0$

$(x+2)(x-4) = 0$

ut $x + 2 = 0$ or $x - 4 = 0$

$x + 2 - 2 = 0 - 2$ or $x - \cancel{4} + \cancel{4} = 0 + 4$

$x = -2$ or $x = 4$

$\{1, -2, 4\}$

107

$f(x) = -x^4 + 5x^3 + 7x^2 - 5x - 6$

possible

$\pm 6, \pm 3, \pm 2, \pm 1$

use synthetic division

107

$$\begin{array}{r|rrrrr} -1 & -1 & 5 & 7 & -5 & -6 \\ & & 1 & -6 & -1 & 6 \\ \hline & -1 & 6 & 1 & -6 & 0 \end{array}$$

rem

$$\begin{array}{r|rrrr} -1 & -1 & 6 & 1 & -6 \\ & & 1 & -7 & 6 \\ \hline & -1 & 7 & -6 & 0 \end{array}$$

rem

$-x^2 + 7x - 6 = 0$

$-1(-x^2 + 7x - 6) = -1(0)$

$x^2 - 7x + 6 = 0$

$(x - 1)(x - 6) = 0$

set $x - 1 = 0$ OR $x - 6 = 0$

$x - 1 + 1 = 0 + 1$ OR $x \cancel{-6} \cancel{+6} = 0 + 6$

$x = 1$ OR $x = 6$

$\{-1, -1, 1, 6\}$

108

$$6x^3 - 9x^2 - 33x + 18 = 0$$

108

$$\frac{\pm 18}{6} = \frac{\pm 18, \pm 9, \pm 6 \pm 3, \pm 1}{6, 3, 2, 1}$$

Possible

$$\frac{\pm 18}{6}, \frac{\pm 18}{3}, \frac{\pm 18}{2}, \frac{\pm 18}{1} \quad \frac{\pm 9}{6} \frac{\pm 9}{3} \frac{\pm 9}{2} \frac{\pm 9}{1} \quad \frac{\pm 6}{6} \frac{\pm 6}{3} \frac{\pm 6}{2} \frac{\pm 6}{1}$$

$$\frac{\pm 3}{6}, \frac{\pm 3}{3}, \frac{\pm 3}{2}, \frac{\pm 3}{1}, \quad \frac{\pm 1}{6} \frac{\pm 1}{3}, \frac{\pm 1}{2}, \frac{\pm 1}{1}.$$

Use synthetic division

$$\begin{array}{r|rrrr} -2 & 6 & -9 & -33 & 18 \\ & & -12 & 42 & -18 \\ \hline & 6 & -21 & 9 & 0 \text{ rem} \end{array}$$

$$6x^2 - 21x + 9 = 0$$

$$\frac{6x^2}{3} - \frac{21x}{3} + \frac{9}{3} = \frac{0}{3}$$

$$2x^2 - 7x + 3 = 0$$

$$(2x - 1)(x - 3) = 0$$

Let $2x - 1 = 0$ or $x - 3 = 0$

$2x - 1 + 1 = 0 + 1$ or $x - 3 + 3 = 0 + 3$

$2x = 1$ or $x = 3$

$$\frac{2x}{2} = \frac{1}{2}$$

$$x = 1/2$$

$$\left\{-2, \frac{1}{2}, 3\right\}$$

109 $f(x)=1x^3+x^2-17x+15$

possibly

$\pm 15, \pm 5, \pm 3, \pm 1$

use Synthetic division

109

$$\begin{array}{r|rrrr} 1 & 1 & 1 & -17 & 15 \\ & & 1 & 2 & -15 \\ \hline & 1 & 2 & -15 & 0 \end{array}$$ rem

$x^2+2x-15=0$

$(x-3)(x+5)=0$

set $x-3=0$ OR $x+5=0$

$x-3+3=0+3$ OR $x+\cancel{5}-\cancel{5}=0-5$

$x=3$ OR $x=-5$

$\{1, 3, -5\}$

110

$f(x) = 2x^3 - 3x^2 - 50x + 75$

Prime
2, 3, 5, 7

110

$\frac{\pm 75, \pm 25, \pm 15, 5, \pm 3, \pm 1}{2, 1}$

3 | 75
5 | 25
5 | 5
1

Possible

$\pm\frac{75}{2}$ $\pm\frac{75}{1}$ $\pm\frac{25}{2}$ $\pm\frac{25}{1}$ $\pm\frac{15}{2}$ $\pm\frac{15}{1}$ $\pm\frac{5}{2}$ $\pm\frac{5}{1}$

$\pm\frac{3}{2}$, $\pm\frac{3}{1}$, $\pm\frac{1}{2}$ $\pm\frac{1}{1}$

use synthetic division

5	2	−3	−50	75
		10	35	−75
	2	7	−15	0

15 · 1
3 · 5

$2x^2 + 7x - 15 = 0$

$(2x - 3)(x + 5) = 0$

set $2x - 3 = 0$ OR $x + 5 = 0$

$2x - \cancel{3} + \cancel{3} = 0 + 3$ OR $x + 5 - 5 = 0 - 5$

$2x = 3$ OR $x = -5$

$\frac{2x}{2} = \frac{3}{2}$

$x = 3/2$

$\left\{5, \frac{3}{2}, -5\right\}$

111

$f(x) = \frac{x+1}{x-4}$ find Horizontal asymptote 111

$y =$ Horiz Asym $= \frac{(x)}{(x)}$

$y =$ Horizon Asym $= 1$

$y = 1$ Horizontal asymptote

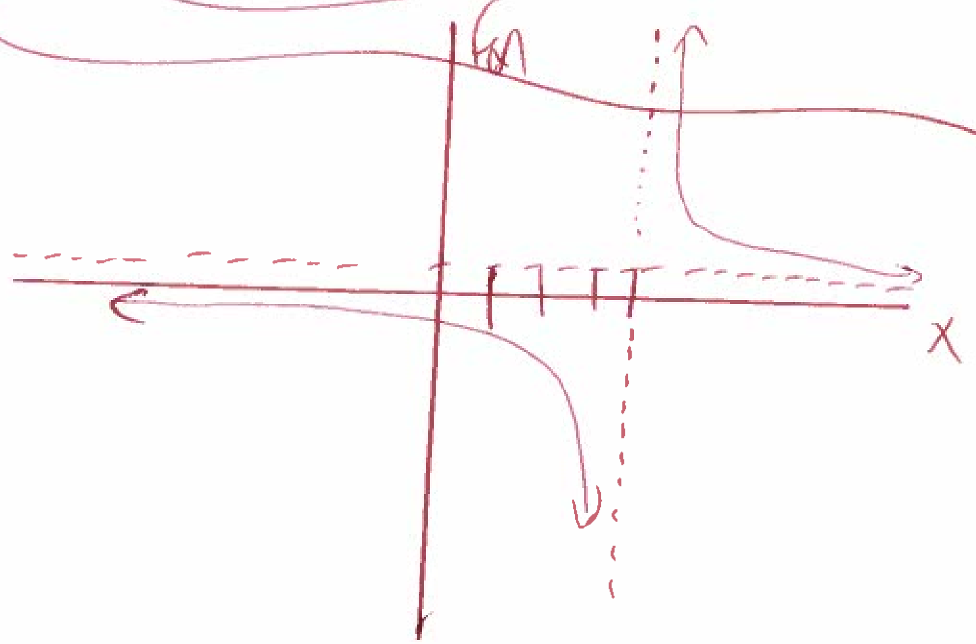
Vertical asymptote

$f(x) = \frac{x+1}{x-4}$

set $x - 4 = 0$

$x - 4 + 4 = 0 + 4$

$x = 4$ Vertical asymptote



112 $f(x) = \frac{9x}{x^2-36}$ List all asymptotes

112

Horizontal asymptote

Formula $\lim_{x\to\infty} \frac{1}{x^n} = 0$

$$\lim_{x\to\infty} \frac{9x}{x^2-36} =$$

$$\lim_{x\to\infty} \left(\frac{9x}{x^2-36}\right)\frac{\frac{1}{x^2}}{\frac{1}{x^2}} =$$

$$\lim_{x\to\infty} \left(\frac{\frac{9x}{x^2}}{\frac{x^2}{x^2}-\frac{36}{x^2}}\right) =$$

$$\lim_{x\to\infty} \left(\frac{\frac{9}{x}}{1-\frac{36}{x^2}}\right) =$$

$$\frac{0}{1-0} =$$

$$\frac{0}{1} =$$

$$0 =$$

Vertical asymptote

set $x^2-36=0$

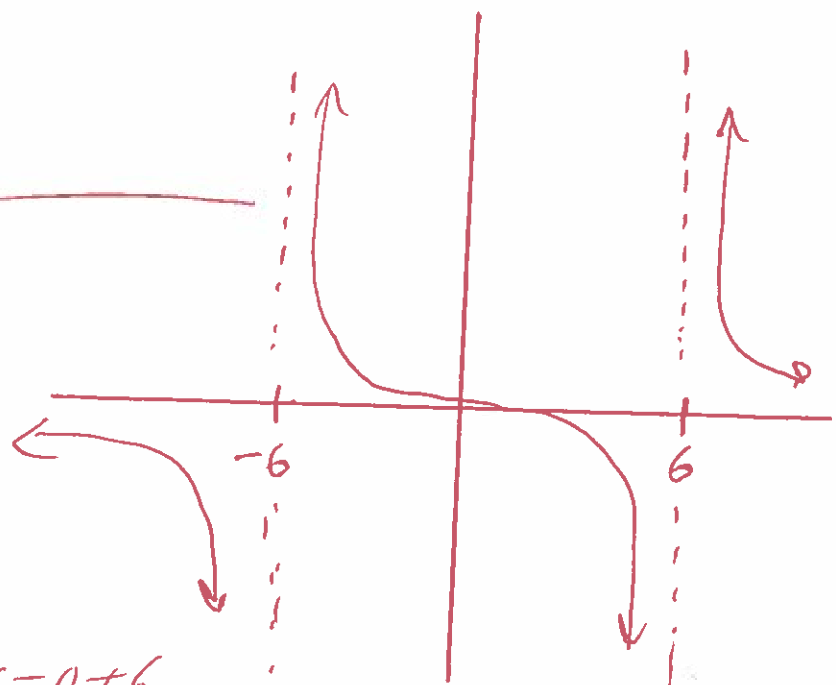
$(x)^2-(6)^2=0$

$(x+6)(x-6)=0$

$x+6=0$ or $x-6=0$

$x+6-6=0-6$ or $x-6+6=0+6$

$x=-6$ or $x=6$ vertical asymptotes



113

$$C(t) = \frac{250t}{3t^2+75}$$

113

$$C(1) = \frac{250(1)}{3(1)^2+75} = (250(1))/(3(1)^2+75) =$$

$= 3.205128205$

OR Round

$= 3.21$

$$C(6) = \frac{250(6)}{3(6)^2+75} = (250(6))/(3(6)^2+75)$$

$= 8.196721311$

OR Round

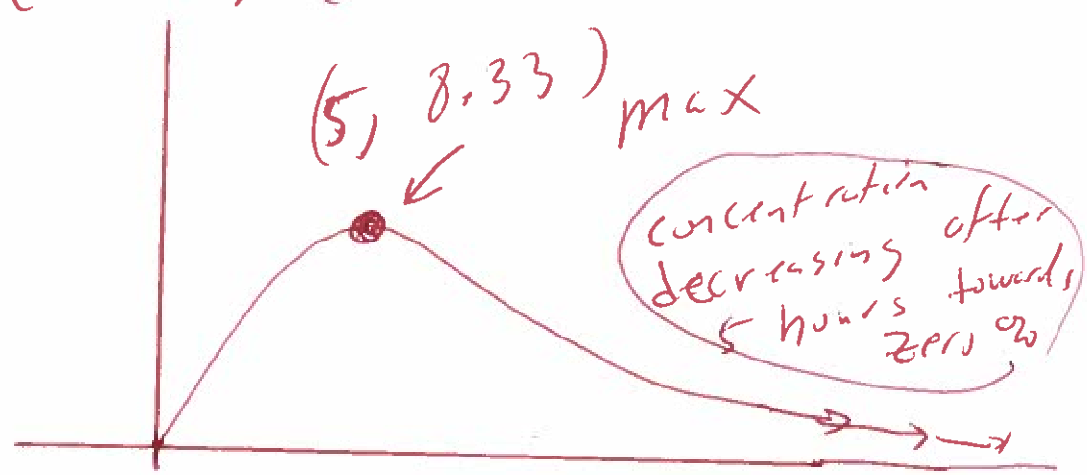
$= 8.2$

Graph

$$C(t) = \frac{250t}{3t^2+75}$$

$$y_1 = (250x)/(3x^2+75)$$

Xmin = 0
Xmax = 20
Xscl = 1
Ymin = 0
Ymax = 20
Yscl = 1



114

$$x+2y-z=3$$
$$x+3y+z=-8$$
$$x-5y+3z=-10$$

114

2ND, matrix, Edit, [A], 3x4

$$[A]=\begin{bmatrix} 1 & 2 & -1 & 3 \\ 1 & 3 & 1 & -8 \\ 1 & -5 & 3 & -10 \end{bmatrix}$$

2ND Quit

2ND, matrix, Math

↓

rref([A])

enter

$$\begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & -1 \\ 0 & 0 & 1 & -5 \end{bmatrix}$$

$(x, y, z) = (0, -1, -5)$ ✓

115

115

$x+y=2700$

$70x+60y=181000$

$(x+y=2700)(-60)$

$(70x+60y=181000)(1)$

$-60x-60y=-162000$

$70x+60y=181000$

$10x=19000$

$\frac{\cancel{10}x}{\cancel{10}}=\frac{19000}{10}$

$x=1900$

mult

$x=$ \$70 ticket

$y=$ \$60 ticket

Subst

$x+y=2700$

$1900+y=2700$

$\cancel{1900}+y-\cancel{1900}=2700-1900$

$y=800$

(x, y)

$(1900, 800)$