1. find the intercepts and graph M1414ALVAREZIII Step 1

~~11-20-17~~ ~~11-28-17~~ 11-30-17 12-12-17

$2x+3y=6$

find 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 y-intercept let $x=0$

$2(0)+3y=6$

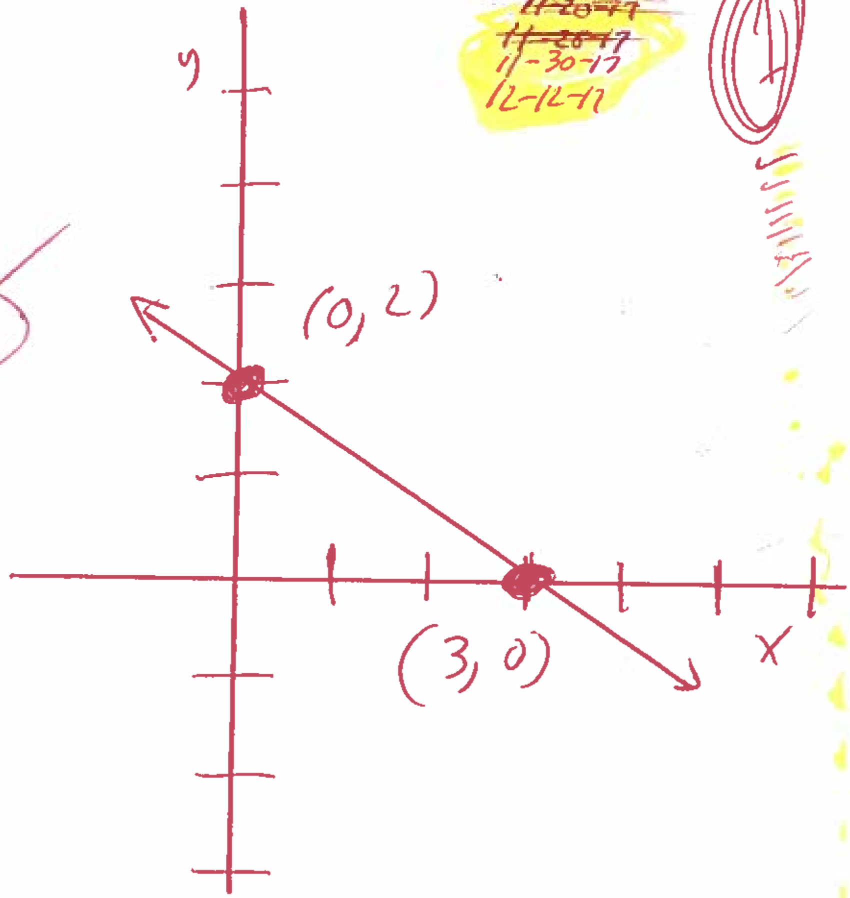
$0+3y=6$

$3y=6$

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

$y=2$

$(0,2)$



OR

$2x+3y=6$ Solve for y $\rightarrow$ $y=-\frac{2}{3}x+2$

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

$3y=6-2x$

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

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

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

slope $=-\frac{2}{3}=m$

y-intercept $=2$

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

$y=0+2$

$y=2$

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

$y=-2+2$

$y=0$

x	y
0	2
3	0

slope intercept form $y=mx+b$

2. $y = x^3 - 8$

find x-intercept let $y = 0$

$0 = x^3 - 8$

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

$8 = x^3$

$\sqrt[3]{8} = \sqrt[3]{x^3}$ $(2, 0)$

$2 = x$

find y-intercept let $x = 0$

$y = x^3 - 8$

$y = (0)^3 - 8$

$y = (0)(0)(0) - 8$

$y = 0 - 8$ $(0, -8)$

$y = -8$

$f(x) = y = x^3 - 8$

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

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

$f(-x) = (-x)(-x)(-x) - 8$

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

$f(-x) = -1(x^3 + 8)$

$f(-x) \neq -f(x)$ NOT odd

$f(-x) \neq f(x)$ NOT Even

NOT Symmetric to origin

NOT Symmetric to
x-axis
y-axis
origin

2.

3. $y=x^2-x-56$

find x-intercept
find y-intercept
vertex
graph

3.

use graphing calculator

find x-intercept let $y=0$

$0=x^2-x-56$

$0=(x+7)(x-8)$

let $x+7=0$ OR $x-8=0$

$x+7-7=0-7$ OR $x-8+8=0+8$

$x=-7$ OR $x=8$

$(-7,0)$, $(8,0)$

x-intercepts

find y-intercept let $x=0$

$y=x^2-x-56$

$y=(0)^2-(0)-56$

$y=(0)(0)-(0)-56$

$y=0-0-56$

$y=-56$

$(0,-56)$

y intercept

find vertex

$y=x^2-x-56$

$y=1x^2-1x-56$

$a=1,\ b=-1,\ c=-56$

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

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

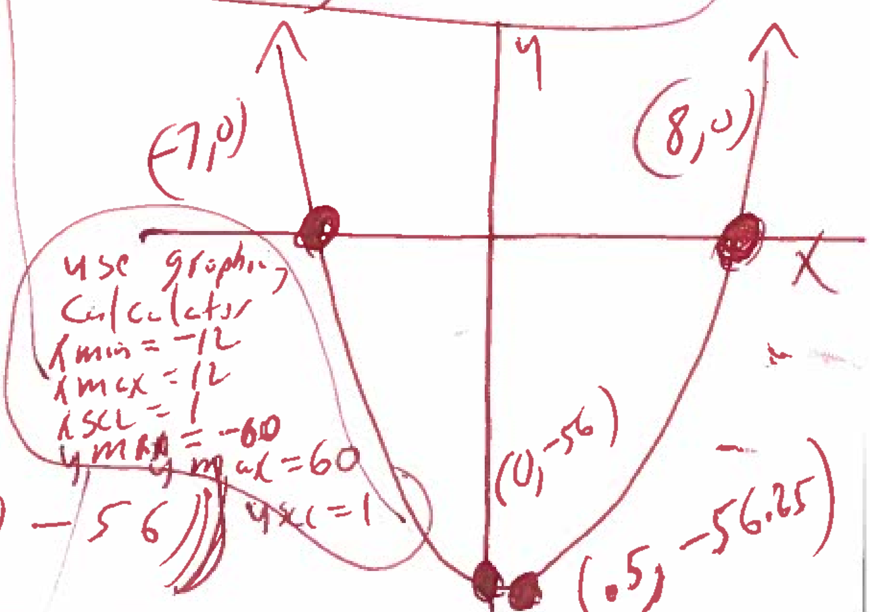
$\text{Vertex}=\left(\frac{1}{2}, f\left(\frac{1}{2}\right)\right)$

$\text{Vertex}=(.5, f(.5))$

$\text{Vertex}=(.5, (.5)^2-(.5)-56)$

$\text{vertex}=(.5, .25-.5-56)$

$\boxed{\text{Vertex}=(.5, -56.25)}$



4. $y = \dfrac{-9x}{x^2+9}$

4

find x-intercept let $y=0$

$$0 = \frac{-9x}{x^2+9}$$

$$\frac{0}{1} = \frac{-9x}{x^2+9}$$

$$0(x^2+9) = 1(-9x)$$

$$0 = -9x$$

$$\frac{0}{-9} = \frac{-9x}{-9}$$

$$0 = x$$

$(0,0)$

find y-intercept let $x=0$

$$y = \frac{-9(0)}{(0)^2+9}$$

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

$$y = \frac{0}{0+9}$$

$$y = \frac{0}{9}$$

$$y = 0$$

$(0,0)$

$$f(x) = y = \frac{-9x}{x^2+9}$$

$$f(-x) = \frac{-9(-x)}{(-x)^2+9}$$

$$f(-x) = \frac{9}{(-x)(-x)+9}$$

$$f(-x) = \frac{9x}{x^2+9}$$

$$f(-x) = -\left(\frac{-9x}{x^2+9}\right)$$

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

Symmetric with respect to the origin

5. list the intercepts and test for symmetry 5

$f(x) = y = \frac{-x^3}{x^2 - 9}$

find x-intercept let $y=0$

$0 = \frac{-x^3}{x^2-9}$

$\frac{0}{1} = \frac{-x^3}{x^2-9}$

$0(x^2-9) = 1(-x^3)$

$0 = -x^3$

$\frac{0}{-1} = \frac{-x^3}{-1}$

$0 = x^3$

$\sqrt[3]{0} = \sqrt[3]{x^3}$

$0 = x$

$(0,0)$ ✓

find y-intercept let $x=0$

$y = \frac{-x^3}{x^2-9}$

$y = \frac{-(0)^3}{(0)^2-9}$

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

$y = \frac{0}{0-9}$

$y = \frac{0}{-9}$

$y = 0$

$(0,0)$ ✓

$f(x) = \frac{-x^3}{x^2-9}$

$f(-x) = \frac{-(-x)^3}{(-x)^2-9}$

$f(-x) = \frac{-(-x)(-x)(-x)}{(-x)(-x)-9}$

$f(-x) = \frac{-(-x^3)}{x^2-9}$

$f(-x) = \frac{x^3}{x^2-9}$

$f(-x) = -1\left(\frac{-x^3}{x^2-9}\right)$

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

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

Symmetric with respect to origin ✓

6. Give the slope and the y-intercept of the line with the given equation

6

$y = 3x + 5$

Formula $y = mx + b$

slope

y-intercept

Slope $= m = 3$

y intercept

$b = 5$

$y = 3x + 5$

$y = 3(0) + 5$

$y = 0 + 5$

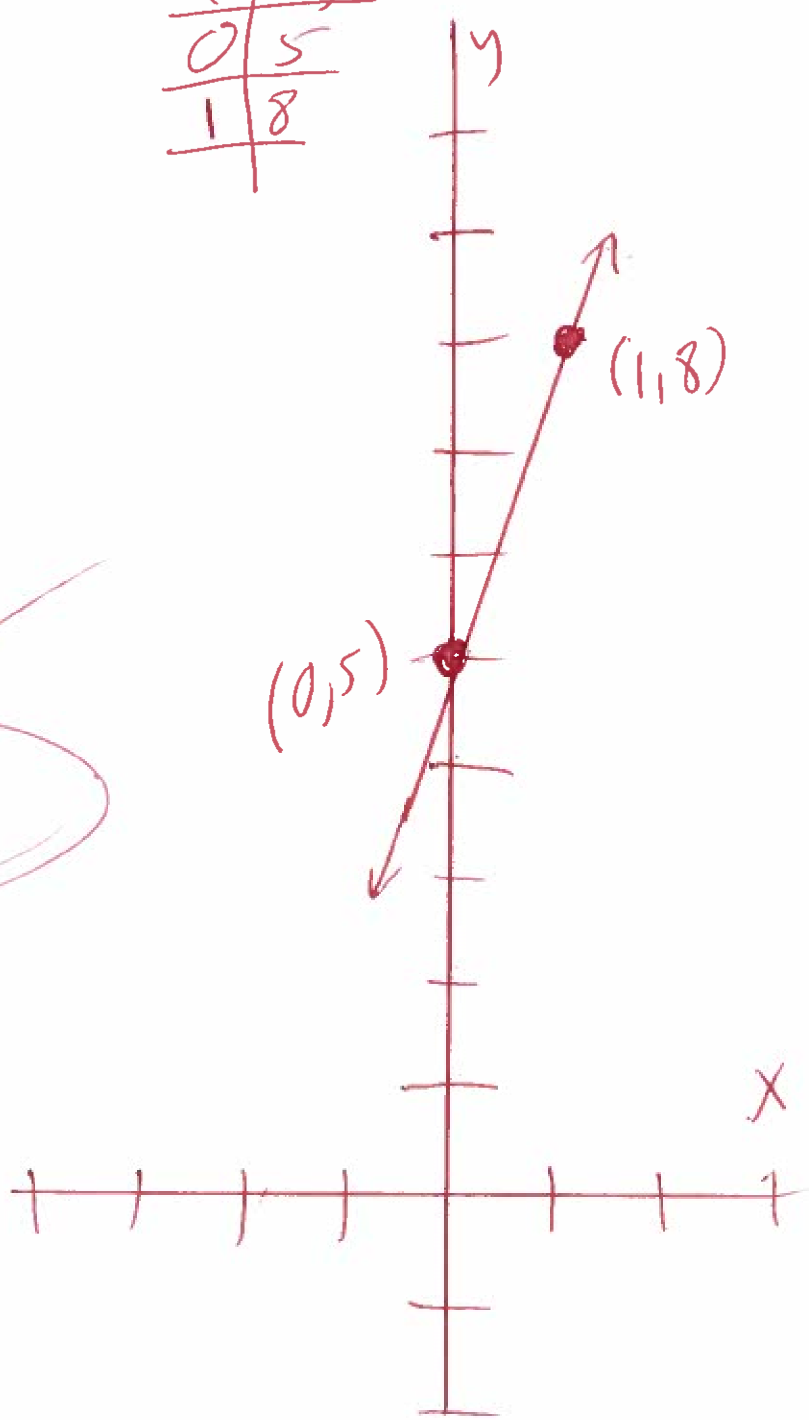
$y = 5$

$y = 3(1) + 5$

$y = 3 + 5$

$y = 8$

x	y
0	5
1	8



y-intercept $(0, 5)$

7.

$11-2x > -1$

$\cancel{11}-2x-\cancel{11} > -1-11$

$-2x > -12$

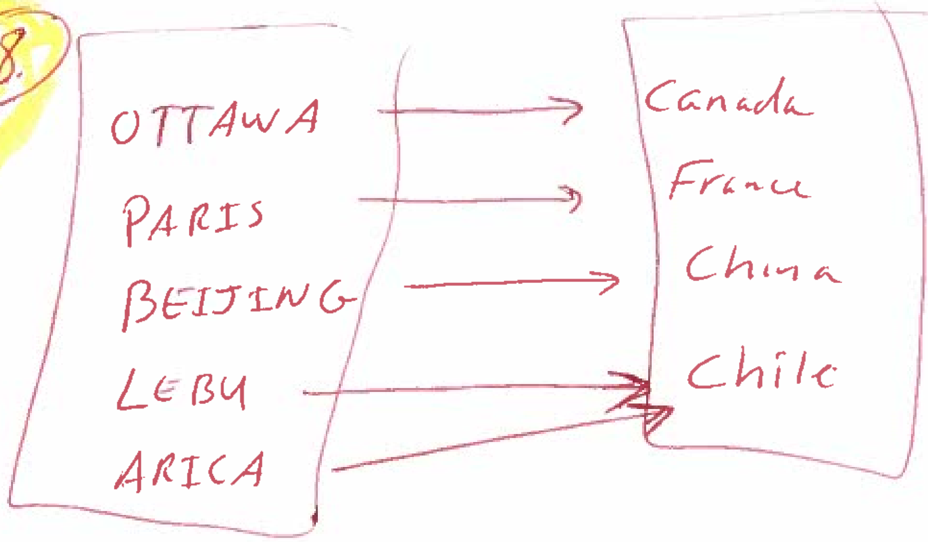
$\frac{-\cancel{2}x}{-\cancel{2}} < \frac{-12}{-2}$ ← divide by a negative and turn alligator around.

7.

$x < 6$

$(-\infty, 6)$

8.



Domain {OTTAWA, PARIS, BEIJING, LEBU, ARICA}

Range {Canada, France, China, Chile}

Yes this is a function because each element in the first set corresponds to exaclty one element in the second set.

9. $\{(3,8),\ (-6,8),\ (9,10),\ (3,19)\}$

domain $= \{-6,\ 3,\ 9\}$

range $= \{8,\ 10,\ 19\}$

1

The relation is not a function because there are ordered pairs with 3 as the first element and different second elements.

$(3,\ 8)$ and $(3,\ 19)$

NOT A function

10. State the domain and range for the following relation. Then determine whether the relation represents a function.

{(7,1), (8,1), (9,1), (10,1)}

10.

The domain of the relation is {7, 8, 9, 10}.
(Use a comma to separate answers as needed.)

The range of the relation is {1}.
(Use a comma to separate answers as needed.)

Does the relation represent a function? Choose the correct answer below.

- A. The relation is not a function because there are ordered pairs with 7 as the first element and different second elements.
- B. The relation is not a function because there are ordered pairs with 1 as the second element and different first elements.
- C. The relation is a function because there are no ordered pairs with the same first element and different second elements.
- D. The relation is a function because there are no ordered pairs with the same second element and different first elements.

11. State the domain and range for the following relation. Then determine whether the relation represents a function.

{(− 6,5), (− 5,1), (− 4,0), (− 3,1)}

11.

The domain of the relation is {−6, −5, −4, −3}.
(Use a comma to separate answers as needed.)

The range of the relation is {0, 1, 5}.
(Use a comma to separate answers as needed.)

Does the relation represent a function? Choose the correct answer below.

- A. The relation is a function because there are no ordered pairs with the same second element and different first elements.
- B. The relation is not a function because there are ordered pairs with − 6 as the first element and different second elements.
- C. The relation is a function because there are no ordered pairs with the same first element and different second elements.
- D. The relation is not a function because there are ordered pairs with 0 as the second element and different first elements.

12. $f(x) = 3x^2 + 4x - 4$

12

$f(-3) = 3(-3)^2 + 4(-3) - 4$

$f(-3) = 3(-3)(-3) + 4(-3) - 4$

$f(-3) = 3(9) + 4(-3) - 4$

$f(-3) = 27 - 12 - 4$

$f(-3) = 15 - 4$

$f(-3) = 11$ ✓

$f(x+3) = 3(x+3)^2 + 4(x+3) - 4$

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

$f(x+3) = 3(x^2 + 3x + 3x + 9) + 4(x+3) - 4$

$f(x+3) = 3(x^2 + 6x + 9) + 4(x+3) - 4$

$f(x+3) = 3x^2 + 18x + 27 + 4x + 12 - 4$

$f(x+3) = 3x^2 + 22x + 35$

13.

$$f(x) = \frac{3x+8}{7x-4}$$

$$f(x+h) = \frac{3(x+h)+8}{7(x+h)-4}$$

$$f(x+h) = \frac{3x+3h+8}{7x+7h-4}$$

13.

$$f(0) = \frac{3(0)+8}{7(0)-4}$$

$$f(0) = \frac{0+8}{0-4}$$

$$f(0) = \frac{8}{-4}$$

$$f(0) = -2$$

(14) find the domain

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

domain is all real numbers

$(-\infty, \infty)$

14.

15 find the domain of the function

$$f(x) = \frac{3x^2}{2x^2+4}$$

15

set $2x^2+4=0$

$2x^2+4-4=0-4$

$2x^2=-4$

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

$x^2 = -2$

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

$x = \pm\sqrt{2}\, i$

domain $(-\infty, \infty)$

all real #s

numbers

16 Find the domain

16

$$g(x) = \frac{x+4}{x^2-9}$$

formula

$a^2-b^2 = (a+b)(a-b)$

Can not be zero

Buttom

set $x^2 - 9 = 0$

$(x)^2 - (3)^2 = 0$

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

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

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

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

domain $= \{x \mid x \neq -3 \text{ or } x \neq 3\}$

$(-\infty,-3) \cup (-3,3) \cup (3,\infty)$

17. find the domain of the function

$$f(x) = \frac{x-2}{x^3+9x}$$

17

set $x^3+9x=0$

$x(x^2+9)=0$

$x=0$ OR $x^2+9=0$

$x^2+\cancel{9}-\cancel{9}=0-9$

$x^2=-9$

$\sqrt{x^2}=\pm\sqrt{-9}$

$x=\pm 3i$

$x \neq 0$

domain

$(-\infty, 0) \cup (0, \infty)$

$x<0$ OR $x>0$

18. find domain

$f(x) = \sqrt{4x-20}$

set $4x - 20 \geq 0$

$4x - \cancel{20} + \cancel{20} \geq 0 + 20$

$4x \geq 20$

$\frac{\cancel{4}x}{\cancel{4}} \geq \frac{20}{4}$

$x \geq 5$

$[5, \infty)$

18. formula domain

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

set $Ax + B \geq 0$

18 find domain

19

formula domain

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

set $Ax+B \geq 0$

$$f(x) = \frac{3x}{\sqrt{x-9}}$$

$x \neq 9$ and $x - 9 \geq 0$

means $\Longrightarrow$ $x - 9 > 0$ only possible

$x - 9 + 9 > 0 + 9$

$x > 9$

$(9, \infty)$

21. $f(x) = x^2 - 4x + 9$ 21.

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

$$\frac{((x+h)^2 - 4(x+h) + 9) - (x^2 - 4x + 9)}{h} =$$

$$\frac{(x+h)(x+h) - 4x - 4h + 9 - x^2 + 4x - 9}{h} =$$

$$\frac{x^2 + 1xh + 1xh + h^2 - 4x - 4h + 9 - x^2 + 4x - 9}{h} =$$

$$\frac{x^2 + 2xh + h^2 - 4x - 4h + 9 - x^2 + 4x - 9}{h} =$$

$$\frac{\cancel{x^2} + 2xh + h^2 - \cancel{4x} - 4h + \cancel{9} - \cancel{x^2} + \cancel{4x} - \cancel{9}}{h} =$$

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

$$\frac{\cancel{h}(2x + h - 4)}{\cancel{h}} = \quad \text{Factor}$$

$$2x + h - 4 =$$

22. given $f(x) = x^2 - 3x + 3$, find the values for x such that $f(x) = 31$

22

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

$$x^2 - 3x + 3 = 31$$

$$x^2 - 3x + 3 - 31 = 31 - 31$$

possible
28.1
14.2
4.7

$$x^2 - 3x - 28 = 0$$

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

let $x + 4 = 0$ OR $x - 7 = 0$

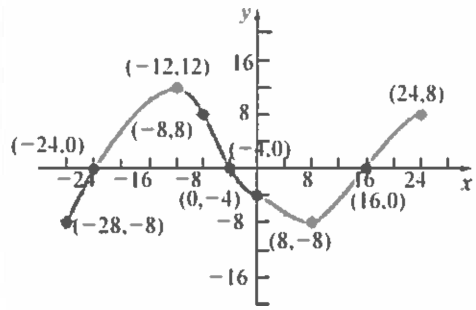
$x + 4 \cancel{- 4} = 0 - 4$ OR $x - \cancel{7 + 7} = 0 + 7$

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

$$\{-4, 7\}$$

23.

Use the graph of the function f shown to the right to answer parts (a)-(~~j~~k).



23.

(a) Find f(− 28) and f(8).

f(− 28) = -8

f(8) = -8

(b) Find f(24) and f(0).

f(24) = 8

f(0) = -4

(c) Is f(8) positive or negative?

- Positive
- [x] Negative

(d) Is f(− 8) positive or negative?

- [x] Positive
- Negative

(e) For what value(s) of x is f(x) = 0?

x = -24, -4, 16

(Use a comma to separate answers as needed.)

(f) For what values of x is f(x) > 0?

$-24 < x < -4$ and $16 < x \le 24$

(Type a compound inequality. Use a comma to separate answers as needed.)

(g) What is the domain of f?

The domain of f is {x| $-28 \le x \le 24$

(Type a compound inequality.)

(h) What is the range of f?

The range of f is {y| $-8 \le y \le 12$

(Type a compound inequality.)

(i) What are the x-intercept(s)?

x = (-24, 0), (-4, 0), (16, 0)

(Type an integer or a simplified fraction. Use a comma to separate answers as needed.)

(j) What are the y-intercept(s)?

y = (0, -4)

(Type an integer or a simplified fraction. Use a comma to separate answers as needed.)

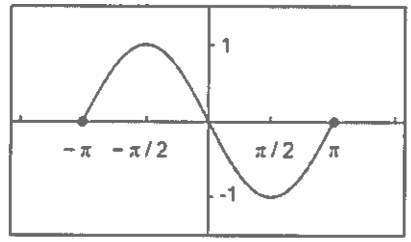
(k) How often does the line y = 1 intersect the graph?

3 Times time(s)

24.

24

Determine whether the graph below is that of a function by using the vertical-line test. If it is, use the graph to find
(a) its domain and range.
(b) the intercepts, if any.
(c) any symmetry with respect to the x-axis, y-axis, or the origin.



Is the graph that of a function?

- [x] Yes
- [ ] No

If the graph is that of a function, what are the domain and range of the function? Select the correct choice below and fill in any answer boxes within your choice.

- [x] **A.** The domain is $[-\pi, \pi]$. The range is $[-1, 1]$.
  (Type your answers in interval notation.)
- [ ] **B.** The graph is not a function.

What are the intercepts? Select the correct choice below and fill in any answer boxes within your choice.

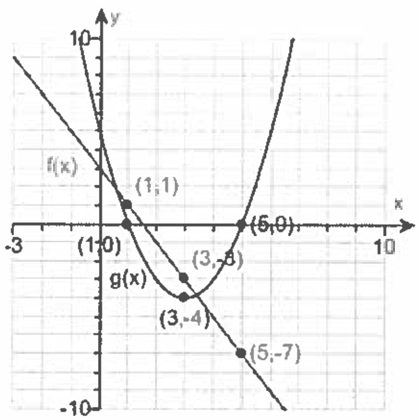
- [x] **A.** The intercepts are $(\pi, 0), (-\pi, 0), (0, 0)$
  (Type an ordered pair. Type an exact answer using π as needed. Use a comma to separate answers as needed.)
- [ ] **B.** There are no intercepts.
- [ ] **C.** The graph is not a function.

Determine if the graph is symmetrical.

- [ ] **A.** It is symmetrical with respect to the x-axis.
- [x] **B.** It is symmetrical with respect to the origin.
- [ ] **C.** It is symmetrical with respect to the y-axis.
- [ ] **D.** The graph is not symmetrical.
- [ ] **E.** The graph is not a function.

25.

The graph of two functions, f and g, is illustrated below. Use the graph to answer parts (a) through (f).



(a) $(f+g)(1) =$ 1
(Simplify your answer.)

(b) $(f+g)(3) =$ -7
(Simplify your answer.)

(c) $(f-g)(5) =$ -7
(Simplify your answer.)

(d) $(g-f)(5) =$ 7
(Simplify your answer.)

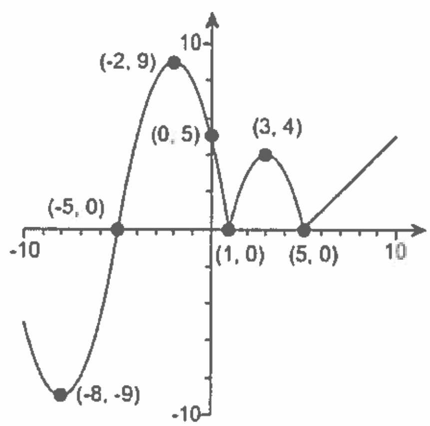
(e) $(f \cdot g)(1) =$ 0
(Simplify your answer.)

(f) $\left(\frac{f}{g}\right)(3) =$ 3/4
(Simplify your answer.)

25

26.

Use the graph of the function f given below to answer the question.



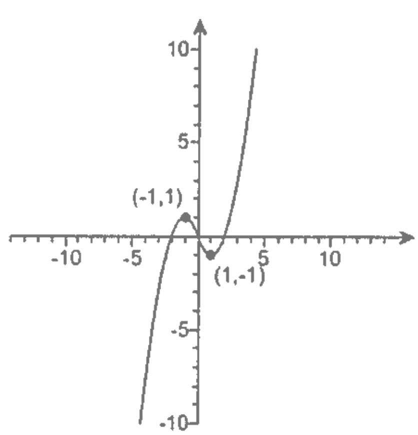
Is f strictly decreasing on the interval $(-2, 0)$?

- No
- Yes

26

27.

List the intervals on which f is decreasing.



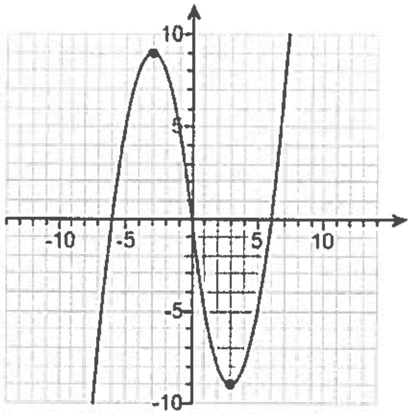
(-1, 1)

(Type your answer in interval notation. Use a comma to separate answers as needed.)

27

28.

Use the graph of the function f given below to answer the questions.



28.

Is there a local maximum at x = − 3?

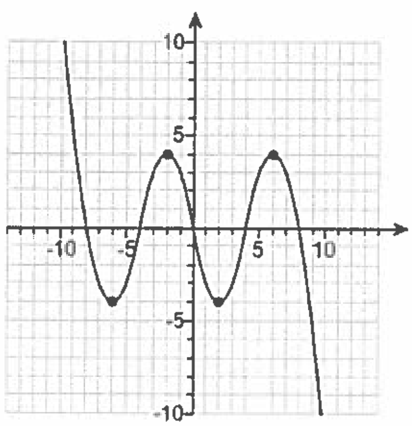
- [x] Yes
- No

If there is a local maximum at x = − 3, what is it? Select the correct choice below and fill in any answer boxes within your choice.

- [x] **A.** The local maximum is y = 9 or (−3, 9)
  (Type an integer.)
- **B.** There is no local maximum at x = − 3.

29.

Use the graph of the function f given below to answer the questions.



List the values of x at which f has a local minimum. Select the correct choice below and fill in any answer boxes within your choice.

29.

- [x] **A.** x = −6, 2
  (Type an integer. Use a comma to separate answers as needed.)
- **B.** There are no local minima.

What are these local minima, if they exist? Select the correct choice below and fill in any answer boxes within your choice.

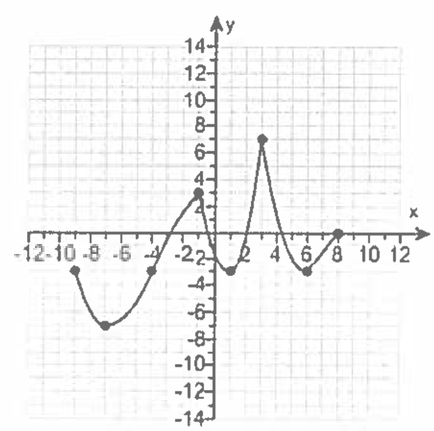
- [x] **A.** The local minima are −4, −4. or (−6, −4) (2, −4)
  (Type an integer. Use a comma to separate answers as needed.)
- **B.** There are no local minima.

30.

Find the absolute minimum of f on [− 9,8].

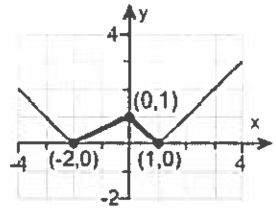
Select the correct choice below and, if necessary, fill in the answer boxes to complete your choice.

- **A.** The absolute minimum of f is f(−7) = −7.
  (Type integers or fractions.)
- **B.** There is no absolute minimum.



30.

31.



Use the graph to find:

(a) The numbers, if any, at which f has a local maximum. What are these local maxima?
(b) The numbers, if any, at which f has a local minimum. What are these local minima?

(a) Select the correct choice below and fill in any answer boxes within your choice.

31

- **A.** The value(s) of x at which f has a local maximum is/are x = 0.
  (Type an integer. Use a comma to separate answers as needed.)
- **B.** There are no values of x at which f has a local maximum.

Select the correct choice below and fill in any answer boxes within your choice.

- **A.** The local maxima is/are y = 1. OK (0,1)
  (Type an integer. Use a comma to separate answers as needed.)
- **B.** There are no local maxima.

(b) Select the correct choice below and fill in any answer boxes within your choice.

- **A.** The value(s) of x at which f has a local minimum is/are x = −2, 1.
  (Type an integer. Use a comma to separate answers as needed.)
- **B.** There are no values of x at which f has a local minimum.

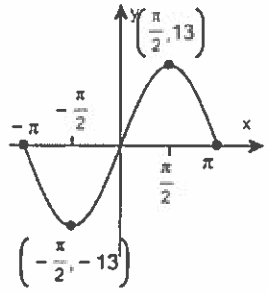
Select the correct choice below and fill in any answer boxes within your choice.

- **A.** The local minima is/are y = 0, 0. OK (−2, 0) (1, 0)
  (Type an integer. Use a comma to separate answers as needed.)
- **B.** There are no local minima.

32. Using the given graph of the function f, find the following.

32.

(a) The numbers, if any, at which f has a local maximum. What are these local maxima?
(b) The numbers, if any, at which f has a local minimum. What are these local minima?



(a) Find the value(s) of x at which f has a local maximum. Select the correct choice below and fill in any answer boxes in your choice.

☒ A. x = $\pi/2$
(Type an exact answer, using π as needed. Use a comma to separate answers as needed.)

○ B. There is no solution.

Find the local maximum. Select the correct choice below and fill in any answer boxes in your choice.

☒ A. 13 OR $(\frac{\pi}{2}, 13)$
(Type an exact answer, using π as needed. Use a comma to separate answers as needed.)

○ B. There is no solution.

(b) Find the value(s) of x at which f has a local minimum. Select the correct choice below and fill in any answer boxes in your choice.

☒ A. x = $-\pi/2$
(Type an exact answer, using π as needed. Use a comma to separate answers as needed.)

○ B. There is no solution.

Find the local minimum. Select the correct choice below and fill in any answer boxes in your choice.

☒ A. -13 OR $(-\frac{\pi}{2}, -13)$
(Type an exact answer, using π as needed. Use a comma to separate answers as needed.)

○ B. There is no solution.

33. Determine algebraically whether the given function is even, odd, or neither.

33.

$f(x) = 5x^3 + 8x$

○ Even
☒ Odd
○ Neither

$f(-x) = 5(-x)^3 + 8(-x)$
$f(-x) = 5(-x)(-x)(-x) + 8(-x)$
$f(-x) = 5(-x^3) + 8(-x)$
$f(-x) = -5x^3 - 8x$
$f(-x) = -1(5x^3 + 8x)$
$f(-x) = -1 f(x)$

Since $f(-x) = -f(x)$ Odd

34. determine algebraically whether the given function is even, odd, or neither.

34.

$g(x) = -5x^3 - 2$

$g(-x) = -5(-x)^3 - 2$

$g(-x) = -5(-x)(-x)(-x) - 2$

$g(-x) = -5(-x^3) - 2$

$g(-x) = 5x^3 - 2$

$g(-x) = -1(-5x^3 + 2)$

$g(-x) \neq -g(x)$ Not odd

$g(-x) \neq g(x)$ Not Even

Neither

35 Find the average rate of change from 3 to 5. $f(x) = 2x^2+2$

35

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

$$\frac{f(5) - f(3)}{5-3} =$$

$$\frac{(2(5)^2+2) - (2(3)^2+2)}{5-3} =$$

$$\frac{(2(5)(5)+2) - (2(3)(3)+2)}{5-3} =$$

$$\frac{(2(25)+2) - (2(9)+2)}{5-3} =$$

$$\frac{(50+2) - (18+2)}{5-3} =$$

$$\frac{52-20}{5-3} =$$

$$\frac{32}{2} = 16$$

36 $g(x) = -x^3+3x$ 36

determine whether g is even, odd, or neither

$g(-x) = -(-x)^3+3(-x)$

$g(-x) = -(-x)(-x)(-x)+3(-x)$

$g(-x) = -(-x^3)+3(-x)$

$g(-x) = x^3-3x$

$g(-x) = -1(-x^3+3x)$

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

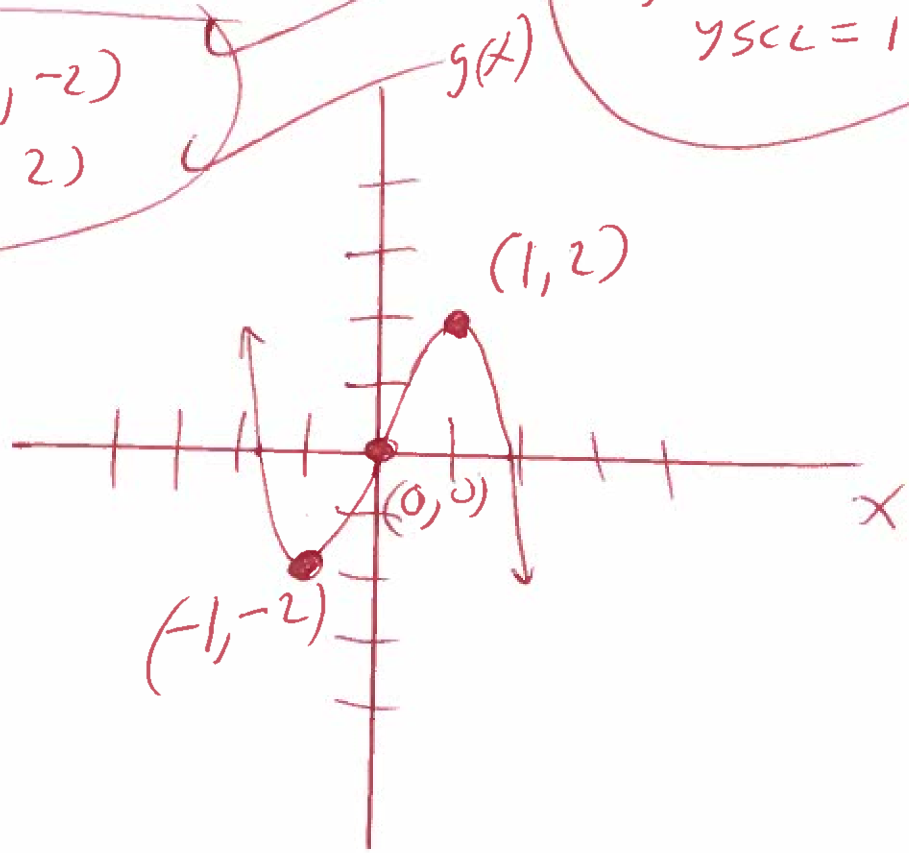
find max and min

use graphing calculator

$y_1 = -x^3+3x$

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

Minimum = (-1, -2)
Maximum = (1, 2)



37 graph

$y = |x|$

$y = |-1|$

$y = 1$

$y = |0|$

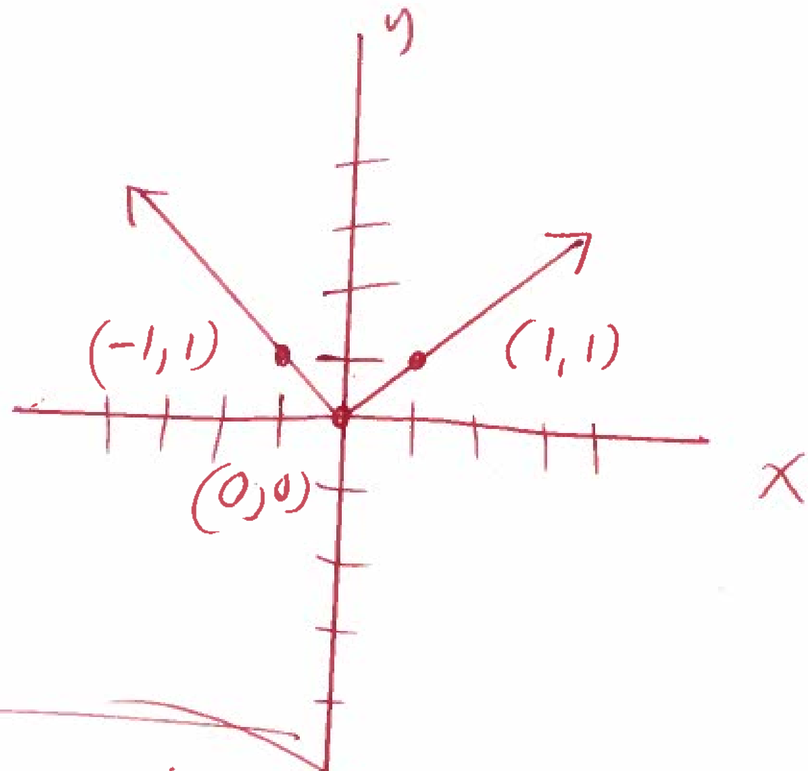
$y = 0$

$y = |1|$

$y = 1$

37

x	y
-1	1
0	0
1	1



$y = |x|$ is symmetric about the y-axis

38

graph

$y = x^3$

Cube function

38

x	y
-2	-8
-1	-1
0	0
1	1
2	8

$y = (-2)^3$

$y = (-2)(-2)(-2)$

$y = -8$

$y = (-1)^3$

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

$y = -1$

$y = (0)^3$

$y = (0)(0)(0)$

$y = 0$

$y = (1)^3$

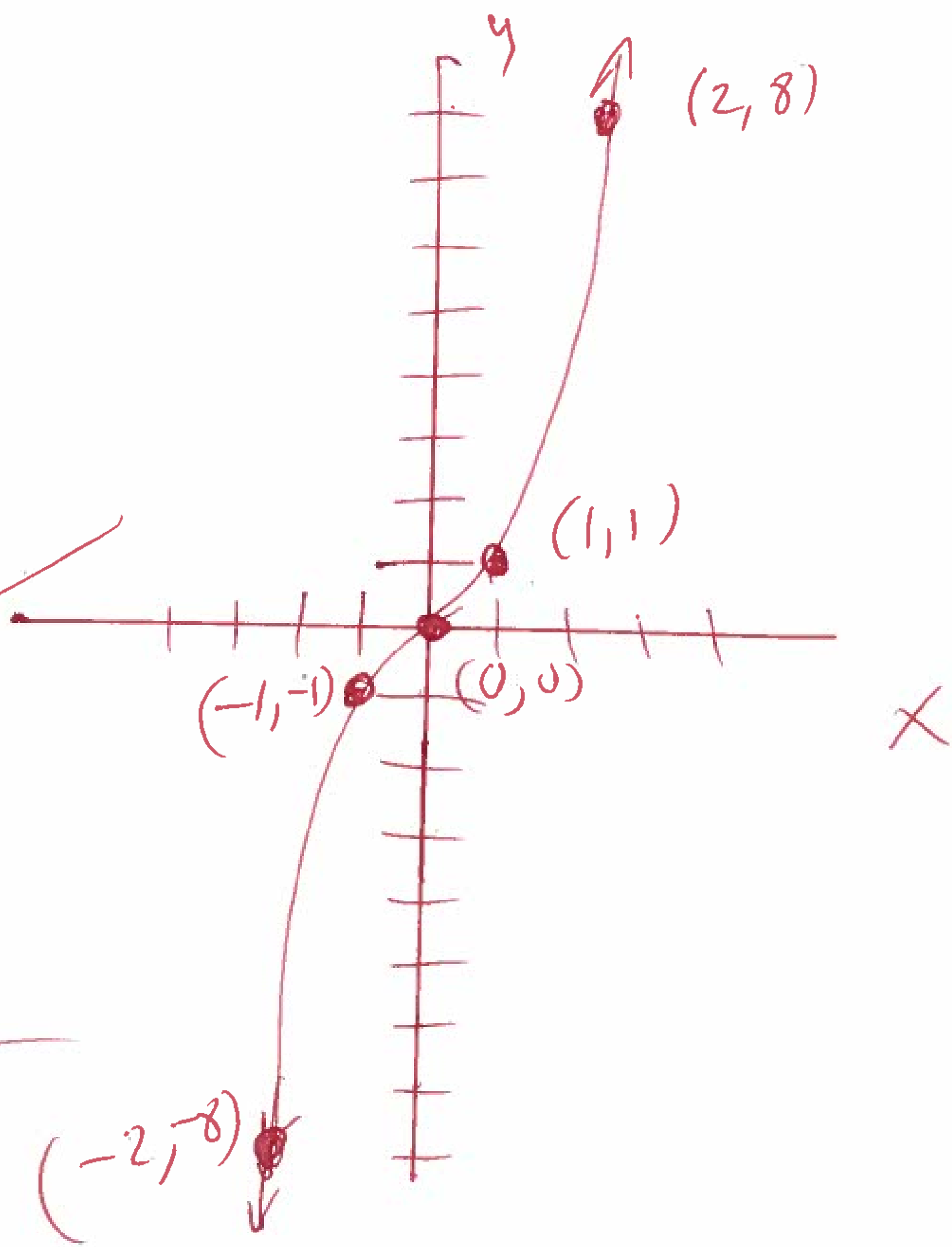
$y = (1)(1)(1)$

$y = 1$

$y = (2)^3$

$y = (2)(2)(2)$

$y = 8$



39. Graph

Reciprocal function

39.

$f(x) = y = \frac{1}{x}$

$y = \frac{1}{-2} = -\frac{1}{2}$ ✓

$y = \frac{1}{-1} = -1$ ✓

$y = \frac{1}{-\frac{1}{2}} = \frac{1}{1} \cdot \frac{-2}{1} = -2$

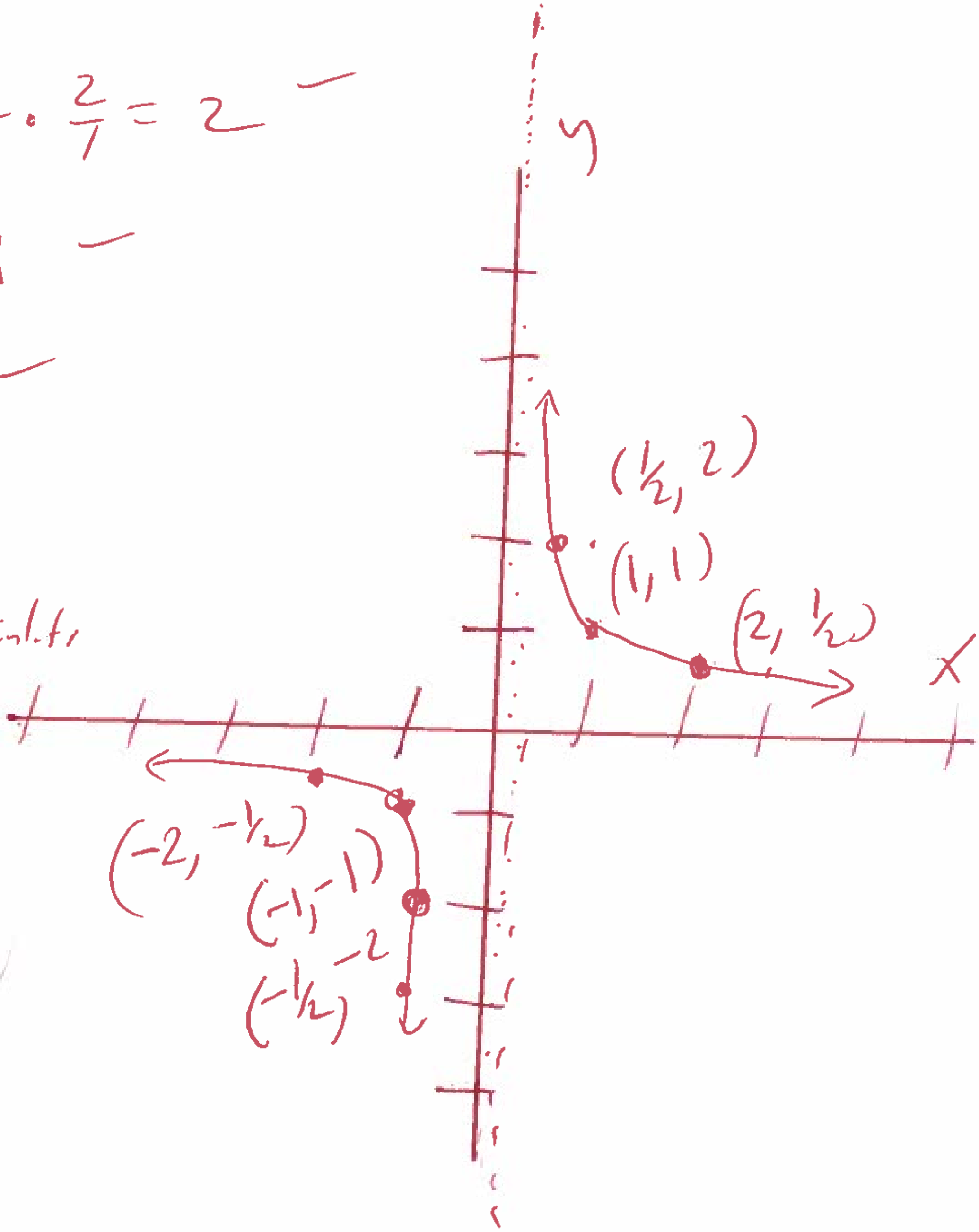
$y = \frac{1}{0}$ undefined

$y = \frac{1}{\frac{1}{2}} = \frac{1}{1} \cdot \frac{2}{1} = 2$

$y = \frac{1}{1} = 1$

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

x	y
-2	$-\frac{1}{2}$
-1	-1
$-\frac{1}{2}$	-2
0	undefined
$\frac{1}{2}$	2
1	1
2	$\frac{1}{2}$



use graphing calculator

$y_1 = \frac{1}{x}$

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

40

40.

graph

$f(x) = -4x^3$

$f(-1) = -4(-1)^3$

$f(-1) = -4(-1)(-1)(-1)$

$f(-1) = -4(-1)$

$f(-1) = 4$

$f(0) = -4(0)^3$

$f(0) = -4(0)(0)(0)$

$f(0) = -4(0)$

$f(0) = 0$

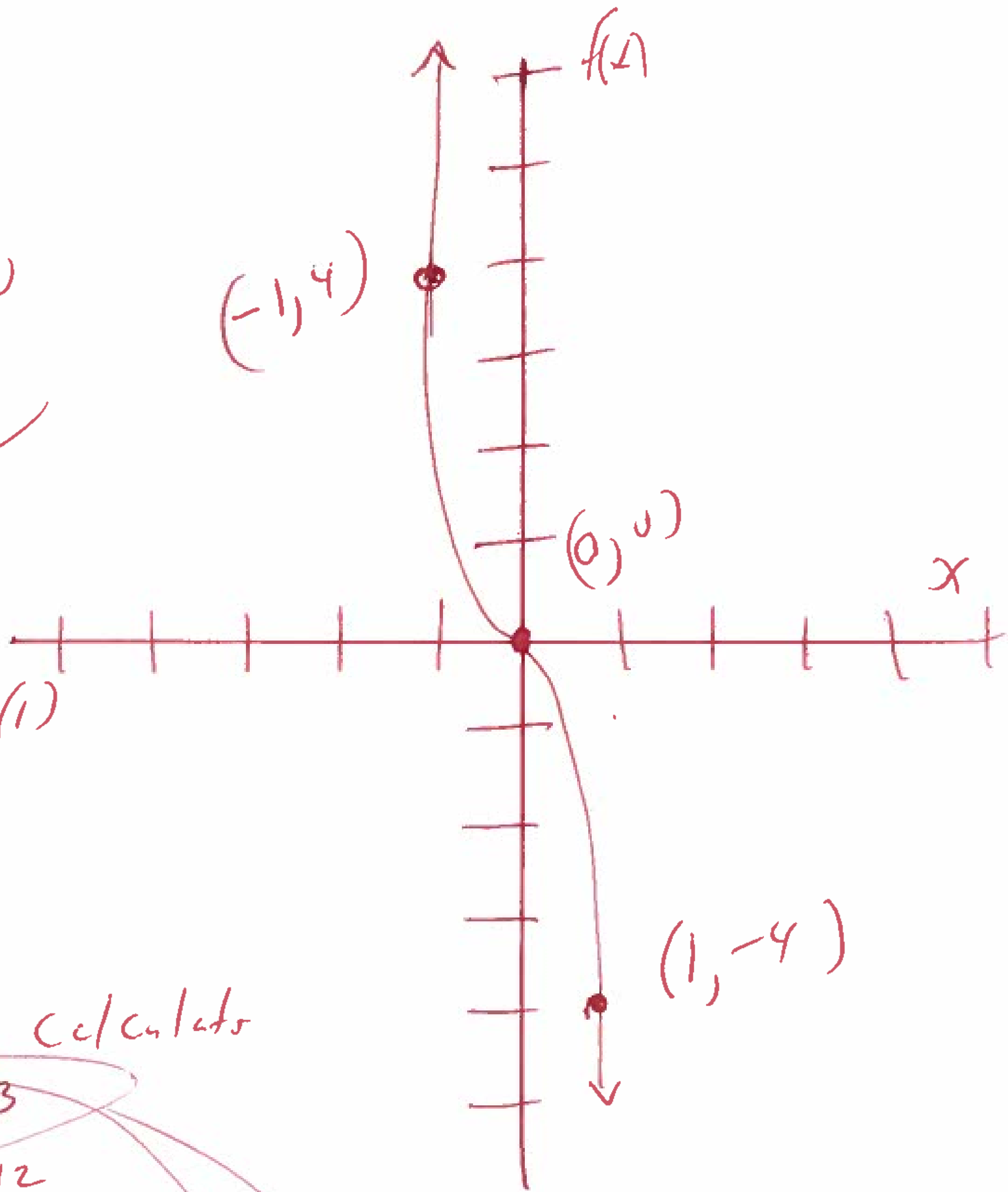
$f(1) = -4(1)^3$

$f(1) = -4(1)(1)(1)$

$f(1) = -4(1)$

$f(1) = -4$

x	$f(x)$
-1	4
0	0
1	-4



use graphing calculator

$y_1 = -4x^3$

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

41. graph

$$f(x) = \frac{6}{x}$$

$$f(-2) = \frac{6}{-2} = -3$$

$$f(-1) = \frac{6}{-1} = -6$$

$$f(-\tfrac{1}{2}) = \frac{6}{-\frac{1}{2}} = \frac{6}{1} \cdot \frac{-2}{1} = -12$$

$$f(0) = \frac{6}{0} \text{ undefined}$$

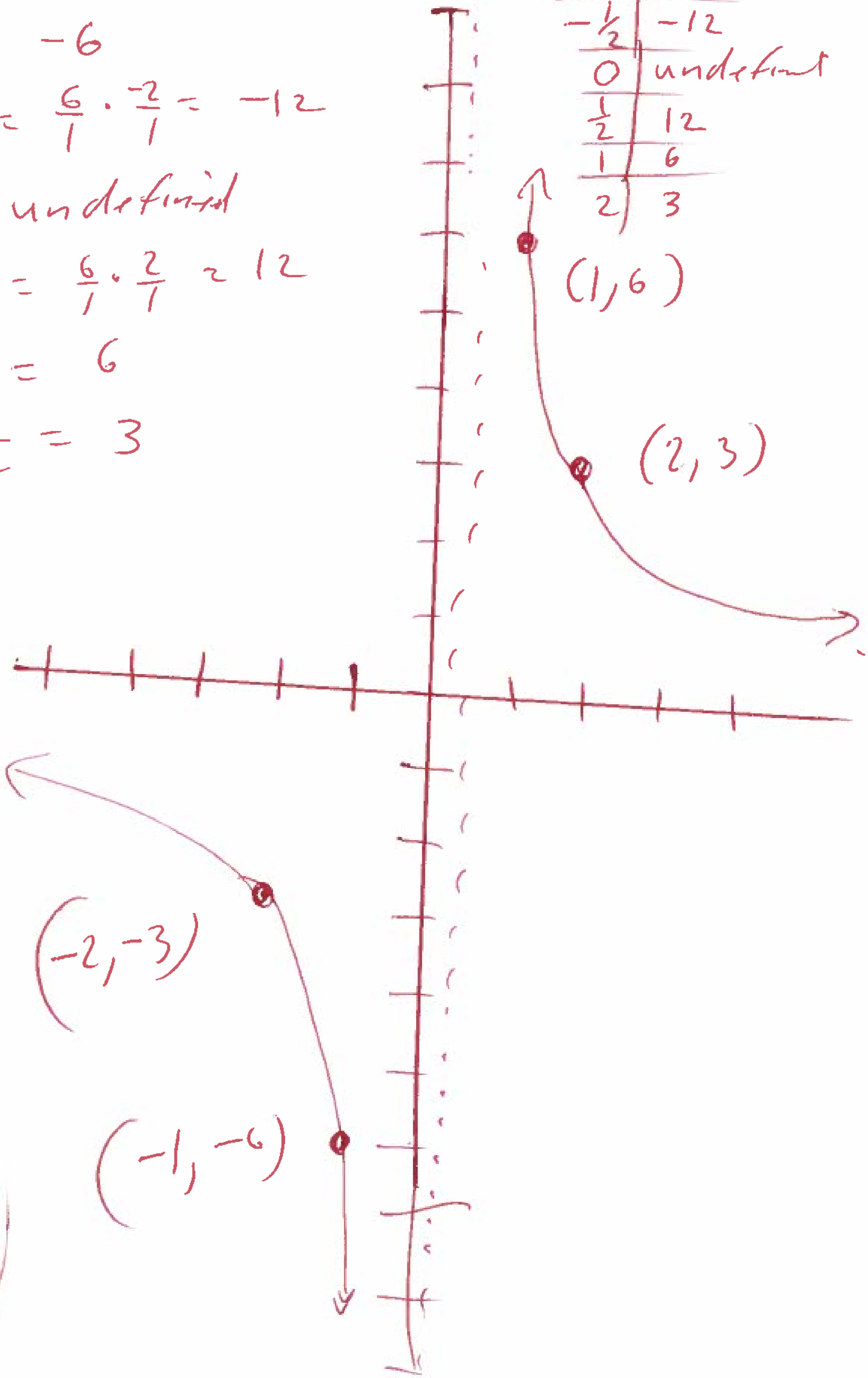
$$f(\tfrac{1}{2}) = \frac{6}{\frac{1}{2}} = \frac{6}{1} \cdot \frac{2}{1} = 12$$

$$f(1) = \frac{6}{1} = 6$$

$$f(2) = \frac{6}{2} = 3$$

x	$f(x)$
-2	-3
-1	-6
$-\frac{1}{2}$	-12
0	undefined
$\frac{1}{2}$	12
1	6
2	3

41.



use graphing calculator

$y_1 = \frac{6}{x}$

xmin = −12
xmax = 12
xscl = 1
ymin = −10
ymax = 10
yscl = 1

42.

$$f(x) = \begin{cases} 5x-2 & \text{if } -5 \le x \le 2 \\ x^3-2 & \text{if } 2 < x \le 4 \end{cases}$$

42.

$f(0) = 5(0) - 2$

$f(0) = 0 - 2$

$f(0) = -2$

$f(1) = 5(1) - 2$

$f(1) = 5 - 2$

$f(1) = 3$

$f(2) = 5(2) - 2$

$f(2) = 10 - 2$

$f(2) = 8$

$f(4) = (4)^3 - 2$

$f(4) = (4)(4)(4) - 2$

$f(4) = 64 - 2$

$f(4) = 62$

43

$$f(x) = \begin{cases} 2x & \text{if } x \neq 0 \\ 1 & \text{if } x = 0 \end{cases}$$

43

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

$f(x) = 2x$

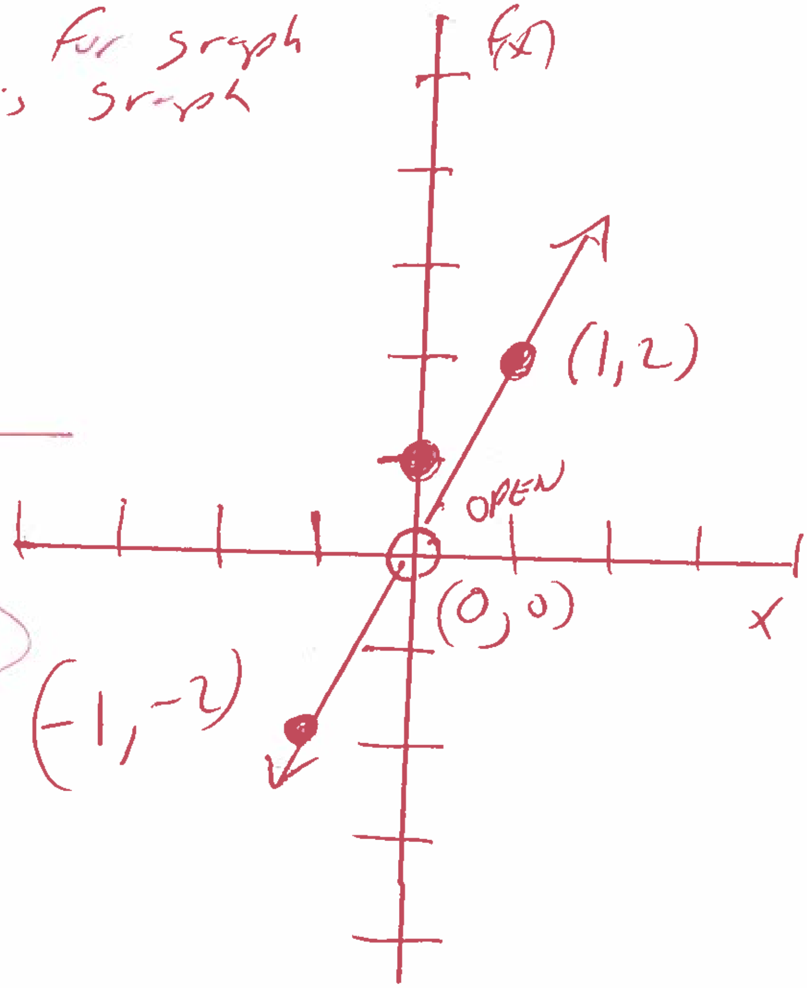
$f(-1) = 2(-1)$

$f(-1) = -2$

$f(0) = 2(0) = 0$ undefined for graph on this graph

$f(1) = 2(1)$

$f(1) = 2$



use graphing calculator

$y_1 = 2x / (X < 0 \text{ or } x > 0)$

$y_2 = 1 / (x = 0)$

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

$f(0) = 1$

x	f(x)
0	1

y-intercept (0, 1)

range $(-\infty, 0) \cup (0, \infty)$ (up down graph)

No f is discontinuous at $x = 0$

44 graph

$$f(x) = \begin{cases} -3x+4 & \text{if } x<1 \\ 4x-3 & \text{if } x \geq 1 \end{cases}$$

44.

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

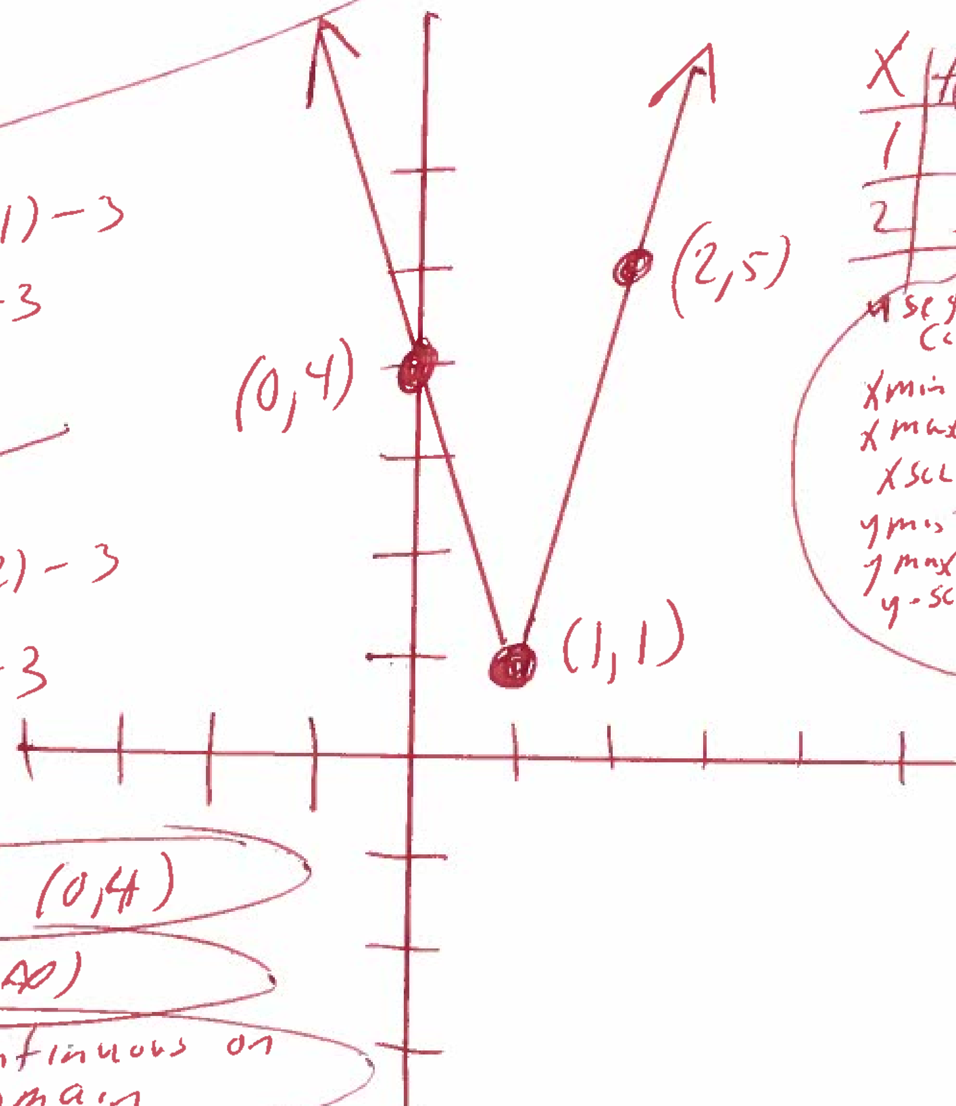
$f(1) = -3(1)+4$
$f(1) = -3+4$
$f(1) = 1$

x	$f(x)$
0	4
1	1

← undefined for graph first part

$f(1) = 4(1)-3$
$f(1) = 4-3$
$f(1) = 1$

$f(2) = 4(2)-3$
$f(2) = 8-3$
$f(2) = 5$



x	$f(x)$
1	1
2	5

use graphing calculator
Xmin = -12
Xmax = 12
Xscl = 1
Ymin = -10
Ymax = 10
Y-scl = 1

y-intercept (0,4)

range $[1, \infty)$

Yes f is continuous on its domain

45. graph

$$f(x) = \begin{cases} 4+x & \text{if } x<0 \\ x^2 & \text{if } x \geq 0 \end{cases}$$

45.

$f(x) = 4+x$

$f(-1) = 4+(-1)$

$f(-1) = 4-1$

$f(-1) = 3$

$f(0) = 4+(0)$

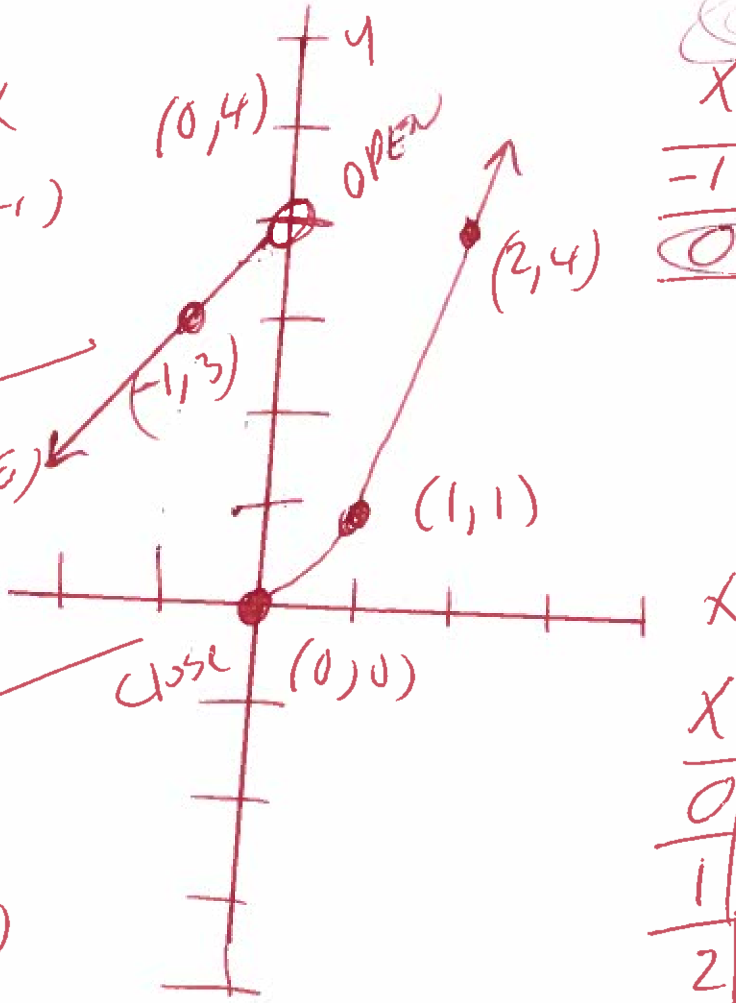
$f(0) = 4+0$

$f(0) = 4$

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

$f(0) = (0)(0)$

$f(0) = 0$



$f(x) = 4+x$

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

← Not on graph open

$f(x) = x^2$

x	$f(x)$
0	0
1	1
2	4

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

$f(1) = (1)(1)$

$f(1) = 1$

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

$f(2) = (2)(2)$

$f(2) = 4$

use graphing calculator

$y_1 = 4+x \div (x<0)$ open

$y_2 = x^2 \div (x \geq 0)$ close

$x_{min} = -12$

$x_{max} = 12$

$x_{scl} = 1$

$y_{max} = 10$

$y_{min} = -10$

$y_{scl} = 1$

46 graph

$y=-x^2+5$

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

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

$y=-(1)+5$

$y=-1+5$

$y=4$

$y=-(0)^2+5$

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

$y=-(0)+5$

$y=0+5$

$y=5$

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

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

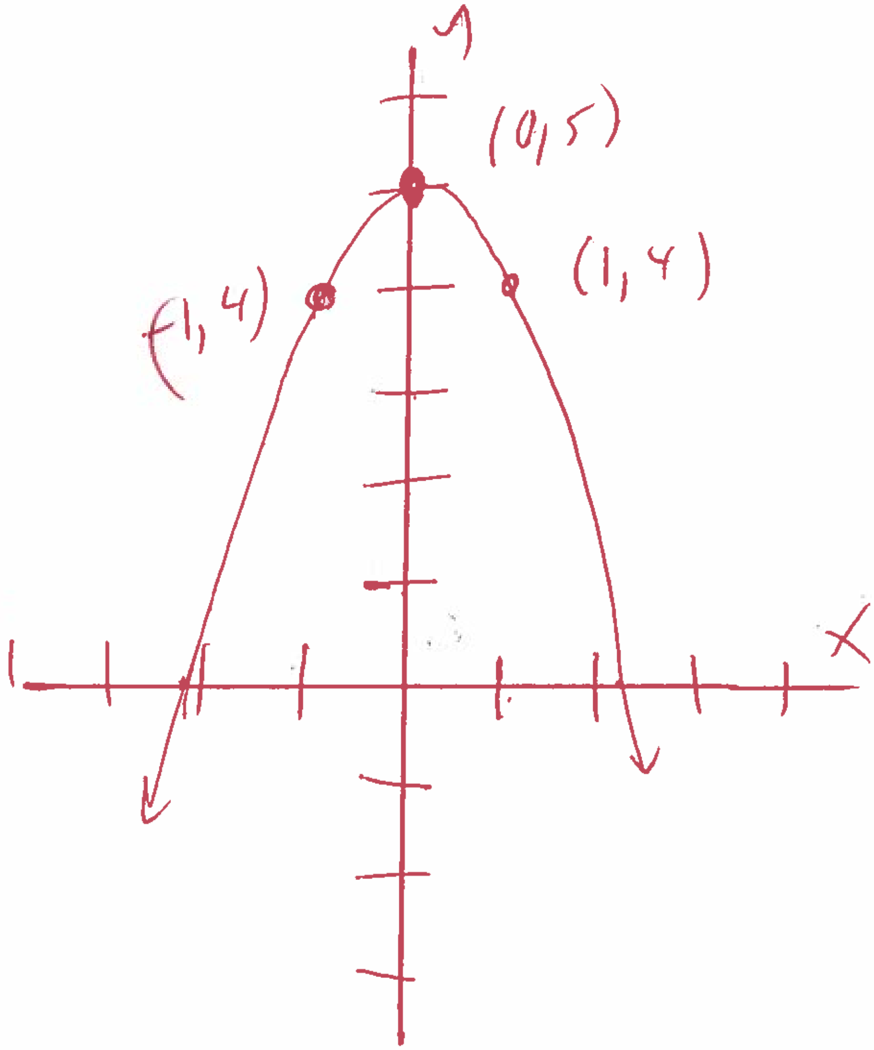
$y=-(1)+5$

$y=-1+5$

$y=4$

x	y
-1	4
0	5
1	4

46



47. graph

$y = -|x+8|$

$y = -|-9+8|$

$y = -|-1|$

$y = -(1)$

$y = -1$

$y = -|-8+8|$

$y = -|0|$

$y = -(0)$

$y = 0$

$y = -|-7+8|$

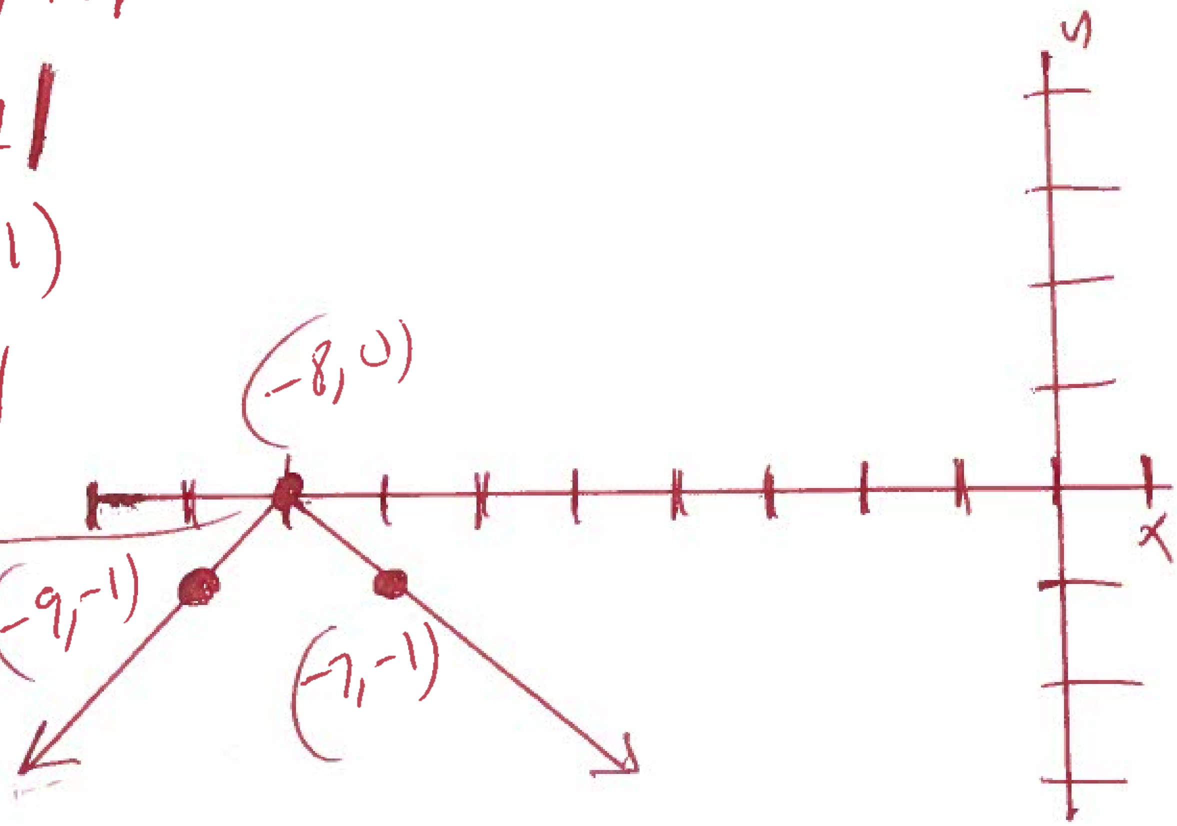
$y = -|1|$

$y = -(1)$

$y = -1$

x	y
-9	-1
-8	0
-7	-1

47



48. graph

$y = 3x^2$

$y = 3(-1)^2$

$y = 3(-1)(-1)$

$y = 3(1)$

$y = 3$

$y = 3(0)^2$

$y = 3(0)(0)$

$y = 3(0)$

$y = 0$

$y = 3(1)^2$

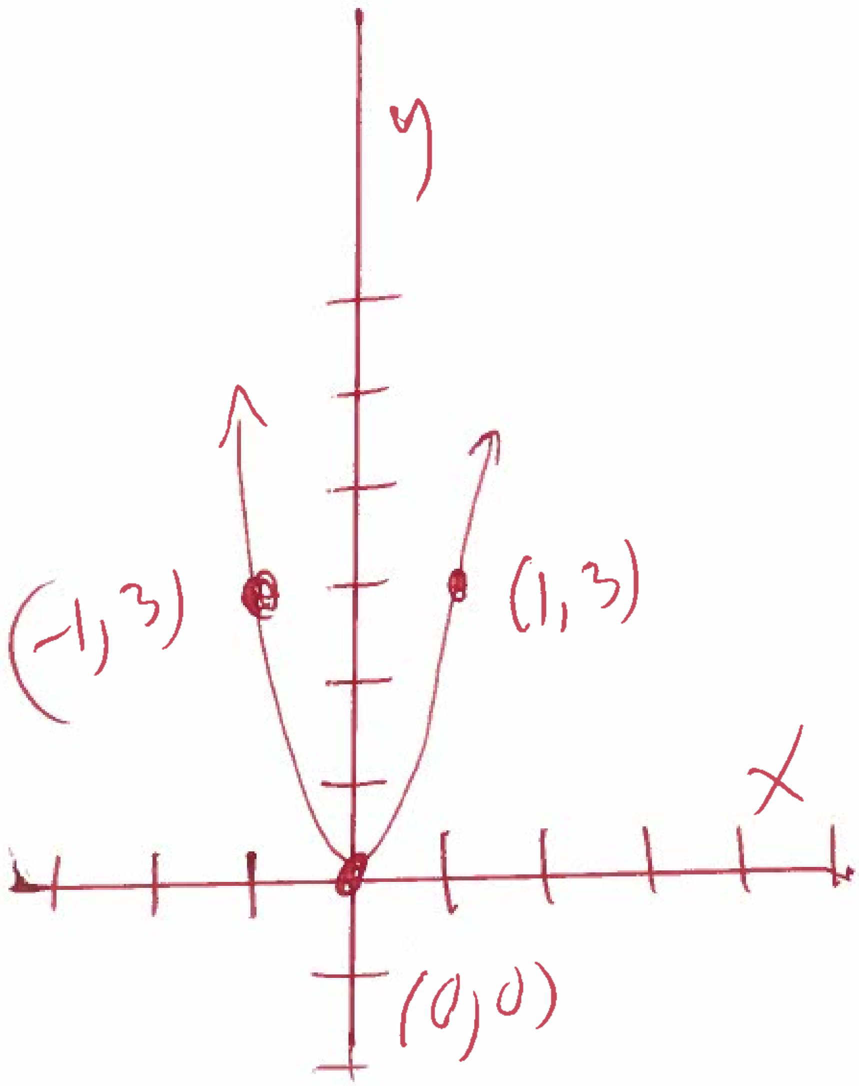
$y = 3(1)(1)$

$y = 3(1)$

$y = 3$

48

x	y
-1	3
0	0
1	3



49 graph

$y = |x-7|$

$y = |6-7|$

$y = |-1|$

$y = 1$

$y = |7-7|$

$y = |0|$

$y = 0$

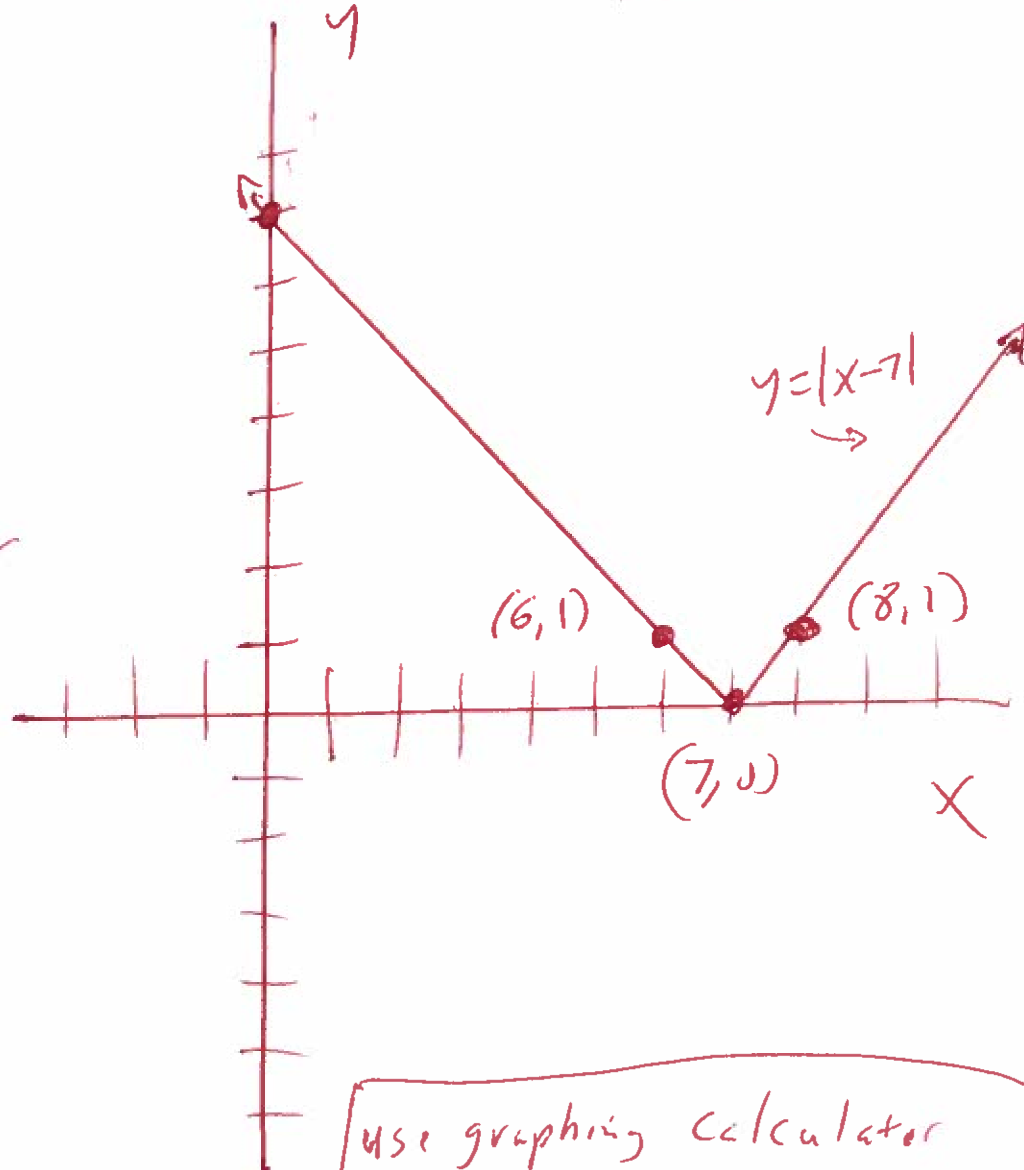
$y = |8-7|$

$y = |1|$

$y = 1$

x	y
6	1
7	0
8	1

49



use graphing calculator

Y_1 = math, num, abs, x-7,

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

51. graph

$h(x) = \sqrt{x+5}$

$h(-5) = \sqrt{-5+5}$

$h(-5) = \sqrt{0}$

$h(-5) = 0$

$h(-4) = \sqrt{-4+5}$

$h(-4) = \sqrt{1}$

$h(-4) = 1$

$h(-1) = \sqrt{-1+5}$

$h(-1) = \sqrt{4}$

$h(-1) = 2$

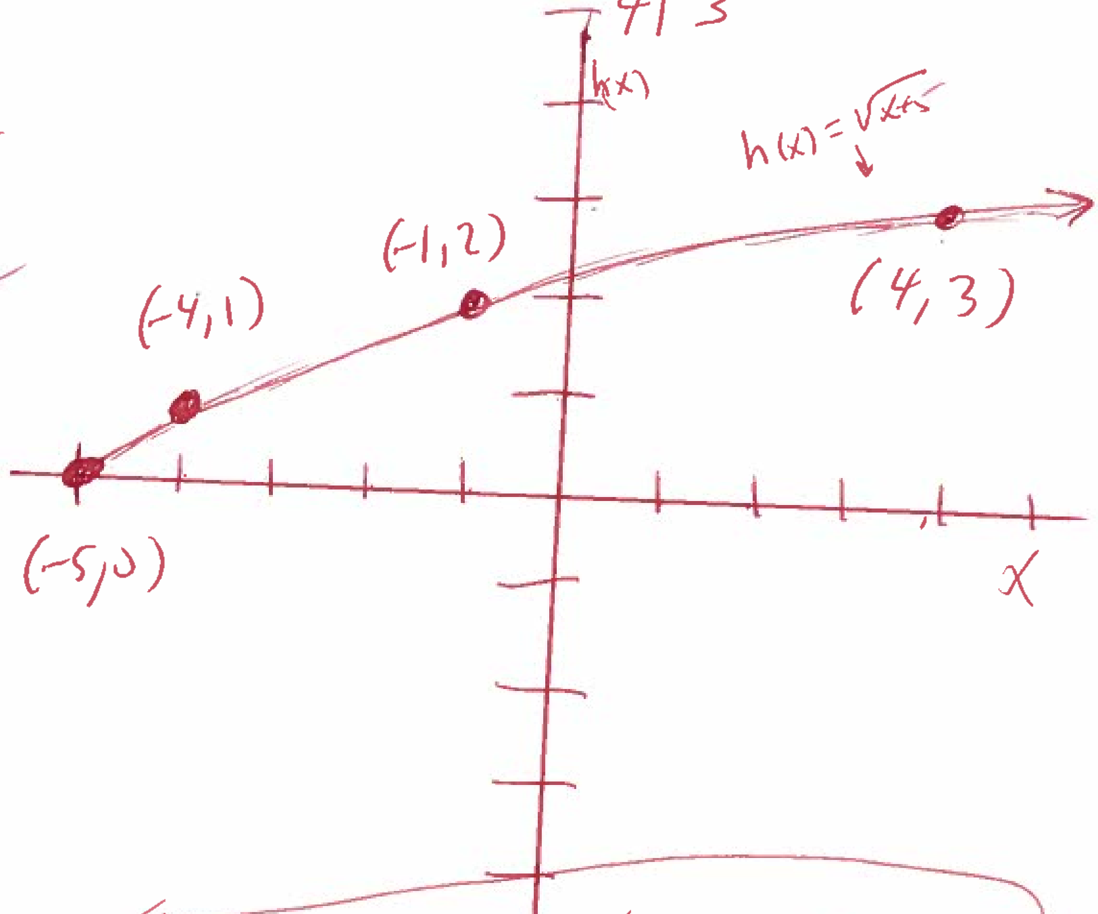
$h(4) = \sqrt{4+5}$

$h(4) = \sqrt{9}$

$h(4) = 3$

51

x	$h(x)$
-5	0
-4	1
-1	2
4	3



use graphing calculator

Y_1 = 2ND, √, (X+5), enter

Xmax = -12
Xmin = 12
X scl = 1
y max = 10
y min = -10
y scl = 1

54

x	-2	-1	0	1	2
y	-5	-1	1	3	6

54

find the equation of the line containing the first and last data points

$(-2, -5)$ and $(2, 6)$

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

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

$$y - (-5) = \frac{(-5) - (6)}{(-2) - (2)}(x - (-2))$$

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

$$y + 5 = \frac{-11}{-4}(x + 2)$$

$$y + 5 = \frac{11}{4}(x + 2)$$

$$y + 5 = \frac{11}{4}x + \frac{22}{4}$$

$$y + 5 = \frac{11}{4}x + \frac{11}{2}$$

$$y + \cancel{5} \cancel{-5} = \frac{11}{4}x + \frac{11}{2} - 5$$

$$y = \frac{11}{4}x + \frac{11}{2} - 5\left(\frac{2}{2}\right)$$

$$y = \frac{11}{4}x + \frac{11}{2} - \frac{10}{2}$$

$$y = \frac{11}{4}x + \frac{11 - 10}{2}$$

$$y = \frac{11}{4}x + \frac{1}{2}$$

use a graphing calculator to find the line of best fit

Stat, Edit, L1, L2, Stat, Calc, LinReg (ax+b), enter

$y = ax + b$

$a = 2.6$

$b = .8$

$$y = 2.6x + .8$$

57 graph

$y = f(x) = (x+5)^2 - 1$

find the x-intercept let $y=0$

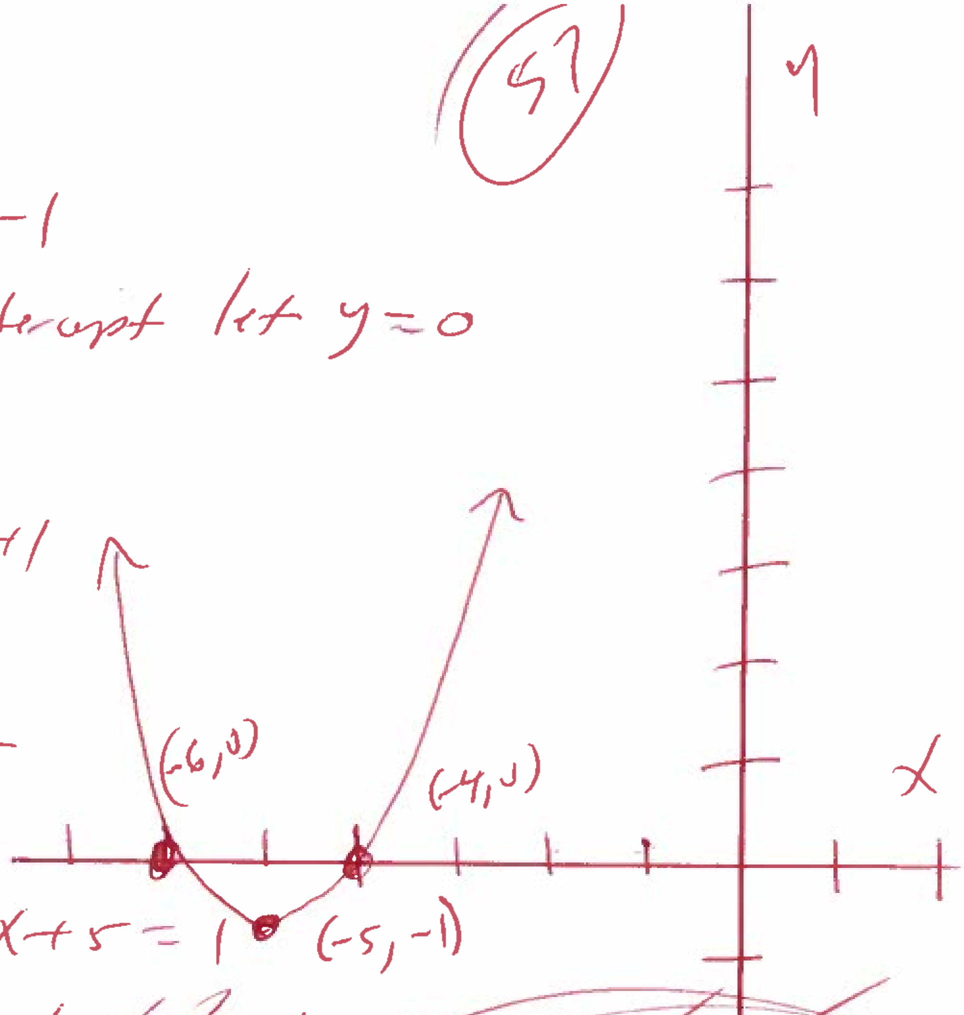
$(x+5)^2 - 1 = 0$

$(x+5)^2 - \cancel{1} + \cancel{1} = 0 + 1$

$(x+5)^2 = 1$

$\sqrt{(x+5)^2} = \pm\sqrt{1}$

$x+5 = \pm 1$



$x+5 = -1$ OR $x+5 = 1$

$x+5-5 = -1-5$ OR $x+\cancel{5}-\cancel{5} = 1-5$

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

$(-6,0), (-4,0)$

find the y-intercept let $x=0$

$y = f(0) = (0+5)^2 - 1$

$f(0) = (5)^2 - 1$

$f(0) = (5)(5) - 1$

$f(0) = 25 - 1$

$f(0) = 24$

$(0, 24)$

use graphing calculator
$y_1 = (x+5)^\wedge 2 - 1$
Xmax = 12
Xmin = -12
Xscl = 1
ymax = 10
ymin = -10
yscl = 1

Vertex $= (-5+5)^2 - 1$

$= (0)^2 - 1$

$= (0)(0) - 1$

$= 0 - 1$

$= -1$

$(-5, -1)$

58. graph

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

set $f(x) = g(x)$

$2x - 3 = x^2 - 6$

$0 = x^2 - 6 - 2x + 3$ rewrite

$0 = x^2 - 2x - 3$

$x^2 - 2x - 3 = 0$ rewrite

$(x+1)(x-3) = 0$

set $x+1 = 0$ OR $x - 3 = 0$

$x+1-1 = 0-1$ OR $x - \cancel{3} + \cancel{3} = 0 + 3$

$x = -1$ Or $x = 3$

$f(x) = 2x - 3$

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

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

$f(-1) = -5$

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

$f(3) = 6 - 3$

$f(3) = 3$

$g(x) = x^2 - 6$

$g(-1) = (-1)^2 - 6$

$g(-1) = (-1)(-1) - 6$

$g(-1) = 1 - 6$

$g(-1) = -5$

$g(0) = (0)^2 - 6$

$g(0) = (0)(0) - 6$

$g(0) = 0 - 6$

$g(0) = -6$

$g(3) = (3)^2 - 6$

$g(3) = (3)(3) - 6$

$g(3) = 9 - 6$

$g(3) = 3$

58

x	$g(x)$
-1	-5
0	-6
3	3

use graphing calcul

$y_1 = 2x - 3$

$y_2 = x^2 - 6$

$x\max = 12$

$x\min = -12$

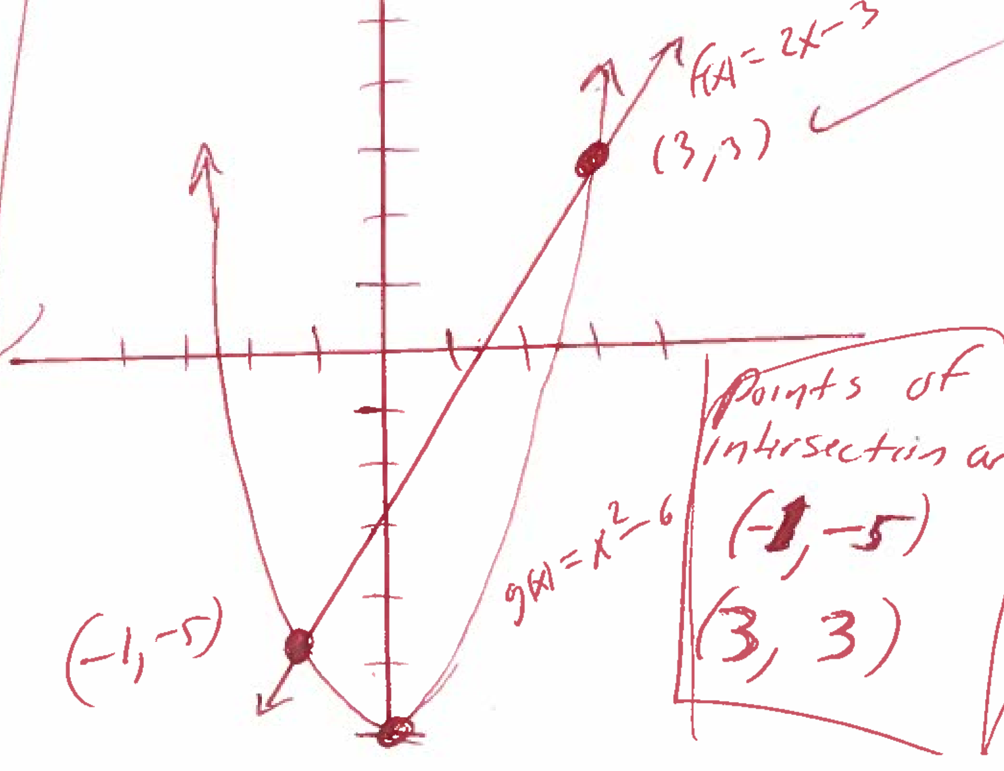
$x\mathrm{scl} = 1$

$y\max = 10$

$y\min = -10$

$y\mathrm{scl} = 1$

x	$f(x)$
-1	-5
3	3



Points of intersection are

$(-1, -5)$

$(3, 3)$

59. find max

59

$f(x) = x(9000 - 2x)$

$f(x) = 9000x - 2x^2$

$f(x) = -2x^2 + 9000x$ rewrite

$a = -2, \quad b = 9000, \quad c = 0$

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

$\text{Vertex} = \left(-\frac{(9000)}{2(-2)}, f\left(-\frac{(9000)}{2(-2)}\right)\right)$

$\text{Vertex} = \left(\frac{-9000}{-4}, f\left(\frac{-9000}{-4}\right)\right)$

$\text{Vertex} = (2250, f(2250))$

use graphing calculator

$\text{Vertex} = \left(2250, \boxed{-2(2250)^2 + 9000(2250)}\right)$

$\text{Vertex} = (2250, 10125000)$

60

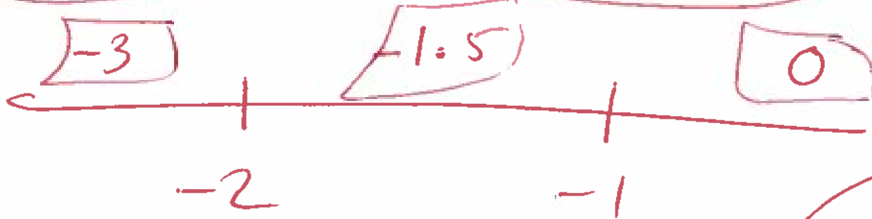
$x^2+3x+2<0$

$(x+1)(x+2)<0$

set $x+1=0$ or $x+2=0$

$x+1-1=0-1$ or $x+\cancel{2}-\cancel{2}=0-2$

$x=-1$ or $x=-2$



Ck

$(x+1)(x+2)<0$

$(-3+1)(-3+2)<0$

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

$2<0$ NO

Ck

$(x+1)(x+2)<0$

$(-1.5+1)(-1.5+2)<0$

$(-.5)(.5)<0$

$-.25<0$ YES

Ck $(x+1)(x+2)<0$

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

$(1)(2)<0$

$2<0$ NO

Possibly 2.1

60

$(-2,-1)$

$-2<x<-1$

61.

$x^2+x\geq 2$

$x^2+x-2\geq 2-2$

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

$(x-1)(x+2)\geq 0$

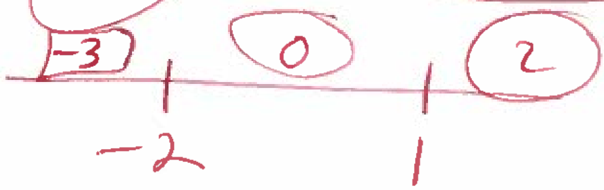
let $x-1=0$ or $x+2=0$

$x-1+1=0+1$ OR $x+\cancel{2}-\cancel{2}=0-2$

$x=1$ or $x=-2$

Possible 1, 2

61



ck $(x-1)(x+2)\geq 0$

$(-3-1)(-3+2)\geq 0$

$(-4)(-1)\geq 0$

$4\geq 0$ yes

$(-\infty,-2]\cup[1,\infty)$

ck $(x-1)(x+2)\geq 0$

$(0-1)(0+2)\geq 0$

$(-1)(2)\geq 0$

$\cancel{-2\geq 0}$ NO

$x\leq -2$ or $x\geq 1$

ck $(x-1)(x+2)\geq 0$

$(2-1)(2+2)\geq 0$

$(1)(4)\geq 0$

$4\geq 0$ yes

62. $G(x) = 3(x-4)^2(x^2+5)$

62

$G(x)$ is a polynomial of degree 4

since $G(x) = 3(x-4)^2(x^2+5)$ $2+2=4$

$G(x) = 3(x-4)^2(x^2+5)$

$G(x) = 3(x-4)(x-4)(x^2+5)$

$G(x) = 3(x^2-4x-4x+16)(x^2+5)$

$G(x) = 3(x^2-8x+16)(x^2+5)$

$G(x) = 3(x^4+5x^2-8x^3-40x+16x^2+80)$

$G(x) = 3(x^4-8x^3+21x^2-40x+80)$

$G(x) = 3x^4-24x^3+63x^2-120x+240$

Standard form

63. graph

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

$f(-3) = (-3+2)^4$

$f(-3) = (-1)^4$

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

$f(-3) = 1$

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

$f(-2) = (0)^4$

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

$f(-2) = 0$

$f(-1) = (-1+2)^4$

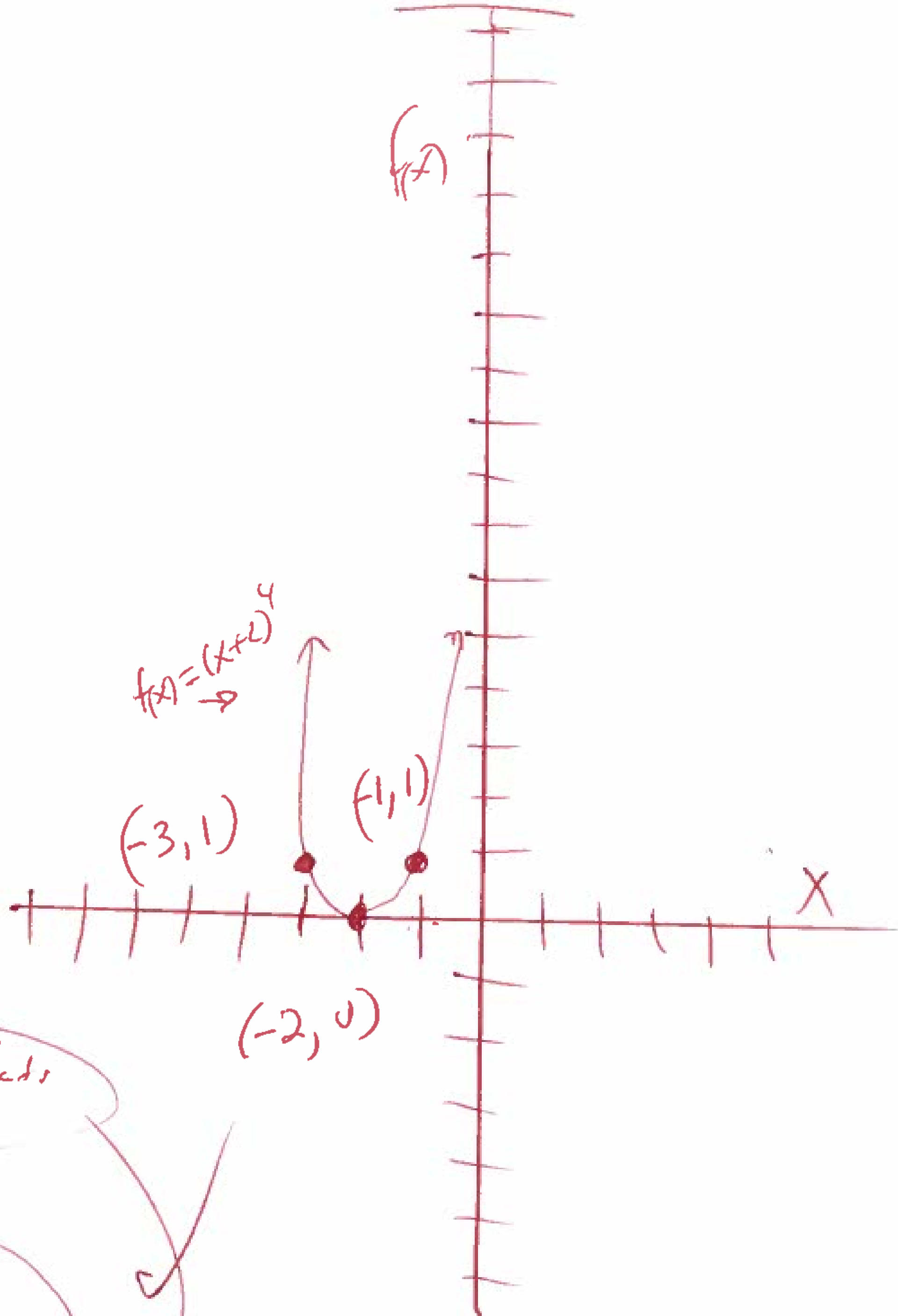
$f(-1) = (1)^4$

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

$f(-1) = 1$

63.

x	$f(x)$
−3	1
−2	0
−1	1



Use graphing calculator

$y_1 = (x+2)^4$

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

64. form a polynomial whose zeros and degree are given

Zeros $-4, 4, 5$ degree 3

64.

$x = -4 \quad x = 4 \quad x = 5$

$x + 4 = -4 + 4 \quad x - 4 = 4 - 4 \quad x - 5 = 5 - 5$

$x + 4 = 0, \quad x - 4 = 0, \quad x - 5 = 0$

$f(x) = (x+4)(x-4)(x-5)$

$f(x) = (x+4)(x^2 - 5x - 4x + 20)$

$f(x) = (x+4)(x^2 - 9x + 20)$

$f(x) = x^3 - 9x^2 + 20x + 4x^2 - 36x + 80$

$f(x) = x^3 - 5x^2 - 16x + 80$

65. form a polynomial whose real zeros and degree are given.

65.

zeros $-2, 0, 3$ degree 3

$x = -2$, $x = 0$, $x = 3$

$x + 2 = -2 + 2$, $x = 0$, $x - 3 = 3 - 3$

$x + 2 = 0$, $x = 0$, $x - 3 = 0$

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

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

$f(x) = x^3 - 3x^2 + 2x^2 - 6x$

$f(x) = x^3 - 1x^2 - 6x$

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

(66) find a polynomial function with the zeros $-2, 1, 3$ whose graph passes through the point $(7, 432)$.

66

$x=-2$, $x=1$, $x=3$

$x+2=-2+2$, $x-1=1-1$, $x-3=3-3$

$x+2=0$, $x-1=0$, $x-3=0$

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

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

$f(x) = (x+2)(x^2-4x+3)$

$f(x) = x^3-4x^2+3x+2x^2-8x+6$

$f(x) = x^3-2x^2-5x+6$

$f(x) = a(x^3-2x^2-5x+6)$

rewrite with a ~~point~~ and $(7, 432)$

$f(7) = a((7)^3-2(7)^2-5(7)+6) = 432$

$f(7) = a(216) = 432$

$\frac{a(216)}{216} = \frac{432}{216}$

$a = 2$

$f(x) = 2(x^3-2x^2-5x+6)$

$f(x) = 2x^3-4x^2-10x+12$

67. $f(x) = -4(x-4)(x+8)^2$

67

$x-4=0$ OR $x+8=0$

$x-4+4=0+4$ OR $x+8-8=0-8$

$x=4$ OR $x=-8$

Zeros are $\{x=4,\ x=-8\}$

$\boxed{4}$ multiplicity 1 crosses graph

$\boxed{-8}$ multiplicity 2 touches graph

The maximum number of turning points on the graph is 2

Type of power function that the graph of f resembles for large value of $|x|$ is

$-4x^3$

Since $f(x) = -4(x-4)^1(x+8)^2$ → add the powers $1+2=3$ power

72 Find the domain

$$H(x) = \frac{-2x^2}{(x-6)(x+1)}$$

Bottom can not be zero denominator

72

$(x-6)(x+1)=0$

$x-6=0$ OR $x+1=0$

$x-6+6=0+6$ OR $x+1-1=0-1$

$x=6$ OR $x=-1$

where function is undefined

$(-\infty,-1) \cup (-1, 6) \cup (6,\infty)$

$\{x \mid x \neq -1 \text{ OR } x \neq 6\}$

74. $R(x) = \dfrac{10x}{x+11}$ find horizontal asymptote

74

set $x+11=0$

$x+11-11=0-11$

$x=-11$ vertical asymptote

$$\lim_{x\to\infty} \frac{10x}{x+11} =$$

$$\lim_{x\to\infty} \left(\frac{10x}{x+11}\right)\frac{\frac{1}{x}}{\frac{1}{x}} =$$ mult

formula

$$\lim_{x\to\infty} \frac{1}{x^n} = 0$$

$$\lim_{x\to\infty}\left(\frac{\frac{10x}{x}}{\frac{x}{x}+\frac{11}{x}}\right) =$$

$$\lim_{x\to\infty}\left(\frac{10}{1+\frac{11}{x}}\right) =$$

$$\frac{10}{1+0} =$$

$$\frac{10}{1} =$$

$10 =$

$y=10$ horizontal asymptote

there are no oblique (since powers are same top / bottom)

75

$$Q(x) = \frac{2x^2-7x-4}{3x^2-11x-4}$$

No oblique since powers are same TOP & Bottom

factor

$$Q(x) = \frac{(2x+1)\cancel{(x-4)}}{(3x+1)\cancel{(x-4)}}$$

$$Q(x) = \frac{2x+1}{3x+1}$$

Hole $x-4=0$

$x-4+4=0+4$

$x=4$

75

Vertical asymptote

set $3x+1=0$

$3x+1-1=0-1$

$3x=-1$

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

$x = -1/3$

Vertical asymptote

horizontal asymptote

formula

$\lim_{x\to\infty} \left(\frac{1}{x^n}\right) = 0$

$\lim_{x\to\infty} \frac{2x+1}{3x+1} =$

mult

$\lim_{x\to\infty} \left(\frac{2x+1}{3x+1}\right) \frac{\frac{1}{x}}{\frac{1}{x}} =$

$\lim_{x\to\infty} \left(\frac{\frac{2\cancel{x}}{\cancel{x}} + \frac{1}{x}}{\frac{3\cancel{x}}{\cancel{x}} + \frac{1}{x}}\right) =$

$\lim_{x\to\infty} \left(\frac{2+\frac{1}{x}}{3+\frac{1}{x}}\right) =$

$\frac{2+0}{3+0} =$

$\frac{2}{3} =$

horizontal asymptote

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

No oblique asymptote since powers are same top/B.

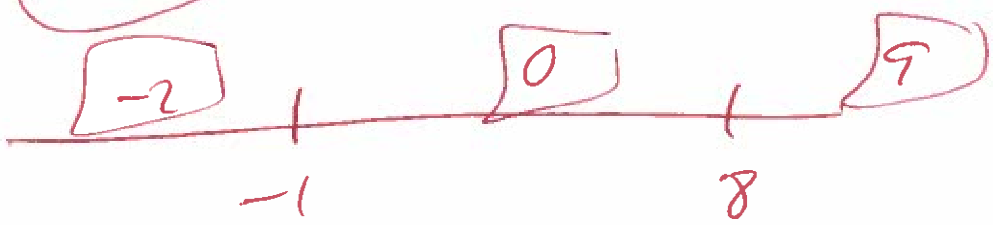
77) $\frac{x+1}{x-8} > 0$

77.

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

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

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



Ck

$\frac{x+1}{x-8} > 0$

$\frac{-2+1}{-2-8} > 0$

$\frac{-1}{-10} > 0$

$\frac{1}{10} > 0$ yes

Ck $\frac{x+1}{x-8} > 0$

$\frac{9+1}{9-8} > 0$

$\frac{10}{1} > 0$

$10 > 0$ yes

Ck $\frac{x+1}{x-8} > 0$

$\frac{0+1}{0-8} > 0$

$\frac{1}{-8} > 0$

NO

$(-\infty,-1) \cup (8,\infty)$

$x < -1$ OR $x > 8$

78

$$\frac{x+10}{x-19} \le 1$$

$$\frac{x+10}{x-19} - 1 \le 1 - 1$$

$$\frac{x+10}{x-19} - 1 \le 0$$

$$\frac{x+10}{x-19} - \frac{x-19}{x-19} \le 0$$

$$\frac{(x+10) - (x-19)}{x-19} \le 0$$

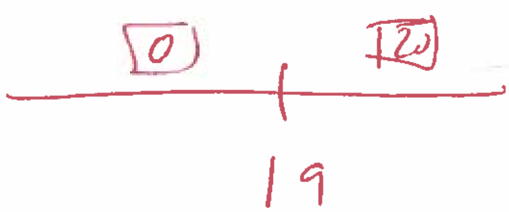
$$\frac{x+10-\cancel{x}+19}{x-19} \le 0$$

$$\frac{29}{x-19} \le 0$$

sc $x - 19 = 0$

$x - 1\cancel{9} + 1\cancel{9} = 0 + 19$

$x = 19$



Ck $\frac{29}{x-19} \le 0$

$\frac{29}{0-19} \le 0$

$\frac{29}{-19} \le 0$ yes

Ck

$\frac{29}{x-19} \le 0$

$\frac{29}{20-19} \le 0$

$\frac{29}{1} \le 0$

$29 \le 0$ NO

78

rewrite 1 as $\frac{x-19}{x-19}$

$(-\infty, 19)$

$x < 19$

81. Use rational zeros theorem to factor and solve

$f(x) = 1x^3 + 6x^2 - 9x - 14$

$\frac{\text{Last}}{\text{first}} =$

$\frac{\pm 14}{1} = \frac{\pm 14}{1}, \frac{\pm 7}{1}, \frac{\pm 2}{1}, \frac{\pm 1}{1}$

$\pm 14, \pm 7, \pm 2, \pm 1$ possible rational roots

$$\begin{array}{r|rrrr} -1 & 1 & 6 & -9 & -14 \\ & & -1 & -5 & 14 \\ \hline & 1 & 5 & -14 & 0 \end{array}$$ rem

use synthetic division

set $x^2 + 5x - 14 = 0$

$(x - 2)(x + 7) = 0$

$x - 2 = 0$ or $x + 7 = 0$

$x - 2 + 2 = 0 + 2$ or $x + 7 - 7 = 0 - 7$

$x = 2$ or $x = -7$

$x = -1, \; x = 2, \; x = -7$

$\{-1, 2, -7\}$

$f(x) = x^3 + 6x^2 - 9x - 14$

$x = -1 \quad x = 2 \quad x = -7$

$x + 1 = 0, \quad x - 2 = 0, \quad x + 7 = 0$

$f(x) = (x+1)(x-2)(x+7)$

21

82. Find bounds on the real zeros of the polynomial function.

82

$f(x) = x^4 - 48x^2 - 49$

$f(x) = (x^2+1)(x^2-49)$

set $x^2+1=0$ OR $x^2-49=0$

$x^2=-1$ OR $x^2=49$

$\sqrt{x^2}=\pm\sqrt{-1}$ OR $\sqrt{x^2}=\pm\sqrt{49}$

$x=\pm i$ OR $x=\pm 7$

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

Lower bound

upper bound

Lower bound

upper bound

83. use the intermediate Value theorem to show that the polynomial function has a zero in the given interval.

83.

$f(x) = 17x^4 - 7x^2 + 9x - 1$ $[-2, 0]$

$f(-2) = 17(-2)^4 - 7(-2)^2 + 9(-2) - 1$

$f(-2) = 17(-2)(-2)(-2)(-2) - 7(-2)(-2) + 9(-2) - 1$

$f(-2) = 17(16) - 7(4) + 9(-2) - 1$

$f(-2) = 272 - 28 - 18 - 1$

$f(-2) = 225$

$f(0) = 17(0)^4 - 7(0)^2 + 9(0) - 1$

$f(0) = 17(0)(0)(0)(0) - 7(0)(0) + 9(0) - 1$

$f(0) = 17(0) - 7(0) + 9(0) - 1$

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

$f(0) = -1$

since
$f(0) = -1 < 0$
and
$f(-2) = 225 > 0$
then use Intermediate Value theorem

f has a zero ~~in the interval~~ $[-2, 0]$

YES

84. $f(x) = \sqrt{x+3}$ and $g(x) = \frac{5}{x}$

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

$f(g(x)) =$

$f\left(\frac{5}{x}\right) =$

$\sqrt{\left(\frac{5}{x}\right) + 3} =$

$\sqrt{\frac{5}{x} + 3} =$

$(f \circ g)(x) = \sqrt{\frac{5}{x} + 3}$

84

85.

x	-3	-2	-1	0	1	2	3
$f(x)$	-8	-5	-2	-1	2	5	8
$g(x)$	6	2	0	-1	0	2	6

a) $(f \circ g)(1) =$

$f(g(1)) =$

$f(0) =$

$-1 =$

b) $(f \circ g)(-1) =$

$f(g(-1)) =$

$f(0) =$

$-1 =$

c) $(g \circ f)(-1) =$

$g(f(-1)) =$

$g(-2) =$

$2 =$

d) $(g \circ f)(0) =$

$g(f(0)) =$

$g(-1) =$

$0 =$

e) $(g \circ g)(-2) =$

$g(g(-2)) =$

$g(2) =$

$2 =$

85

f) $(f \circ f)(-1) =$

$f(f(-1)) =$

$f(-2) =$

$-5 =$

86. $f(x) = 7x$ and $g(x) = 9x^2 + 8$

a) $(f \circ g)(4) =$

$f(g(4)) =$

$f(9(4)^2 + 8) =$

$f(9(4)(4) + 8) =$

$f(9(16) + 8)$

$f(144 + 8) =$

$f(152) =$

$7(152) =$

$1064 =$

b. $(g \circ f)(2) =$

$g(f(2)) =$

$g(7(2)) =$

$g(14) =$

$9(14)^2 + 8 =$

$9(14)(14) + 8 =$

$9(196) + 8 =$

$1764 + 8 =$

$1772 =$

c) $(f \circ f)(1) =$

$f(f(1)) =$

$f(7(1)) =$

$f(7) =$

$7(7) =$

$49 =$

86.

d) $(g \circ g)(0) =$

$g(g(0)) =$

$g(9(0)^2 + 8) =$

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

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

$g(0 + 8) =$

$g(8) =$

$9(8)^2 + 8 =$

$9(8)(8) + 8 =$

$9(64) + 8 =$

$576 + 8 =$

$584 =$

87. $f(x) = 7x - 2$ and $g(x) = \frac{1}{7}(x+2)$

87.

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

$f(g(x)) =$

$f(\frac{1}{7}(x+2)) =$

$\cancel{7}(\frac{1}{\cancel{7}}(x+2)) - 2 =$

$1(x+2) - 2 =$

$x + 2 - 2 =$

$x =$

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

$g(f(x)) =$

$g(7x-2) =$

$\frac{1}{7}((7x-2)+2) =$

$\frac{1}{7}(7x - \cancel{2} + \cancel{2}) =$

$\frac{1}{7}(7x) =$

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

$x =$

Yes

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

find inverse

90. $f(x) = 8x - 4$ find $f^{-1}(x)$

90.

$y = 8x - 4$

switch
$x \to y$
$y \to x$

rewrite

$x = 8y - 4$

$x + 4 = 8y \cancel{-4} \cancel{+4}$

$x + 4 = 8y$

$$\frac{x+4}{8} = \frac{\cancel{8}y}{\cancel{8}}$$

$$\frac{x+4}{8} = y$$

$$f^{-1}(x) = \frac{x+4}{8}$$

inverse

Find Inverse

91. $f(x) = x^3 + 10$ find $f^{-1}(x)$

$y = x^3 + 10$

switch
$x \to y$
$y \to x$

91.

$x = y^3 + 10$ rewrite

$x - 10 = y^3 + \cancel{10} - \cancel{10}$

$x - 10 = y^3$

$\sqrt[3]{x-10} = \sqrt[3]{y^3}$

$\sqrt[3]{x-10} = y$

$f^{-1}(x) = \sqrt[3]{x-10}$

Inverse

92 $f(x) = \frac{1}{x+6}$

find inverse

find $f^{-1}(x)$

92

$y = \frac{1}{x+6}$

$x = \frac{1}{y+6}$ rewrite

switch

$x \rightarrow y$

$y \rightarrow x$

$\frac{x}{1} = \frac{1}{y+6}$

$x(y+6) = 1(1)$

$xy + 6x = 1$

$xy + \cancel{6x} - \cancel{6x} = 1 - 6x$

$xy = 1 - 6x$

$\frac{xy}{x} = \frac{1-6x}{x}$

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

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

INVERSE

93

$$3^{5x+1} = 9$$

$$\cancel{3}^{5x+1} = \cancel{3}^{2}$$

$$5x+1 = 2$$

$$5x+\cancel{1}-\cancel{1} = 2-1$$

$$5x = 1$$

$$\frac{\cancel{5}x}{\cancel{5}} = \frac{1}{5}$$

$$x = \frac{1}{5}$$

rewrite

93

if formula $a^x = a^y$

then $x = y$

94.

$16^{-x+27} = 32^{x}$

$(2^{4})^{-x+27} = (2^{5})^{x}$ rewrite

$2^{-4x+108} = \cancel{2}^{5x}$

$-4x+108 = 5x$

$-4x+\cancel{108}-\cancel{108} = 5x-108$

$-4x = 5x-108$

$-4x-5x = \cancel{5x}-108-\cancel{5x}$

$-9x = -108$

$\frac{-9x}{-9} = \frac{-108}{-9}$

$x = 12$

94.

formula if $a^{x} = a^{y}$ $x = y$

96.

$D(h) = 8e^{-0.22h}$

$D(1) = 8e^{-0.22(1)}$ 2ND LN, on graphing calculator

96

$D(1) = 8e^{\wedge}(-0.22(1))$

$D(1) = 6.4201503841$

use graphing calculator

$D(1) = 6.42$ round

$D(7) = 8e^{-0.22(7)}$ 2ND LN on graphing calculator

$D(7) = 8e^{\wedge}(-0.22(7))$

$D(7) = 1.715048811$

$D(7) = 1.72$ round

97. Change the logarithmic statement to an equivalent statement involving an exponent.

$$\log_8 512 = x$$

97.

$$8^x = 512$$

rewrite

formula

$$\log_b(y) = x$$

then

$$b^x = y$$

98. find the domain

$h(x) = \ln(x+9)$

set $x+9>0$

$x+\cancel{9}-\cancel{9}>0-9$

$x>-9$

-9

$(-9, \infty)$

formula domain

$f(x) = \ln(Ax+B)$

set $Ax+B>0$

98

99

$$5e^{0.5x} = 7$$

$$\frac{\cancel{5}e^{0.5x}}{\cancel{5}} = \frac{7}{5}$$

$$e^{0.5x} = \frac{7}{5}$$

$$\ln\left(e^{0.5x}\right) = \ln\left(\frac{7}{5}\right)$$

$$(0.5x)\ln(e) = \ln\left(\frac{7}{5}\right)$$

$$(0.5x)(1) = \ln\left(\frac{7}{5}\right)$$

$$0.5x = \ln\left(\frac{7}{5}\right)$$

$$\frac{\cancel{0.5}x}{\cancel{0.5}} = \frac{\ln\left(\frac{7}{5}\right)}{0.5}$$

$$x = \frac{\ln\left(\frac{7}{5}\right)}{0.5}$$

$$x = \frac{\ln(1.4)}{0.5}$$

OR

$$x = .6729444732$$

99

formula

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

$$\ln(e) = 1$$

$$\begin{array}{r} 1.4 \\ 5\overline{)7.0} \\ -(5) \\ \hline 20 \\ -20 \\ \hline 0 \end{array}$$

100

$$2\cdot(10^{4-x}) = 13$$

100

$$\frac{2(10^{4-x})}{2} = \frac{13}{2}$$

$$10^{4-x} = \frac{13}{2}$$

$$\log_{10}(10^{4-x}) = \log_{10}\left(\frac{13}{2}\right)$$

$$(4-x)\log_{10}(10) = \log_{10}\left(\frac{13}{2}\right)$$

$$(4-x)(1) = \log_{10}\left(\frac{13}{2}\right)$$

$$4-x = \log_{10}\left(\frac{13}{2}\right)$$

$$\cancel{4}-x-\cancel{4} = \log_{10}\left(\frac{13}{2}\right)-4$$

$$-x = \log_{10}\left(\frac{13}{2}\right)-4$$

$$-1(-x) = -1\left(\log_{10}\left(\frac{13}{2}\right)-4\right)$$

$$x = -\log_{10}\left(\frac{13}{2}\right)+4$$

$$x = 4-\log_{10}\left(\frac{13}{2}\right)$$

$$x = 4-\log\left(\frac{13}{2}\right)$$

OR

$$x = 3.187086643$$

formulas

$\log_{10}(10) = 1$

$\log_{10}(A^N) =$

$N\log_{10}(A) =$

101. Write as a single log

$\log_a(u) - \log_a(v) + 2\log_a(w) =$

101

$\log_a\left(\frac{u}{v}\right) + 2\log_a(w) =$

$\log_a\left(\frac{u}{v}\right) + \log_a(w^2) =$

$\log_a\left(\frac{u}{v}\right)(w^2) =$

$\log_a\left(\frac{uw^2}{v}\right) =$

Formulas

$\log_a(A) - \log_a(B) =$

$\log_a\left(\frac{A}{B}\right)$

$\log_a(A) + \log_a(B) =$

$\log_a(AB) =$

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

102. expand

102.

$$\log\left(\frac{x(x+4)}{(x+5)^3}\right) =$$

$$\log(x(x+4)) - \log(x+5)^3 =$$

$$\log(x) + \log(x+4) - \log(x+5)^3 =$$

$$\log(x) + \log(x+4) - 3\log(x+5) =$$

formulas

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

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

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

103 Solve

$$2\log_2(x-9)+\log_2(2)=3$$

$$\log_2(x-9)^2+\log_2(2)=3$$

$$\log_2(x-9)^2(2)=3$$

103

Formulas

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

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

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

$$2^3=(x-9)^2(2)$$

$$2\cdot2\cdot2=(x-9)^2(2)$$

$$8=(x-9)^2(2)$$

$$\frac{8}{2}=\frac{(x-9)^2\cancel{(2)}}{\cancel{2}}$$

$$4=(x-9)^2$$

$$\pm\sqrt{4}=\sqrt{(x-9)^2}$$

$$\pm2=x-9$$

$x-9=-2$ or $x-9=2$

$x-\cancel{9}+\cancel{9}=2+9$ OR $x-\cancel{9}+\cancel{9}=2+9$

$\cancel{x=7}$ BAD or $x=11$

Ck

$$2\log_2(x-9)+\log_2(2)=3$$

$$2\log_2(7-9)+\log_2(2)=3$$

$$2\log_2(-2)+\log_2(2)=3$$

BAD

Ck

$$2\log_2(x-9)+\log_2(2)=3$$

$$2\log_2(11-9)+\log_2(2)=3$$

$$2\log_2(2)+\log_2(2)=3$$

Good Good

$\{11\}$

104.

$\log(x) + \log(x+3) = 1$

$\log (x)(x+3) = 1$

$\log_{10} (x)(x+3) = 1$

$10^1 = x(x+3)$

$10 = x^2 + 3x$

$10 - 10 = x^2 + 3x - 10$

$0 = x^2 + 3x - 10$

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

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

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

$x = 2$ Good OR ~~$x = -5$~~ BAD

Ck $\log(x) + \log(x+3) = 1$

$\log(2) + \log(2+3) = 1$

$\log(2) + \log(5) = 1$

Good Good

Ck $\log(-5) + \log(-5+3) = 1$

$\log(-5) + \log(-2) = 1$

BAD BAD

104

formulas

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

$\log_{10} y = x$

$10^x = y$

$\{2\}$ ✓

105 $\log(8x+5) = 1 + \log(x-7)$

rewrite 105

$\log(8x+5) - \log(x-7) = 1$

$\log \frac{8x+5}{x-7} = 1$

$\log_{10} \frac{8x+5}{x-7} = 1$

$10^1 = \frac{8x+5}{x-7}$

$\frac{10}{1} = \frac{8x+5}{x-7}$

cross multiply

$10(x-7) = 1(8x+5)$

$10x - 70 = 8x + 5$

$10x - \cancel{70} + \cancel{70} = 8x + 5 + 70$

$10x = 8x + 75$

$10x - 8x = \cancel{8x} + 75 - \cancel{8x}$

$2x = 75$

$\frac{2x}{2} = \frac{75}{2}$

$x = \frac{75}{2}$ or $x = 37.5$

Ck

$\log(8x+5) = 1 + \log(x-7)$

$\log(8(37.5)+5) = 1 + \log(37.5-7)$

$\log(300+5) = 1 + \log(30.5)$

$\log(305) = 1 + \log(30.5)$

Good Good

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

$\left\{\frac{75}{2}\right\}$

106

week	weight grams
0	100.0
1	87.1
2	73.8
3	66.4
4	55.8
5	48.2
6	41.7

106

stat, Edit, L1, L2, stat, calc, ExpReg

$y = ab^x$

$a = 100.3716374$

$b = .8641889443$

if $y = ab^x$ then $y = a e^{(\ln(b))(x)}$ formula

$y = 100.3716374(.8641889443)^x$

OR since $\ln(.8641889443) = -.1459638486$

$y = 100.3716374 e^{-0.1460x}$

rewrite

OR

$y = 100.3716(0.8642)^x$

$y = 100.3716 e^{-0.1460x}$

Round

Round

107

$x+y=8 \longrightarrow y=8-x$

$x-y=6 \longrightarrow -y=6-x \longrightarrow -1(-y)=-1(6-x)$

107

$y=-6+x$

$2x+0=14$

$2x=14$

$\frac{2x}{2}=\frac{14}{2}$

$x=7$

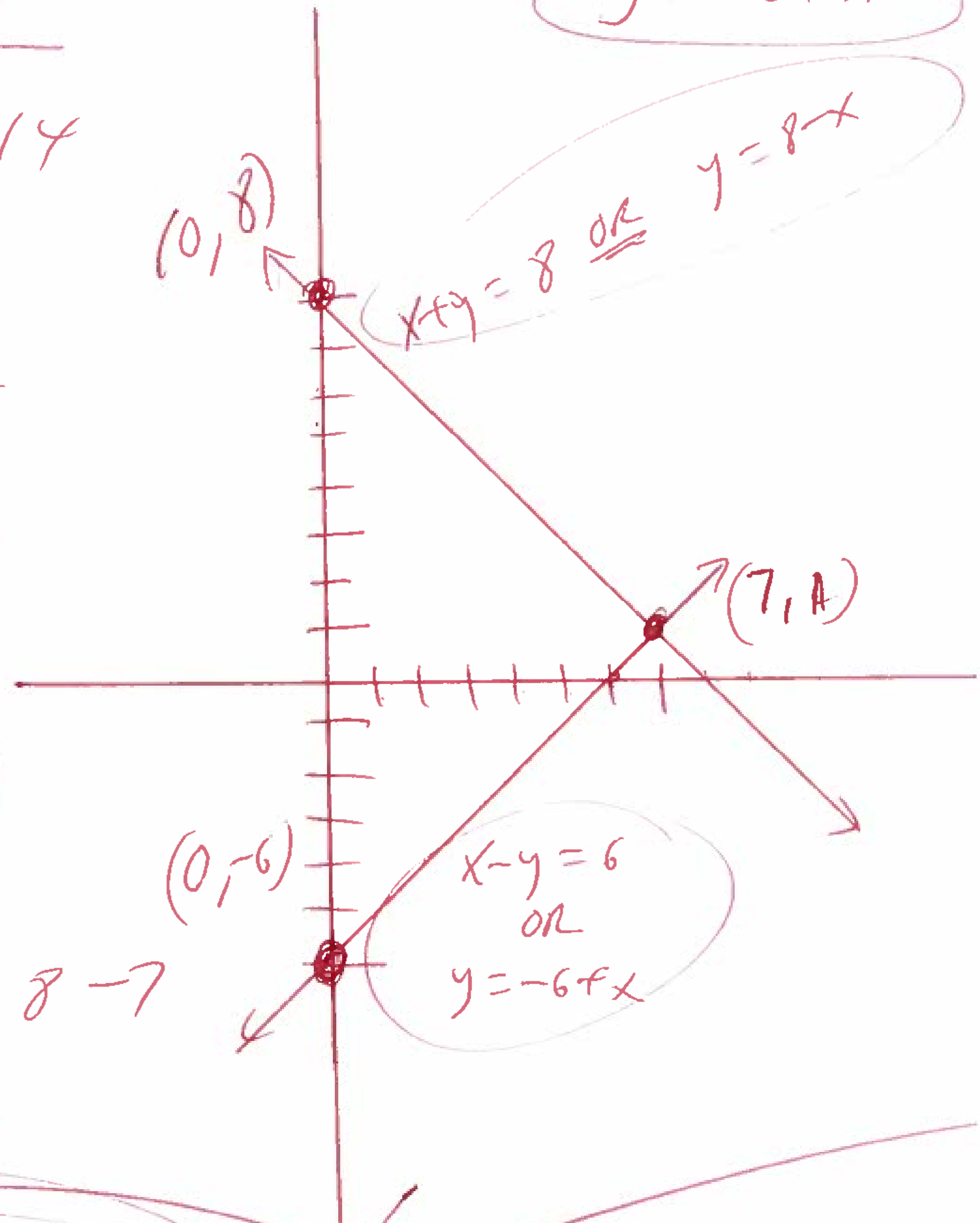
Subs

$x+y=8$

$(7)+y=8$

$\cancel{7}+y-\cancel{7}=8-7$

$y=1$



$(x,y)=(7,1)$

108

$$x+2y=10$$
$$4x+8y=40$$

$$(x+2y=10)(-8)$$
$$(4x+8y=40)(2)$$

$$-8x-16y=-80$$
$$8x+16y=80$$

$$0+0=0$$
$$0=0$$

there are infinitely many solutions

$$\{(x,y) \mid x=-2y+10\}$$

Solve 108

$$x+2y=10$$
$$x+\cancel{2y}-\cancel{2y}=10-2y$$
$$x=10-2y$$
$$x=-2y+10$$

109

$x - y = 2$
$5x \quad - 7z = 20$
$\quad 5y + z = 10$

109

$x - y + 0z = 2$
$5x + 0y - 7z = 20$
$0x + 5y + z = 10$

$$\boxed{A} = \begin{bmatrix} 1 & -1 & 0 & 2 \\ 5 & 0 & -7 & 20 \\ 0 & 5 & 1 & 10 \end{bmatrix}$$

2ND, matrix edit, $\boxed{A}$, 3x4, enter

2ND, matrix, Math, rref

$$rref(\boxed{A}) =$$

$$\begin{bmatrix} 1 & 0 & 0 & 4 \\ 0 & 1 & 0 & 2 \\ 0 & 0 & 1 & 0 \end{bmatrix}$$

$(x, y, z) = (4, 2, 0)$

T10

$$x - y - z = 2$$
$$-x + 2y - 3z = -7$$
$$3x - 2y - 7z = 1$$

10

2ND, matrix, Edit, [A], 3x4, enter

$$[A] = \begin{bmatrix} 1 & -1 & -1 & 2 \\ -1 & 2 & -3 & -7 \\ 3 & -2 & -7 & 1 \end{bmatrix}$$

2ND, matrix, math, rref

$$\text{rref}([A]) = \bcancel{\begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}}$$

$$\begin{bmatrix} 1 & 0 & -5 & -3 \\ 0 & 1 & -4 & -5 \\ 0 & 0 & 0 & 0 \end{bmatrix}$$

$\{(x, y, z) \mid x = 5z - 3,\ y = 4z - 5,\ z \text{ is any real number}\}$

there are infinitely many solutions

111.

$$x + y - z = 6$$
$$3x - 2y + z = 0$$
$$x + 3y - 2z = 12$$

use graphing calculator

2ND, matrix, edit, [A], 3x4,

$$[A] = \begin{bmatrix} 1 & 1 & -1 & 6 \\ 3 & -2 & 1 & 0 \\ 1 & 3 & -2 & 12 \end{bmatrix}$$

2ND, matrix, math, rref( )

2ND matrix

$$rref([A]) = $$

$$\begin{bmatrix} 1 & 0 & 0 & 2 \\ 0 & 1 & 0 & 2 \\ 0 & 0 & 1 & -2 \end{bmatrix}$$

$$(x, y, z) = (2, 2, -2)$$