

Math 1414 Final Exam Review

SHORT ANSWER. Write the word or phrase that best completes each statement or answers the question.

Determine whether the relation represents a function. If it is a function, state the domain and range.

1) $\{(19, -2), (3, -1), (3, 0), (4, 1), (12, 3)\}$

Find the value for the function.

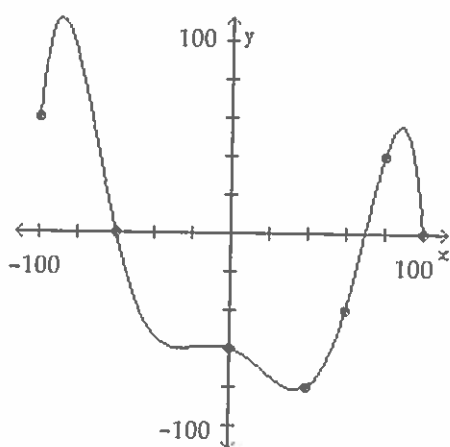
2) Find $f(x - 1)$ when $f(x) = 4x^2 - 4x - 1$.

Find the domain of the function.

3) $\frac{x}{\sqrt{x} - 1}$

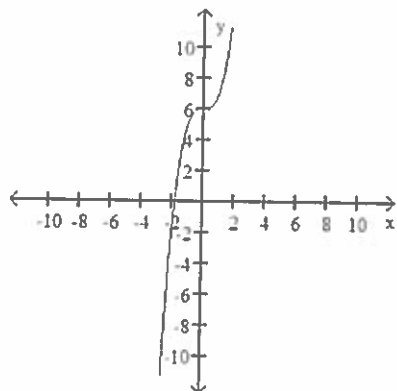
The graph of a function f is given. Use the graph to answer the question.

4) What is the domain of f ?



The graph of a function is given. Decide whether it is even, odd, or neither.

5)

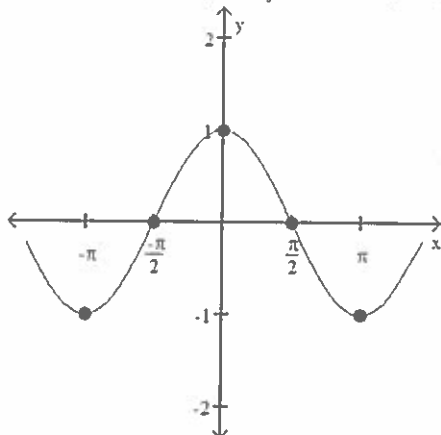


Determine algebraically whether the function is even, odd, or neither.

6) $f(x) = 7x^3 + 3$

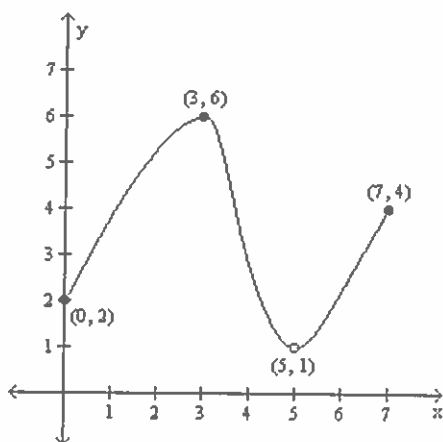
The graph of a function f is given. Use the graph to answer the question.

7) Find the numbers, if any, at which f has a local minimum. What are the local minima?



For the graph of the function $y = f(x)$, find the absolute maximum and the absolute minimum, if it exists.

8)



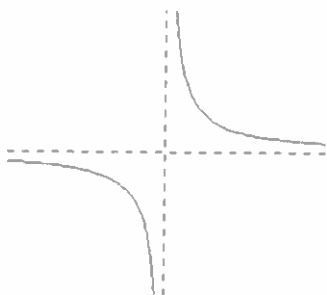
Find the average rate of change for the function between the given values.

9) $f(x) = \sqrt{2x}$; from 2 to 8

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

Match the graph to the function listed whose graph most resembles the one given.

10)



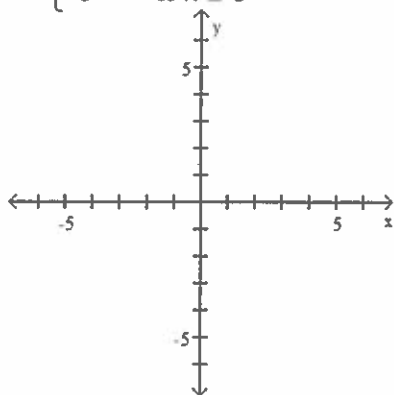
A) absolute value function
C) reciprocal function

B) square root function
D) square function

SHORT ANSWER. Write the word or phrase that best completes each statement or answers the question.

Graph the function.

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



Determine the average rate of change for the function.

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

- 13) To convert a temperature from degrees Celsius to degrees Fahrenheit, you multiply the temperature in degrees Celsius by 1.8 and then add 32 to the result. Express F as a linear function of c .

Use a graphing utility to find the equation of the line of best fit. Round to two decimal places, if necessary.

14)

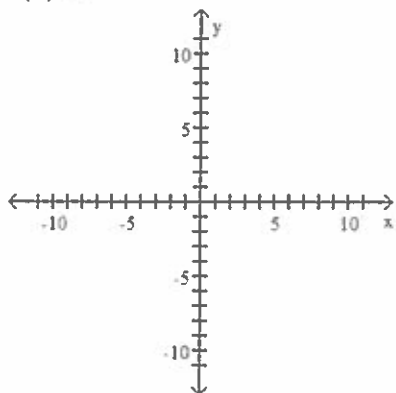
x	2	4	5	6
y	7	11	13	20

Find the vertex and axis of symmetry of the graph of the function.

15) $f(x) = -x^2 + 8x - 8$

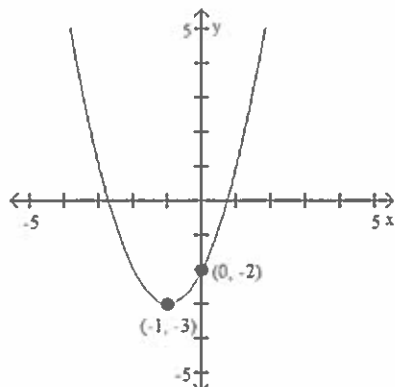
Graph the function using its vertex, axis of symmetry, and intercepts.

16) $f(x) = x^2 + 8x + 7$



Determine the quadratic function whose graph is given.

17)



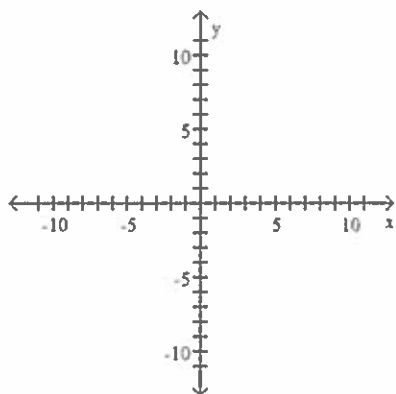
- 18) A developer wants to enclose a rectangular grassy lot that borders a city street for parking. If the developer has 228 feet of fencing and does not fence the side along the street, what is the largest area that can be enclosed?

State whether the function is a polynomial function or not. If it is, give its degree. If it is not, tell why not.

19) $f(x) = 2x + 6x^5$

Use transformations of the graph of $y = x^4$ or $y = x^5$ to graph the function.

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



Form a polynomial whose zeros and degree are given.

21) Zeros: $-1, 1, -3$; degree 3

For the polynomial, list each real zero and its multiplicity. Determine whether the graph crosses or touches the x-axis at each x-intercept.

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

Find the x- and y-intercepts of f.

23) $f(x) = (x + 1)(x - 6)(x - 1)^2$

Find the domain of the rational function.

$$24) f(x) = \frac{x+2}{x^2-64}$$

Find the vertical asymptotes of the rational function.

$$25) g(x) = \frac{x+11}{x^2+36x}$$

Give the equation of the horizontal asymptote, if any, of the function.

$$26) g(x) = \frac{x+8}{x^2-49}$$

Find the indicated intercept(s) of the graph of the function.

$$27) \text{y-intercept of } f(x) = \frac{x-3}{x^2+3x-2}$$

$$28) \text{x-intercepts of } f(x) = \frac{x-6}{x^2+9x-3}$$

Solve the inequality.

$$29) (x+5)(x-1) > 0$$

$$30) \frac{x-8}{x+2} < 1$$

List the potential rational zeros of the polynomial function. Do not find the zeros.

$$31) f(x) = 6x^4 + 2x^3 - 3x^2 + 2$$

Use the Rational Zeros Theorem to find all the real zeros of the polynomial function. Use the zeros to factor f over the real numbers.

$$32) f(x) = 5x^3 - 9x^2 - 6x + 8$$

Solve the equation in the real number system.

$$33) 2x^3 - 13x^2 + 22x - 8 = 0$$

Use the Intermediate Value Theorem to determine whether the polynomial function has a zero in the given interval.

$$34) f(x) = 2x^4 - 6x^2 - 9; [2, 3]$$

Evaluate the expression using the values given in the table.

35) $(g \circ f)(1)$

x	1	7	9	12
f(x)	-2	9	0	12

x	-5	-2	1	3
g(x)	1	-7	7	9

For the given functions f and g , find the requested composite function value.

36) $f(x) = 2x + 4$, $g(x) = 2x^2 + 1$; Find $(g \circ g)(1)$.

Find the domain of the composite function $f \circ g$.

37) $f(x) = x + 6$; $g(x) = \frac{9}{x + 2}$

Indicate whether the function is one-to-one.

38) $\{(4, 5), (-5, -4), (8, -3), (-8, 3)\}$

The function f is one-to-one. Find its inverse.

39) $f(x) = \frac{5}{3x + 7}$

Approximate the value using a calculator. Express answer rounded to three decimal places.

40) $2^{\sqrt{6}}$

Solve the equation.

41) $2^{(3x - 7)} = 4$

Change the exponential expression to an equivalent expression involving a logarithm.

42) $6^x = 216$

Change the logarithmic expression to an equivalent expression involving an exponent.

43) $\log_2 \frac{1}{8} = -3$

Find the domain of the function.

44) $f(x) = \ln(10 - x)$

Solve the equation.

45) $\log_5 x^2 = 4$

Write as the sum and/or difference of logarithms. Express powers as factors.

46) $\log_{14} \frac{11\sqrt{r}}{s}$

Express as a single logarithm.

47) $3 \log_a (2x + 1) - 2 \log_a (2x - 1) + 2$

Solve the equation.

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

49) $3 \cdot 5^{2t-1} = 75$

Find the effective rate of interest.

50) 7.1% compounded continuously

51) The half-life of silicon-32 is 710 years. If 30 grams is present now, how much will be present in 200 years?
(Round your answer to three decimal places.)

Verify that the values of the variables listed are solutions of the system of equations.

52)
$$\begin{cases} x + y = 3 \\ x - y = 5 \end{cases}$$

 $x = -4, y = -1$

Solve the system of equations by elimination.

53)
$$\begin{cases} x + y = -1 \\ x - y = 19 \end{cases}$$

Write the augmented matrix for the system.

54)
$$\begin{cases} 6x + 2z = 6 \\ -2y + 6z = 40 \\ 3x + 2y + 7z = 35 \end{cases}$$

Write the system of equations associated with the augmented matrix. Do not solve.

55)
$$\left[\begin{array}{ccc|c} -3 & 8 & -2 & 5 \\ -6 & 4 & 0 & -7 \\ 5 & 0 & 8 & -5 \end{array} \right]$$

Solve the system of equations using matrices (row operations). If the system has no solution, say that it is inconsistent.

56)
$$\begin{cases} 2x - y + 8z = 60 \\ -2x + 3z = 11 \\ 4y + z = 31 \end{cases}$$

$$57) \begin{cases} x - y + 2z + w = 1 \\ y + z = 2 \\ z - w = 4 \end{cases}$$

Answer Key

Testname: 1414_FINAL_REVIEW

1) not a function

2) $4x^2 - 12x + 7$

3) $\{x \mid x > 1\}$

4) $\{x \mid -100 \leq x \leq 100\}$

5) neither

6) neither

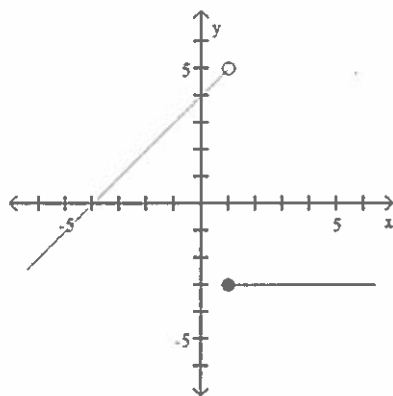
7) f has a local minimum at $x = -\pi$ and π ; the local minimum is -1

8) Absolute maximum: $f(3) = 6$; Absolute minimum: none

9) $\frac{1}{3}$

10) C

11)



12) 2

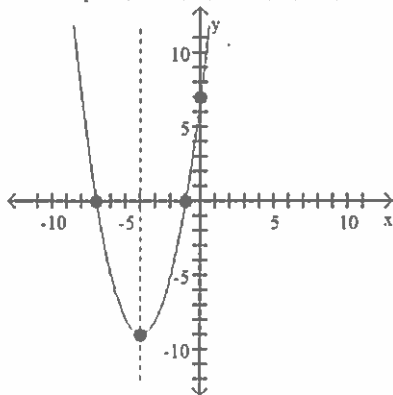
13) $F(c) = 1.8c + 32$

14) $y = 3x$

15) $(4, 8)$; $x = 4$

16) vertex $(-4, -9)$

intercepts $(-1, 0)$, $(-7, 0)$, $(0, 7)$



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

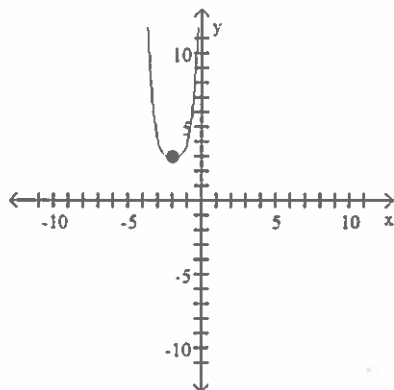
18) 6498 ft^2

19) Yes; degree 5

Answer Key

Testname: 1414_FINAL_REVIEW

20)



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

22) -3, multiplicity 1, crosses x-axis; 1, multiplicity 2, touches x-axis

23) x-intercepts: -1, 1, 6; y-intercept: -6

24) $\{x \mid x \neq -8, x \neq 8\}$

25) $x = 0, x = -36$

26) $y = 0$

27) $\left(0, \frac{3}{2}\right)$

28) (6, 0)

29) $(-\infty, -5)$ or $(1, \infty)$

30) $(-2, \infty)$

31) $\pm \frac{1}{6}, \pm \frac{1}{3}, \pm \frac{1}{2}, \pm \frac{2}{3}, \pm 1, \pm 2$

32) -1, $\frac{4}{5}, 2$; $f(x) = (5x - 4)(x - 2)(x + 1)$

33) $\left\{\frac{1}{2}, 2, 4\right\}$

34) $f(2) = -1$ and $f(3) = 99$; yes

35) -7

36) 19

37) $\{x \mid x \neq -2\}$

38) Yes

39) $f^{-1}(x) = \frac{5 - 7x}{3x}$

40) 5.462

41) {3}

42) $\log_6 216 = x$

43) $2^{-3} = \frac{1}{8}$

44) $(-\infty, 10)$

45) {25, -25}

46) $\log_{14} 11 + \frac{1}{2} \log_{14} r - \log_{14} s$

Answer Key

Testname: 1414_FINAL_REVIEW

47) $\log_a \frac{a^2(2x+1)^3}{(2x-1)^2}$

48) $\{9\}$

49) $\left\{\frac{3}{2}\right\}$

50) 7.358%

51) 24.679

52) not a solution

53) $x = 9, y = -10; (9, -10)$

54) $\left[\begin{array}{ccc|c} 6 & 0 & 2 & 6 \\ 0 & -2 & 6 & 40 \\ 3 & 2 & 7 & 35 \end{array} \right]$

55)

$$\begin{cases} -3x + 8y - 2z = 5 \\ -6x + 4y = -7 \\ 5x + 8z = -5 \end{cases}$$

56) $x = 5, y = 6, z = 7; (5, 6, 7)$

57) $x = -9 - 4w, y = -2 - w, z = 4 + w$, where w is any real number

Determine whether the relation represents a function. If it is a function state the domain and range.

① $\{(19, -2), (3, -1), (3, 0), (4, 1), (12, 3)\}$

①

Not a function since

$$(3, -1) \text{ and } (3, 0)$$

$$\text{Domain} = \{3, 4, 12, 19\}$$

$$\text{Range} = \{-2, -1, 0, 1, 3\}$$

② Find $f(x-1)$

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

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

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

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

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

$$f(x-1) = 4x^2 - 8x + 4 - 4x + 4 - 1$$

$$f(x-1) = 4x^2 - 12x + 7$$

②

3. find the domain

3.

$$\frac{x}{\sqrt{x-1}}$$

let $x-1 \geq 0$ and $x \neq 0$

$$x-1 > 0$$

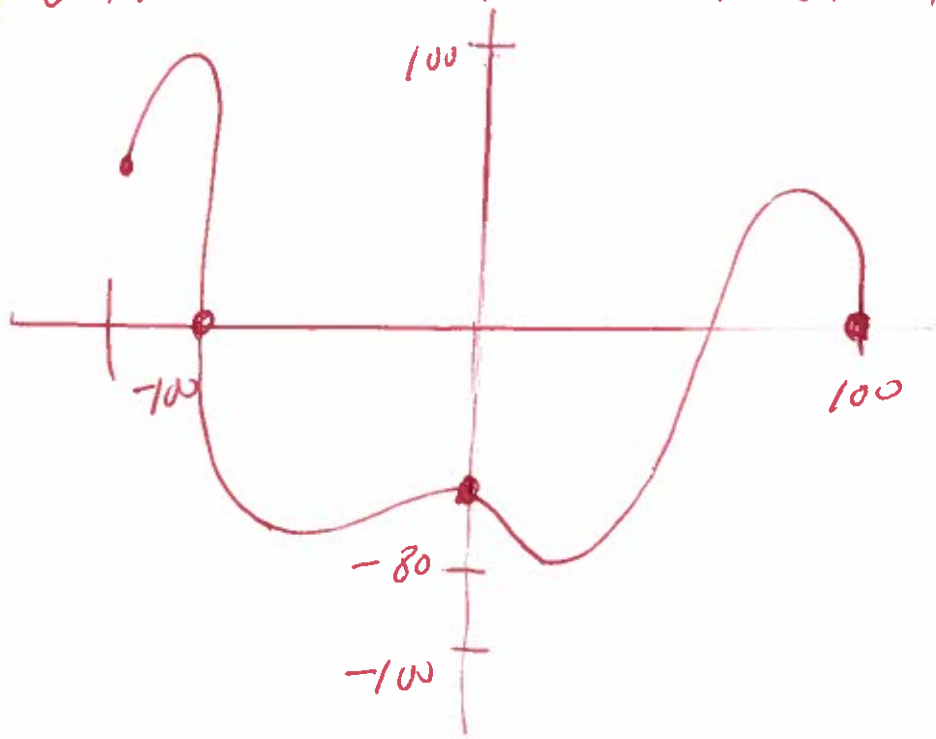
$$x-1+1 > 0+1$$

$$x > 1$$



$$(1, +\infty)$$

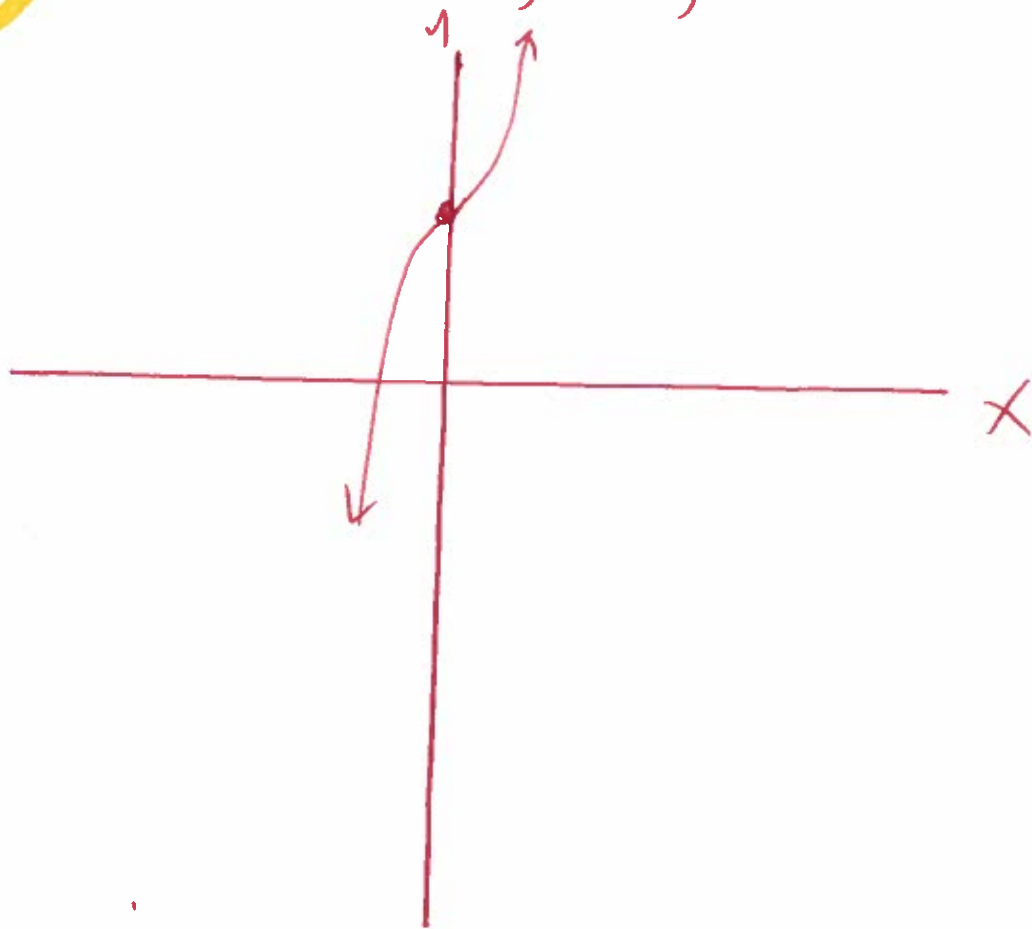
(4) What is the domain of f ?



(4)

Range $\{x \mid -100 \leq x \leq 100\}$

5. Is graph even, odd, or neither.



neither

51

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

6

$$f(x) = 7x^3 + 3$$

$$f(-x) = 7(-x)^3 + 3$$

$$f(-x) = 7(-x)(-x)(-x) + 3$$

$$f(-x) = 7(-x^3) + 3$$

$$f(-x) = -7x^3 + 3$$

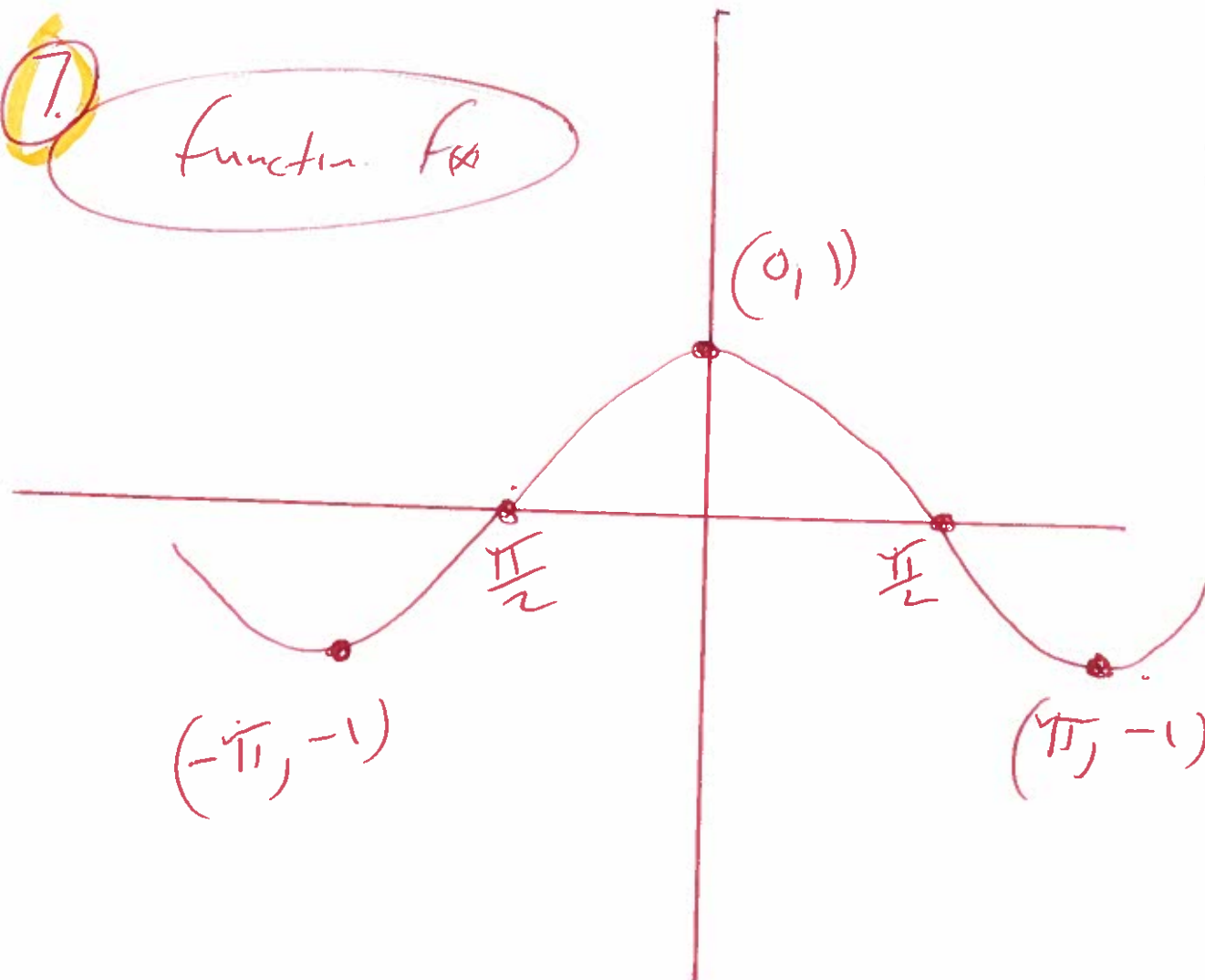
$$f(-x) = -(7x^3 - 3) \neq -f(x)$$

Neither

7.

function $f(x)$

7.



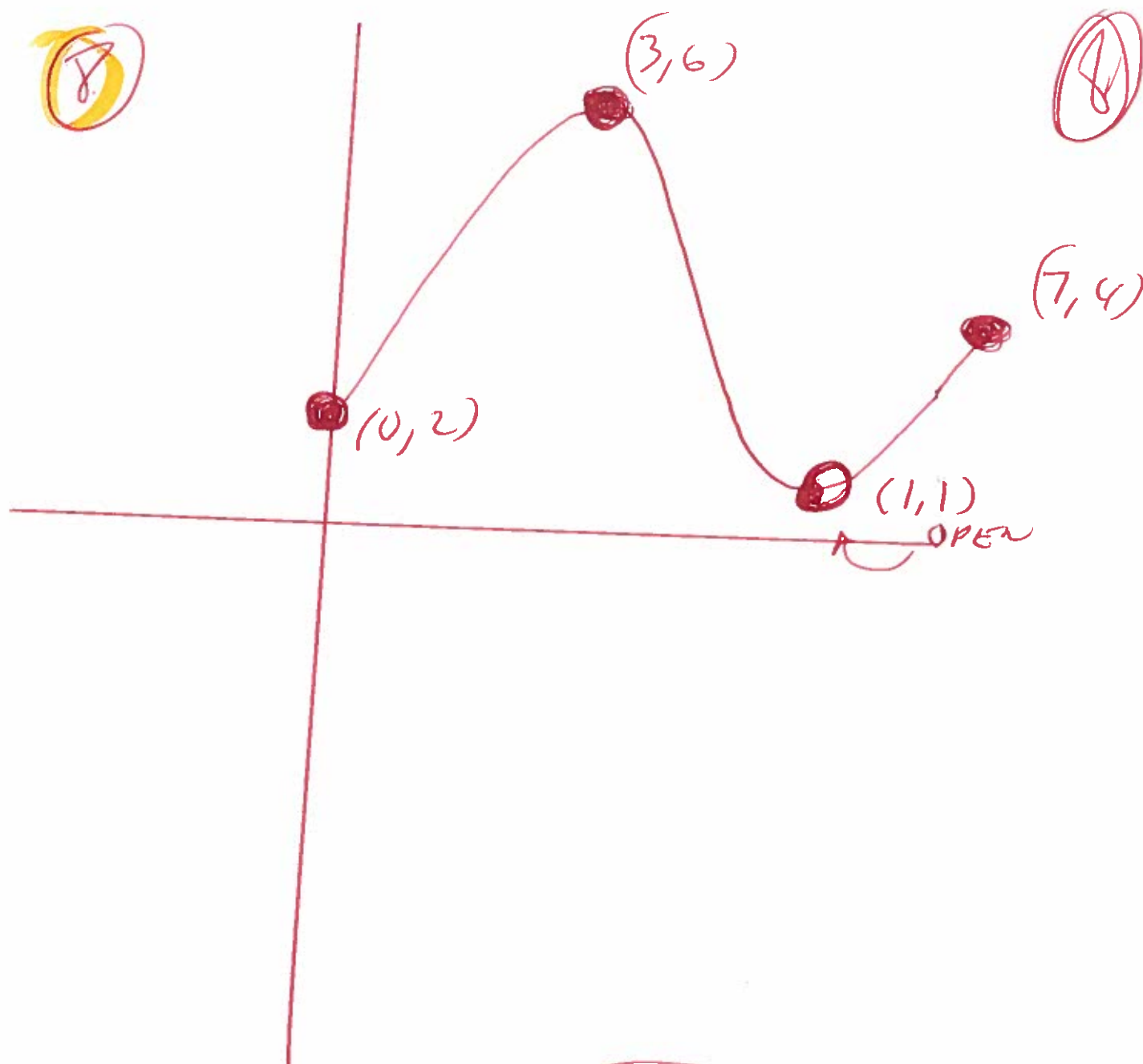
f has a local minimum at $x = -\pi$ and $x = \pi$, the local minimum is -1

✓

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

✓

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



Absolute Maximum $f(3) = 6$

Absolute Minimum None

⑨ Find the average rate of change.

⑨

$$f(x) = \sqrt{2x} \quad \text{from } 2 \text{ to } 8$$

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

$$\frac{f(8) - f(2)}{8 - 2} =$$

$$\frac{\sqrt{2(8)} - \sqrt{2(2)}}{8 - 2} =$$

$$\frac{\sqrt{16} - \sqrt{4}}{8 - 2} =$$

$$\frac{4 - 2}{6} =$$

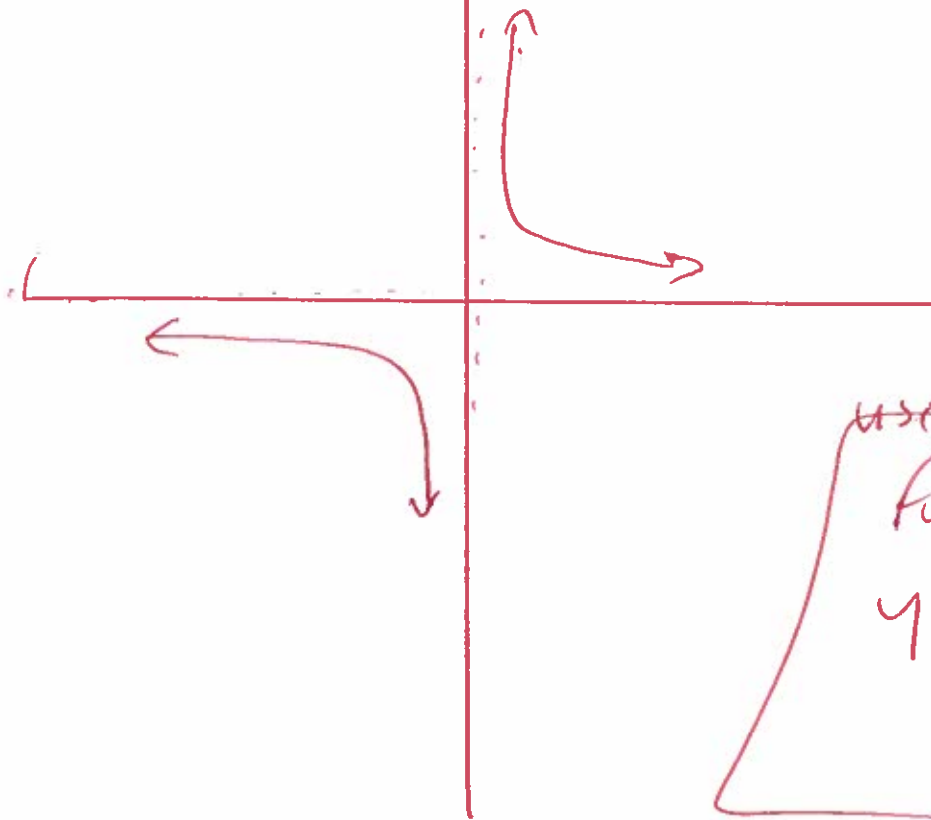
$$\frac{2}{6} =$$

$$\frac{2(1)}{2(3)}$$

$$\frac{1}{3}$$

10.

10



use graphing calculator
for example
 $y_1 = \frac{1}{x}$

(A) absolute value function

(B) square root function

(C) reciprocal function

(D) square function

11

Graph

11

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

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

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

$$f(0) = 4$$

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

$$f(1) = 5$$

$$f(x) = -3$$

$$f(1) = -3$$

$$f(2) = -3$$

x	$f(x)$
0	4
1	5

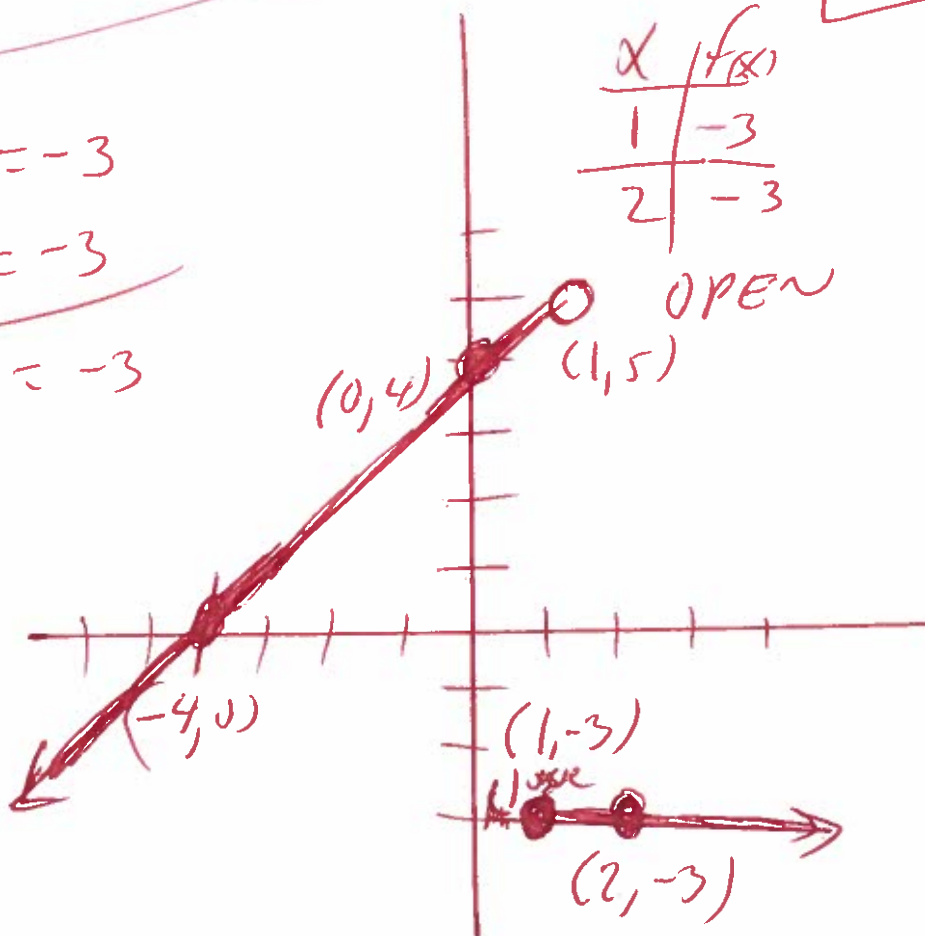
OPEN

Graphs of $f(x)$

$$y_1 = x+4 \quad (x < 1)$$
$$y_2 = -3 \quad (x \geq 1)$$

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

OPEN



12. find the average rate of change 14

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

from $x=a$ to $x=a+1$

$$\frac{f(B_{13}) - f(L_{1H4})}{B_{13} - L_{1H4}} =$$

any two different numbers

$$\frac{f(a+1) - f(a)}{(a+1) - (a)} =$$

$$\frac{(2(a+1) - 5) - (2(a) - 5)}{a+1 - a} =$$

$$\frac{\cancel{2a} + 2 - \cancel{5} - \cancel{2a} + \cancel{5}}{1} =$$

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

$$2 =$$

13. To convert a temperature from degree Celsius to degree Fahrenheit, you multiply the temperature in degree Celsius by 1.8 and then add 32 to the result. Express F as a linear function of C .

$$y = mx + b$$

$$y = 1.8C + 32$$

$$f(C) = 1.8C + 32$$

14. Use a graphing calculator to find the equation of the line of best fit. 14.

X	2	4	5	6
y	7	11	13	20

STAT, Edit L1, L2, STAT, CALC

Lin Reg (ax+b), enter, enter

$$\begin{array}{l} \text{Lin Reg} \\ y = ax + b \\ a = 3 \\ b = 0 \end{array}$$

$$y = 3x + 0$$

$$y = 3x$$

15. Find the vertex and axis of symmetry.

$$f(x) = -x^2 + 8x - 8$$

$$a = -1, \quad b = 8, \quad c = -8$$

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

$$\text{Vertex} = \left(-\frac{(8)}{2(-1)}, f\left(\frac{(8)}{2(-1)}\right)\right)$$

$$\text{Vertex} = \left(\frac{-8}{-2}, f\left(\frac{-8}{-2}\right)\right)$$

$$\text{Vertex} = (4, f(4))$$

$$\text{Vertex} = (4, -(4)^2 + 8(4) - 8)$$

$$\text{Vertex} = (4, -(4)(4) + 8(4) - 8)$$

$$\text{Vertex} = (4, -16 + 32 - 8)$$

$$\text{Vertex} = (4, 16 - 8)$$

$$\text{Vertex} = (4, 8)$$

axis of symmetry

$$x = 4$$

15.

16. Graph the function using its vertex, axis of symmetry and intercepts

$y = f(x) = x^2 + 8x + 7$ find x-intercept let $y = 0$

14

$$0 = x^2 + 8x + 7$$

$$0 = (x+1)(x+7)$$

$$x+1=0 \quad \text{OR} \quad x+7=0$$

$$x+1=0 \Rightarrow -1 \quad \text{OR} \quad x+7=0 \Rightarrow -7 \quad (-1, 0) \quad (-7, 0)$$

$$x = -1 \quad \text{OR} \quad x = -7$$

$y = f(x) = x^2 + 8x + 7$ find y-intercept let $x = 0$

$$y = f(0) = (0)^2 + 8(0) + 7$$

$$y = f(0) = (0)(0) + 8(0) + 7$$

$$y = f(0) = 0 + 0 + 7$$

$$y = f(0) = 7$$

$$(0, 7)$$

use graphing calculator
 $y_1 = x^2 + 8x + 7$

$$f(x) = x^2 + 8x + 7$$

$$a=1 \quad b=8, \quad c=7$$

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

$$\text{Vertex} = \left(-\frac{(8)}{2(1)}, f\left(\frac{(8)}{2(1)}\right) \right)$$

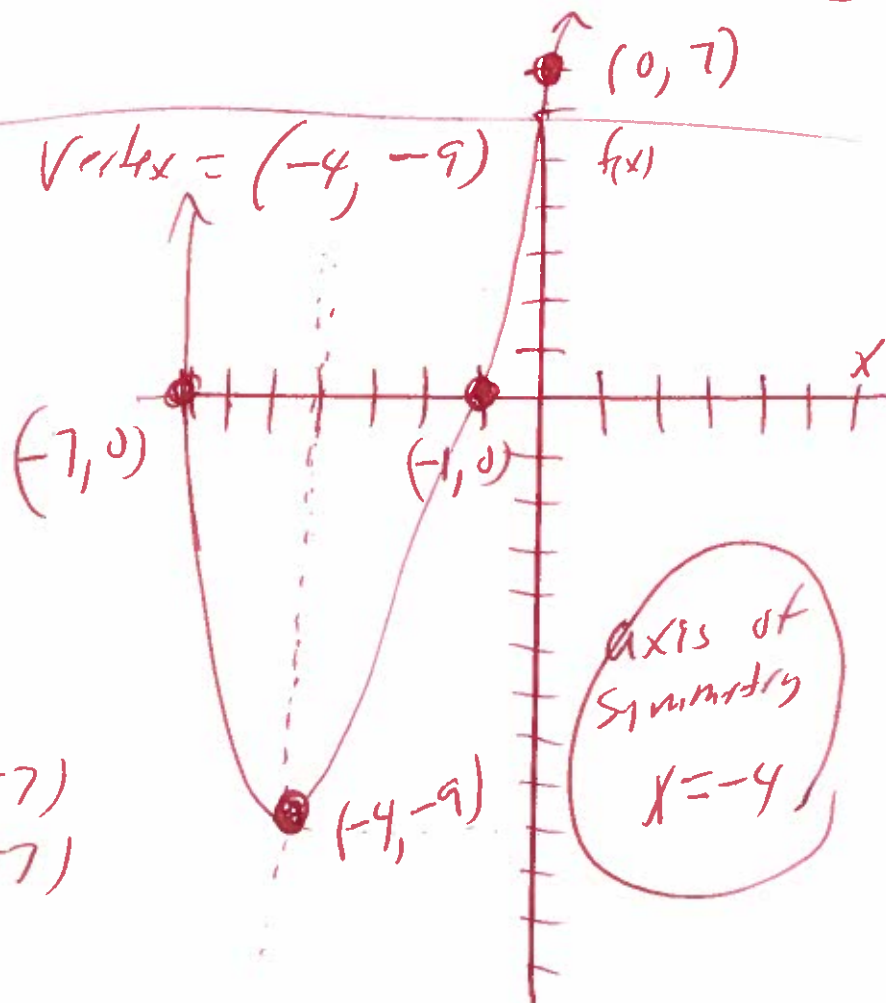
$$\text{Vertex} = \left(-\frac{8}{2}, f\left(-\frac{8}{2}\right) \right)$$

$$\text{Vertex} = (-4, f(-4))$$

$$\text{Vertex} = (-4, (-4)^2 + 8(-4) + 7)$$

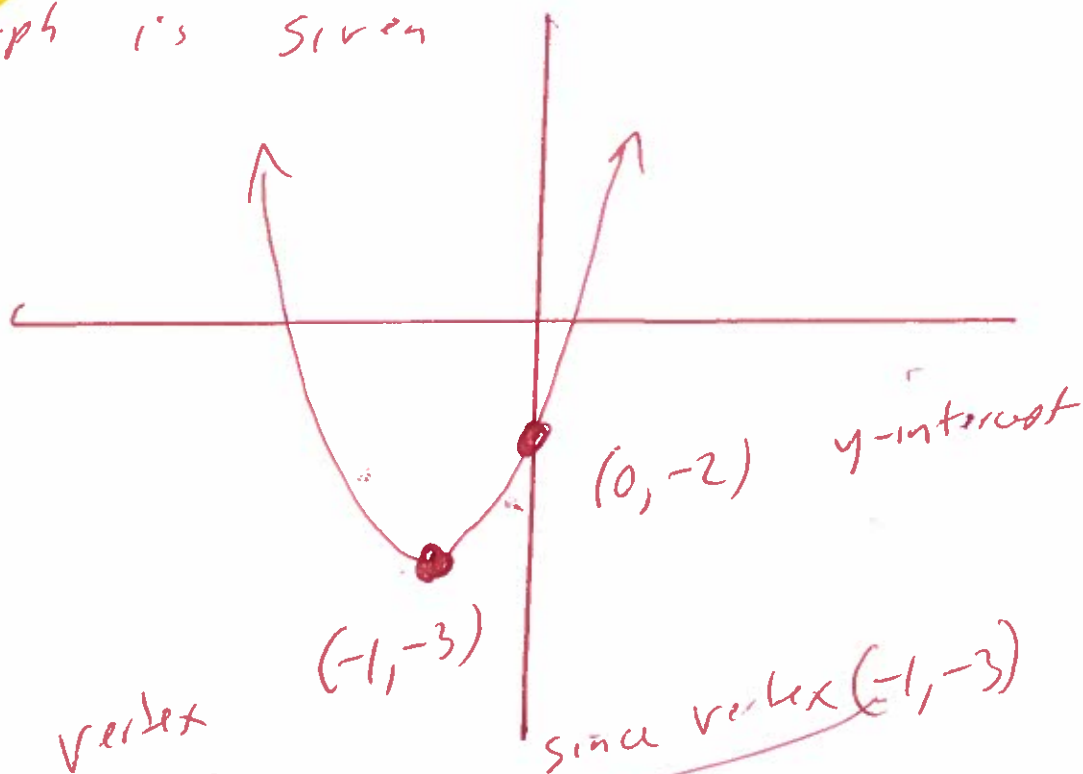
$$\text{Vertex} = (-4, (-4)(-4) + 8(-4) + 7)$$

$$\text{Vertex} = (-4, 16 - 32 + 7)$$



17) Determine the Quadratic function whose graph is given

17



Vertex

since vertex $(-1, -3)$

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

$$f(x) = y = a(x+1)^2 + c$$

since $(-1, -3)$

$$f(-1) = a(-1+1)^2 + c = -3$$

$$a(0)^2 + c = -3$$

$$a(0)(0) + c = -3$$

$$a(0) + c = -3$$

$$0 + c = -3$$

$$c = -3$$

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

$$f(0) = y = a(0+1)^2 - 3 = -2$$

$$a(1)^2 - 3 = -2$$

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

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

$$a - 3 = -2$$

$$a - 3 + 3 = -2 + 3$$

$$a = 1$$

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

OR

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

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

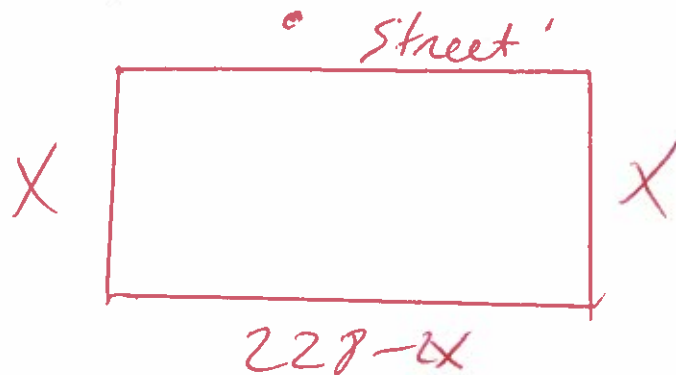
$$y = 1(x^2 + 2x + 1) - 3$$

$$y = x^2 + 2x + 1 - 3$$

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

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

(18) A developer wants to enclose a rectangular grassy lot that borders a city street for parking. If the developer has 228 feet of fencing and does not fence the side along the street, what is the largest area that can be enclosed?



$$f(x) = x(228 - x)$$

$$f(x) = 228x - 2x^2$$

$$f(x) = -2x^2 + 228x \text{ rewrite}$$

$$a = -2, \quad b = 228, \quad c = 0$$

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

$$\text{Vertex} = \left(-\frac{(228)}{2(-2)}, f\left(-\frac{(228)}{2(-2)}\right)\right)$$

$$\text{Vertex} = \left(-\frac{228}{-4}, f\left(-\frac{228}{-4}\right)\right)$$

$$\text{Vertex} = (57, f(57))$$

$$\text{Vertex} = (57, -2(57)^2 + 228(57))$$

$$\text{Vertex} = (57, -2(57)(57) + 228(57))$$

$$\text{Vertex} = (57, -2(3249) + 228(57))$$

$$\text{Vertex} = (57, -6498 + 12996)$$

$$\text{Vertex} = (57, 6498)$$

Max

$$\text{Max} = 6498 \text{ ft}^2$$

19. State whether the function is a polynomial function or not. If it is give its degree. If it is not, tell why not.

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

19.

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

Yes it is a polynomial of the degree 5.

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

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

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

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

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

$$f(-3) = 4$$

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

$$f(-2) = (0)^4 + 3$$

$$f(-2) = (0)(0)(0)(0) + 3$$

$$f(-2) = 0 + 3$$

$$f(-2) = 3$$

$$f(-1) = (-1+2)^4 + 3$$

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

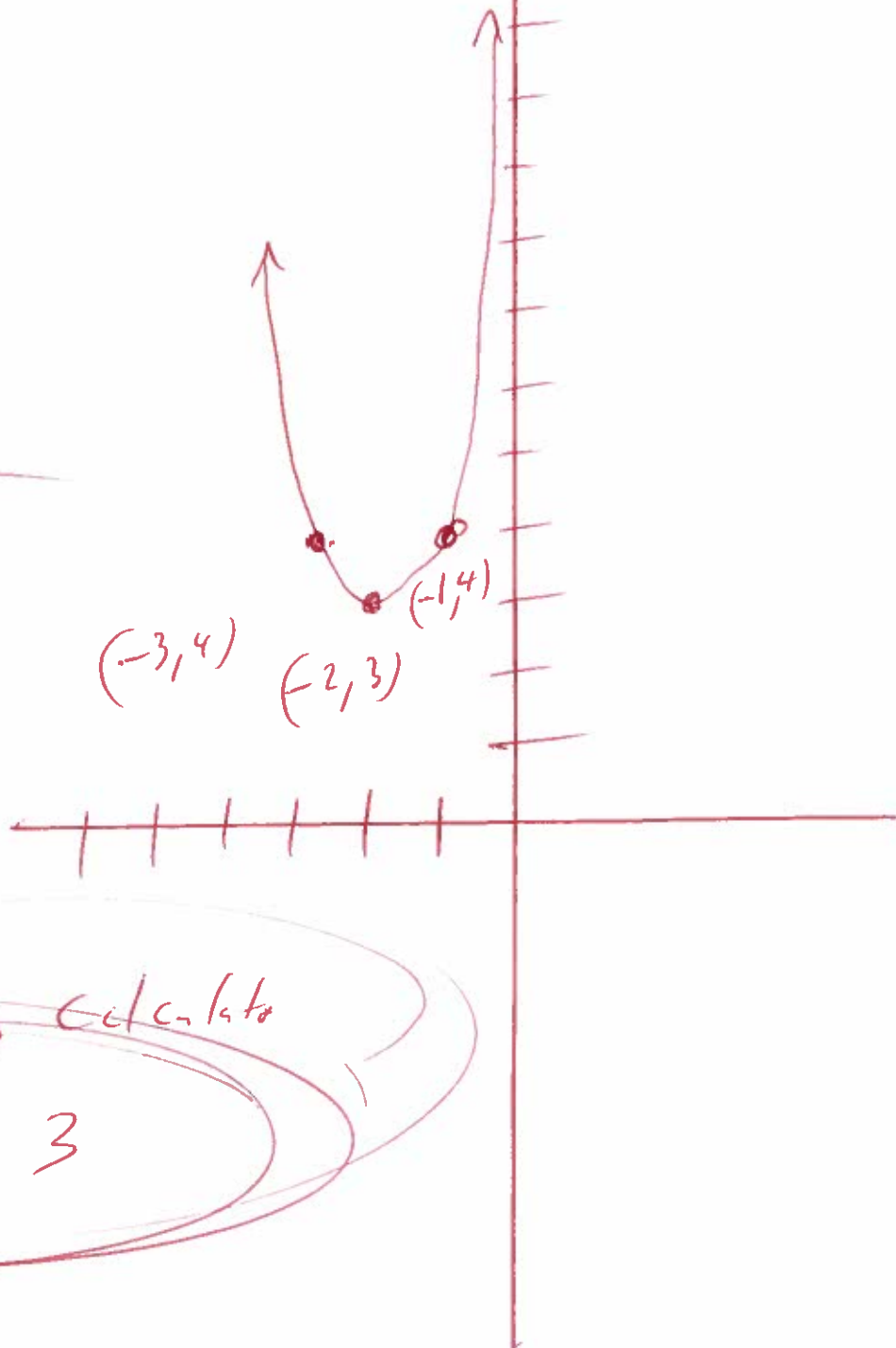
$$f(-1) = (1)(1)(1)(1) + 3$$

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

$$f(-1) = 4$$

x	f(x)
-3	4
-2	3
-1	4

20



or use graphing calculator

$$y_1 = (x+2)^4 + 3$$

(21) form a polynomial whose zeros of degree are given.

Zeros $-1, 1, -3$, degree 3

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

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

$$(x+1)(x-1)(x+3) = 0 \quad \text{Mult}$$

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

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

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

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

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

$$f(x) = a(x+1)(x-1)(x+3) \quad \text{Let } a=1$$

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

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

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

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

(22) for the polynomial, list each real zero and its multiplicity. Determine whether the graph crosses or touches the x-axis at each x-intercept. (22)

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

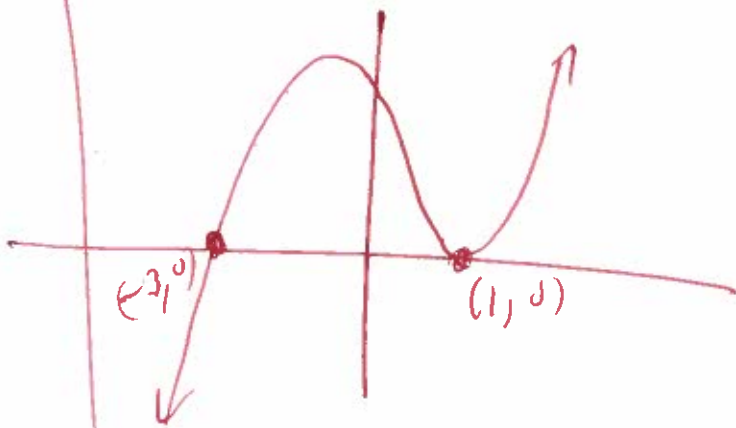
$$f(x) = 3(x+3)(x-1)(x-1)$$

-3, multiplicity 1, crosses x-axis.

1, multiplicity 2, touches x-axis.

OR use graphing calculator

$$y_1 = 3(x+3)(x-1)^2$$



$x_{min} = -4$
 $x_{max} = 4$
 $x_{scl} = 1$
 $y_{min} = -30$
 $y_{max} = 30$
 $y_{scl} = 1$

23

Find x and y -intercepts of f .

$$y = f(x) = (x+1)(x-6)(x-1)^2$$

23

find x -intercept let $y=0$

$$0 = (x+1)(x-6)(x-1)^2$$

$$x+1=0$$

$$x-6=0$$

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

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

$$x-6+6=0+6$$

$$\sqrt{(x-1)^2} = \sqrt{0}$$

$$x = -1$$

$$x = 6$$

$$x-1=0$$

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

$$x = 1$$

x -intercepts

$$(-1, 0) (6, 0) (1, 0)$$

find y -intercept let $x=0$

$$y = f(x) = (x+1)(x-6)(x-1)^2$$

$$f(0) = (0+1)(0-6)(0-1)^2$$

$$f(0) = (1)(-6)(-1)^2$$

$$f(0) = (1)(-6)(-1)(-1)$$

$$f(0) = -6(-1)(-1)$$

$$f(0) = 6(-1)$$

$$f(0) = -6$$

$$(0, -6)$$

y -intercept

(24) find the domain of the rational function

$$f(x) = \frac{x+2}{x^2-64}$$

formula

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

$$\text{Let } x^2 - 64 = 0$$

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

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

$$\begin{array}{lll} \text{Let } x+8=0 & \text{OR} & x-8=0 \\ x+8-8=0-8 & \text{OR} & x-8+8=0+8 \\ x=-8 & \text{OR} & x=8 \end{array}$$

domain

$$\{x \mid x \neq -8 \quad \underline{\text{OR}} \quad x \neq 8\}$$

(25.) find the vertical asymptote of the rational function. (25)

$$g(x) = \frac{x+11}{x^2+36x}$$

$$\text{Let } x^2+36x=0$$

$$x(x+36)=0$$

$$1 \quad x=0$$

$$\text{OR } x+36=0$$

$$\text{OR } x+36-36=0-36$$

$$x=-36$$

26 Give the equation of the horizontal asymptote, if any, of the function. (26)

$$g(x) = \frac{x+8}{x^2-49}$$

$$\lim_{x \rightarrow \infty} \frac{x+8}{x^2-49}$$

$$\lim_{x \rightarrow \infty} \left(\frac{x+8}{x^2-49} \right) \left(\frac{\frac{1}{x^2}}{\frac{1}{x^2}} \right) \text{ mult}$$

$$\lim_{x \rightarrow \infty} \left(\frac{\frac{x}{x^2} + \frac{8}{x^2}}{\frac{x^2}{x^2} - \frac{49}{x^2}} \right)$$

$$\lim_{x \rightarrow \infty} \left(\frac{\frac{1}{x} + \frac{8}{x^2}}{1 - \frac{49}{x^2}} \right)$$

5

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

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

$$0 =$$

horizontal asymptote

$$y = 0$$

27

find the y-intercept

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

find y-intercept let $x=0$

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

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

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

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

$$f(0) = \frac{3}{2}$$

$$(0, \frac{3}{2})$$

✓

y-intercept

27

28. find x-intercept

$$y = f(x) = \frac{x-6}{x^2+9x-3}$$

x-intercept let $y = 0$

$$\frac{0}{1} = \frac{x-6}{x^2+9x-3}$$

$$0(x^2+9x-3) = 1(x-6) \quad \text{cross mult}$$

$$0 = x-6$$

$$0 + 6 = x - 6 + 6$$

$$6 = x$$

$$(6, 0)$$

x intercept

28.

29

$$(x+5)(x-1) > 0$$

$$\text{Let } x+5=0$$

$$x-1=0$$

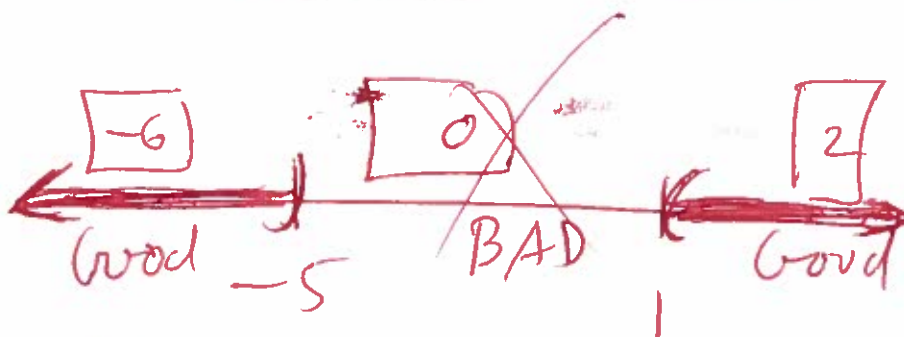
$$x+5-5=0-5$$

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

$$x = -5$$

$$x = 1$$

29



Check

$$(x+5)(x-1) > 0 \quad ?$$

$$(-6+5)(-6-1) > 0 \quad ?$$

$$(-1)(-7) > 0 \quad ?$$

$7 > 0$ yes

$$\text{ck } (0+5)(0-1) > 0$$

$$(5)/(-1) > 0$$

$$-5 > 0 \text{ No}$$

ck

$$(2+5)(2-1) > 0$$

$$(7)/(1) > 0$$

$7 > 0$ yes

ANSWER

$$(-\infty, -5) \cup (1, \infty)$$

30

$$\frac{x-8}{x+2} < 1$$

30

$$\frac{x-8}{x+2} - 1 < 1 - 1$$

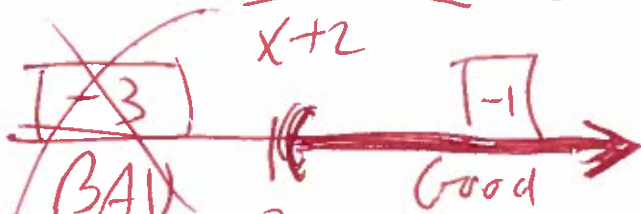
$$\frac{x-8}{x+2} - 1 < 0$$

$$\frac{x-8}{x+2} - \frac{x+2}{x+2} < 0 \quad \text{rewrite}$$

$$\frac{(x-8) - (x+2)}{x+2} < 0$$

$$\frac{x-8-x-2}{x+2} < 0$$

$$\frac{-10}{x+2} < 0$$



$$\begin{aligned} \text{WA} \quad x+2 &= 0 \\ x+2-2 &= 0-2 \\ x &= -2 \end{aligned}$$

Check

$$\frac{-10}{-3+2} < 0 \quad ?$$

$$\frac{-10}{-1} < 0 \quad ?$$

$$10 < 0 \quad \text{NO}$$

BAD

Check

$$\frac{-10}{-1+2} < 0 \quad ?$$

$$\frac{-10}{1} < 0 \quad ?$$

$$-10 < 0 \quad \text{YES}$$

YES

answer
 $(-2, \infty)$

31. List the potential rational zeros of the polynomial function. Do not find the zeros. 31.

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

$$\frac{\text{Last}}{\text{First}} = \text{potential rational zeros}$$

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

$$\frac{\pm 2, \pm 1}{6, 3, 2, 1} =$$

$$\frac{\pm 2}{6}, \frac{\pm 2}{3}, \frac{\pm 2}{2}, \frac{\pm 2}{1}, \frac{\pm 1}{6}, \frac{\pm 1}{3}, \frac{\pm 1}{2}, \frac{\pm 1}{1} =$$

$$\pm \frac{1}{3}, \pm \frac{2}{3}, \pm 1, \pm 2, \pm \frac{1}{6}, \pm \frac{1}{3}, \pm \frac{1}{2}, \pm 1 =$$

$$\boxed{\pm \frac{1}{6}, \pm \frac{1}{3}, \pm \frac{1}{2}, \pm \frac{2}{3}, \pm 1, \pm 2}$$

32. Use the Rational Zeros Theorem to find all the real zeros of the polynomial function. Use the zeros to factor f over the real numbers

$$f(x) = 5x^3 - 9x^2 - 6x + 8$$

List =
first
 $\frac{\pm 8}{5}$

$\frac{\pm 8, \pm 4, \pm 2, \pm 1}{5, 1}$

$\frac{\pm 8}{5}, \frac{\pm 4}{5}, \frac{\pm 2}{5}, \frac{\pm 1}{5}, \frac{\pm 8}{1}, \frac{\pm 4}{1}, \frac{\pm 2}{1}, \frac{\pm 1}{1} =$

$\frac{\pm 8}{5}, \frac{\pm 4}{5}, \frac{\pm 2}{5}, \frac{\pm 1}{5}, \pm 8, \pm 4, \pm 2, \pm 1 =$
use synthetic division

$$\begin{array}{r|rrrr} 5x^3 - 9x^2 - 6x + 8 & x+1 \end{array}$$

$f(x) = 5x^3 - 9x^2 - 6x + 8$
OR

$$\begin{array}{r|rrrr} -1 & 5 & -9 & -6 & 8 \\ & & -5 & 14 & -8 \\ \hline & 5 & -14 & 8 & 0 \end{array}$$

$$5x^2 - 14x + 8 = 0$$

$$(5x - 4)(x - 2) = 0 \text{ Factor}$$

$$5x - 4 = 0$$

$$x - 2 = 0$$

$$5x - 4 + 4 = 0 + 4$$

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

$$5x = 4$$

$$\frac{5x}{5} = \frac{4}{5}$$

$$x = \frac{4}{5}$$

$$x = 2$$

zeros are

$$x = -1$$

$$x = \frac{4}{5}$$

$$x = 2$$

$f(x) = (5x - 4)(x - 2)(x + 1)$

OR

33

Solve

$$2x^3 - 13x^2 + 22x - 8 = 0$$

List

Factors

$$\frac{\pm 8}{2}$$

$$\pm 8, \pm 4, \pm 2, \pm 1$$

$$\pm \frac{8}{2}, \pm \frac{4}{2}, \pm \frac{2}{2}, \pm \frac{1}{2}, \pm 8, \pm 4, \pm 2, \pm 1$$

$$\pm 4, \pm 2, \pm 1, \pm \frac{1}{2}, \pm 8, \pm 4, \pm 2, \pm 1$$
 possible

use synthetic division

$$\begin{array}{r|rrrr} 2 & 2 & -13 & 22 & -8 \\ & & 4 & -18 & 8 \\ \hline & 2 & -9 & 4 & 0 \end{array}$$

$$2x^2 - 9x + 4 = 0$$

$$(2x-1)(x-4) = 0$$

$$\text{or } 2x-1=0 \text{ or } x-4=0$$

$$2x-1+1=0+1 \text{ or } x-4+4=0+4$$

$$2x=1$$

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

$$\text{or } x=4$$

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

$$\left\{ 2, \frac{1}{2}, 4 \right\}$$

38) Use the Intermediate Value Theorem to determine whether the polynomial function has a zero in the given interval, $[2, 3]$

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

34

$$f(2) = 2(2)^4 - 6(2)^2 - 9$$

$$f(2) = 2(2)(2)(2)(2) - 6(2)(2) - 9$$

$$f(2) = 32 - 24 - 9$$

$$f(2) = -1$$

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

$$f(3) = 2(3)(3)(3)(3) - 6(3)(3) - 9$$

$$f(3) = 162 - 54 - 9$$

$$f(3) = 99$$

Since $f(2) = -1$ and $f(3) = 99$

then Yes polynomial function has a zero in the interval $[2, 3]$.

35. $(g \circ f)(1)$

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

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

$$g(-2) =$$

$$-7 =$$

$$(g \circ f)(1) = -7$$

↓

x	1	7	9	12
f(x)	-2	9	0	12

36

↗

x	-5	-2	1	3
g(x)	1	-7	7	9

↖

36

$$f(x) = 2x + 4 \quad g(x) = 2x^2 + 1$$

Find $(g \circ g)(1) =$

$$g(g(1)) =$$

$$g(2(1)^2 + 1) =$$

$$g(2(1)(1) + 1) =$$

$$g(2(1) + 1) =$$

$$g(2 + 1) =$$

$$g(3) =$$

$$2(3)^2 + 1 =$$

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

$$2(9) + 1 =$$

$$18 + 1 =$$

$$19 =$$

$$(g \circ g)(1) = 19$$

36

3? find the domain of the composite function $f \circ g$

$$f(x) = x + 6 \text{ and } g(x) = \frac{9}{x+2}$$

31

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

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

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

$$\frac{9}{x+2} + 6 =$$

$$(f \circ g)(x) = \frac{9}{x+2} + 6$$

Domain:

$$\text{Let } x+2=0$$

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

$$x = -2$$

$$\text{Domain } \{x \mid x \neq -2\}$$

(38) Indicate whether the function is ~~one to one~~ one to one. (38)

$\{(4, 5), (-5, -4), (8, -3), (-8, 3)\}$

YES since no two different
1st Number go to same Second
Number

one to one
function

39 The function f is one-to-one.
Find the inverse. (39)

$$f(x) = \frac{5}{3x+7}$$

Let $y = \frac{5}{3x+7}$

$$\frac{x}{1} = \frac{5}{3y+7} \quad \text{Rewrite}$$

$$x(3y+7) = 1(5) \quad \text{Cross Mult}$$

$$3xy + 7x = 5$$

$$3xy + \cancel{7x} - \cancel{7x} = 5 - 7x$$

$$3xy = 5 - 7x$$

$$\frac{\cancel{3xy}}{\cancel{3x}} = \frac{5-7x}{3x}$$

$$y = \frac{5-7x}{3x}$$

$$f^{-1}(x) = \frac{5-7x}{3x}$$

40

Eval

use graphing calculator

$$2^{\sqrt{6}} =$$

40

$$2^{\wedge}(\sqrt{6}) =$$

$$5.462228786 =$$

use graphing
calculator

(41)

$$2^{(3x-7)} = 4$$

$$2^{(3x-7)} = 2^2$$

$$3x-7 = 2$$

$$3x - \cancel{7} + \cancel{7} = 2 + 7$$

$$3x = 9$$

$$\frac{3x}{3} = \frac{9}{3}$$

$$x = 3$$

(41)

41 Change the exponential expression to an equivalent expression involving a logarithm.

$$6^x = 216$$

$$\log_6 (216) = x$$

43 Change the logarithmic expression to an equivalent expression involving an exponent

43

$$\log_2 \left(\frac{1}{8} \right) = -3$$

$$2^{-3} = \frac{1}{8}$$

(44) Find the domain of the function.

$$f(x) = \ln(10-x)$$

(44)

$$\text{Let } 10-x > 0$$

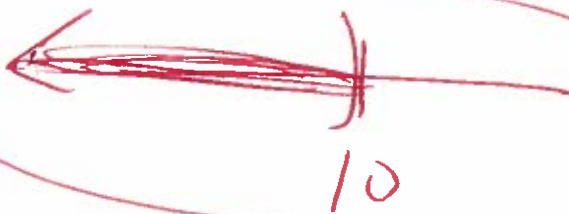
$$10-x-10 > 0-10$$

$$-x > -10$$

$$\frac{-x}{-1} < \frac{-10}{-1}$$

turn the alligator around
since you divide by a
negative

$$x < 10$$



$$(-\infty, 10)$$

45

Solve

$$\log_5 x^2 = 4$$

$$5^4 = x^2$$

$$\pm \sqrt{5^4} = \sqrt{x^2}$$

$$\pm 5^2 = x$$

$$x = -5^2 \text{ OR } x = 5^2$$

$$x = -(5)(5) \text{ OR } x = (5)(5)$$

$$x = -25$$

OR

$$x = 25$$

45

46. Expand

46

$$\log_{14} \left(\frac{11\sqrt{r}}{r^5} \right) =$$

$$\log_{14}(11\sqrt{r}) - \log_{14}(r^5) =$$

$$\log_{14}(11) + \log_{14}(\sqrt{r}) - \log_{14}(r^5) =$$

$$\log_{14}(11) + \log_{14}(r^{1/2}) - \log_{14}(r^5) =$$

$$\log_{14}(11) + \frac{1}{2}\log_{14}(r) - \log_{14}(r^5) =$$

formulas

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

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

47 Express as a single logarithm

$$3 \log_a(2x+1) - 2 \log_a(2x-1) + 2 =$$

$$\log_a(2x+1)^3 - \log_a(2x-1)^2 + 2 =$$

$$\log_a(2x+1)^3 - \log_a(2x-1)^2 + 2 \log_a(a) =$$

$$\log_a(2x+1)^3 - \log_a(2x-1)^2 + \log_a(a^2) =$$

$$\log_a \frac{(2x+1)^3}{(2x-1)^2} + \log_a(a^2) =$$

$$\log_a \frac{(2x+1)^3 a^2}{(2x-1)^2} =$$

$$\log_a \frac{a^2 (2x+1)^3}{(2x-1)^2} =$$

formulas

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

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

48

Solve

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

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

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

$$\frac{3+x}{x-5} = \frac{3}{1}$$

$$1(3+x) = 3(x-5)$$

$$3 + 1x = 3x - 15$$

$$\cancel{3} + 1x - \cancel{3} = 3x - 15 - 3$$

$$1x = 3x - 18$$

$$1x - 3x = 3x - 18 - 3x$$

$$-2x = -18$$

$$\frac{-2x}{-2} = \frac{-18}{-2}$$

$$x = 9$$

ck

$$\log(3+9) - \log(9-5) = \log(3)$$

$$\log(12) - \log(4) = \log(3)$$

Good Good

49.

Solve

$$3 * 5^{2t-1} = 75$$

$$\frac{3 * 5^{2t-1}}{3} = \frac{75}{3}$$

$$5^{2t-1} = 25$$

$$\cancel{5}^{2t-1} = \cancel{5}^2$$

$$2t-1 = 2$$

$$2t - \cancel{1} + \cancel{1} = 2 + 1$$

$$2t = 3$$

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

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

49

50 find the effective rate of interest

$$A = Pe^{rt}$$

$$r = 7.1\%$$

$$t = 1$$

$$A = 1e^{.071(1)}$$

$$A = e^{.071}$$

$$A = 1.073581226$$

$$1.073581226 - 1$$

$$.073581226$$

$$7.3581226\%$$

effective rate

(51) the half-life of silicon-32 is 710 years. If 30 grams is present now, how much will be present in 200 years?

$$A = P \left(\frac{1}{2} \right)^{\frac{t}{N}}$$

$$A = 30 \left(\frac{1}{2} \right)^{\frac{200}{710}}$$

$$A = 30 \left(\frac{1}{2} \right)^{\frac{200}{710}}$$

use
graphing
calculator

$$A = 30 \left(\frac{1}{2} \right)^{(200/710)}$$

$$A = 24.67880196$$

Round

$$A = 24.679$$

52 Verify that the values of the variables listed are solutions of the system of equations.

$$x + y = 3$$

$$x - y = 5$$

$$x = -4, y = -1$$

52

ck

$$x + y = 3$$

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

$$-4 - 1 = 3$$

$$-5 \neq 3$$

Not a solution

Done

Have to work on both equations

53

Solve

$$x + y = -1$$

$$x - y = 19$$

$$2x + 0 = 18$$

$$2x = 18$$

$$\frac{2x}{2} = \frac{18}{2}$$

$$x = 9$$

sub

$$x + y = -1$$

$$(9) + y = -1$$

$$9 + y = -1$$

$$9 + y - 9 = -1 - 9$$

$$y = -10$$

$$(x, y) = (9, -10)$$

53

54. Write the augmented matrix for the system

54

$$6x + 2z = 6$$

$$-2y + 6z = 40$$

$$3x + 2y + 7z = 35$$

$$6x + 0y + 2z = 6$$

$$0x - 2y + 6z = 40$$

$$3x + 2y + 7z = 35$$

rewrite

$$\left[\begin{array}{ccc|c} 6 & 0 & 2 & 6 \\ 0 & -2 & 6 & 40 \\ 3 & 2 & 7 & 35 \end{array} \right]$$

Augmented matrix

55 Write the system of equations associated with the augmented matrix. Do not solve. 55

$$\left[\begin{array}{ccc|c} -3 & 8 & -2 & 5 \\ -6 & 4 & 0 & -7 \\ 5 & 0 & 8 & -5 \end{array} \right]$$

$$-3x + 8y - 2z = 5$$

$$-6x + 4y + 0z = -7$$

$$5x + 0y + 8z = -5$$

56

Solve

$$2x - y + 8z = 60$$

$$-2x + 0y + 3z = 11$$

$$4y + z = 31$$

56

~~1/2~~

$$2x - 1y + 8z = 60$$

$$-2x + 0y + 3z = 11$$

$$0x + 4y + 1z = 31$$

2nd, matrix, edit, $[A]$, 3×4 ,

$$[A] = \left[\begin{array}{ccc|c} 2 & -1 & 8 & 60 \\ -2 & 0 & 3 & 11 \\ 0 & 4 & 1 & 31 \end{array} \right]$$

2nd, matrix, math, rref, enter

rref(
2nd matrix
 $[A]$)

$$\text{rref}([A]) = \left[\begin{array}{ccc|c} 1 & 0 & 0 & 5 \\ 0 & 1 & 0 & 6 \\ 0 & 0 & 1 & 7 \end{array} \right]$$

(x, y, z)
 $(5, 6, 7)$

57

Solve

$$x - y + 2z + w = 1$$

$$y + z = 2$$

$$z - w = 4$$

57

$$z - w = 4$$

$$\cancel{z - w} + w = 4 + w$$

$$z = 4 + w$$

$$y + z = 2$$

$$y + (4 + w) = 2$$

$$y + 4 + w = 2$$

$$y = 2 - 4 - w$$

$$y = -2 - w$$

Where w is any
real number

$$x - y + 2z + w = 1$$

$$x - (-2 - w) + 2(4 + w) + w = 1$$

$$x + 2 + w + 8 + 2w + w = 1$$

$$x + 4w + 10 = 1$$

$$x = 1 - 4w - 10$$

$$x = -9 - 4w$$