M1 3/4 Fiesta 45Q Step

03-23-19
03-25-19
04-03-19
04-05-19

1. $16x^2+2x-3=0$

$a=16,\quad b=2,\quad c=-3$

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

$$x=\frac{-(2)\pm\sqrt{(2)^2-4(16)(-3)}}{2(16)}$$

$$x=\frac{-2\pm\sqrt{4+192}}{32}$$

$$x=\frac{-2\pm\sqrt{196}}{32}$$

$$x=\frac{-2\pm 14}{32}$$

$$x=\frac{-2+14}{32} \quad \text{OR} \quad x=\frac{-2-14}{32}$$

$$x=\frac{12}{32} \quad \text{OR} \quad x=\frac{-16}{32}$$

$$x=\frac{\cancel{4}(3)}{\cancel{4}(8)} \quad \text{OR} \quad x=\frac{\cancel{16}(-1)}{\cancel{16}(2)}$$

$$x=\frac{3}{8} \quad \text{OR} \quad x=\frac{-1}{2}$$

2.

$2x^2 = 13x + 24$

$2x^2 - 13x - 24 = 0$

$a = 2, \; b = -13, \; c = -24$

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

$$x = \frac{-(-13) \pm \sqrt{(-13)^2 - 4(2)(-24)}}{2(2)}$$

$$x = \frac{13 \pm \sqrt{169 + 192}}{4}$$

$$x = \frac{13 \pm \sqrt{361}}{4}$$

$$x = \frac{13 \pm 19}{4}$$

$x = \frac{13 - 19}{4}$ OR $x = \frac{13 + 19}{4}$

$x = \frac{-6}{4}$ OR $x = \frac{32}{4}$

$x = \frac{\cancel{2}(-3)}{\cancel{2}(2)}$ OR $x = 8$

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

③ $1x^2 - 2x + 26 = 0$

$a=1,\ b=-2,\ c=26$

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

$$x = \frac{-(-2) \pm \sqrt{(-2)^2 - 4(1)(26)}}{2(1)}$$

$$x = \frac{2 \pm \sqrt{4 - 104}}{2}$$

$$x = \frac{2 \pm \sqrt{-100}}{2}$$

$$x = \frac{2 \pm 10i}{2}$$

$x = 1 \pm 5i$

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

(4) $\sqrt{4x+33} = x+7$

$(\sqrt{4x+33})^2 = (x+7)^2$

$4x+33 = (x+7)(x+7)$

$4x+33 = x^2+7x+7x+49$

$4x+33 = x^2+14x+49$

$0 = x^2+14x+49-4x-33$

$0 = x^2+10x+16$

$0 = (x+2)(x+8)$

Possible
16.1
8.2
4.4

answer
$\{-2\}$

set $x+2=0$ or $x+8=0$

$x+2-2=0-2$ or $x+8-8=0-8$

$x=-2$ or $x=-8$

Check

$\sqrt{4x+33} = x+7$

$\sqrt{4(-2)+33} = (-2)+7$

$\sqrt{-8+33} = -2+7$

$\sqrt{25} = 5$

$5 = 5$

Good

$\sqrt{4(-8)+33} = (-8)+7$

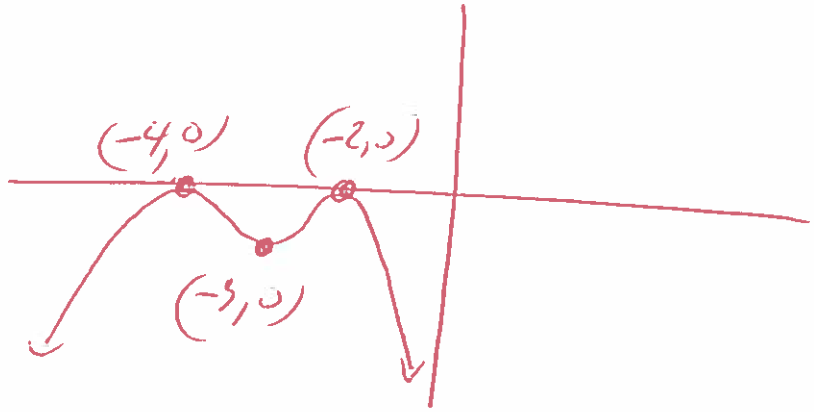
$\sqrt{-32+33} = -8+7$

$\sqrt{1} = -1$

$1 \neq -1$

BAD

5



The function is increasing on the intervals $(-\infty, -4)$ $(-3, -2)$

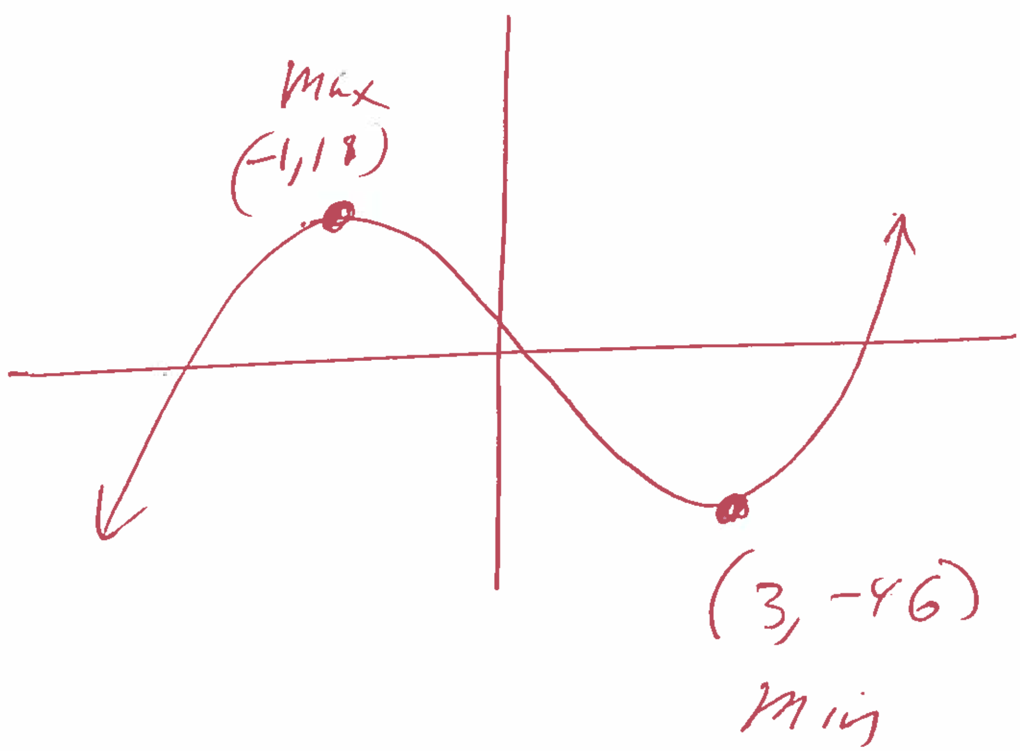
The function is decreasing on the intervals $(-4, -3)$ $(-2, \infty)$

(6.) $f(x) = 2x^3 - 6x^2 - 18x + 8$

use graphing
calculator

X-min -5
X max 5
X scL $= 1$
y min $= -60$
y max $= 60$
y scL $= 1$

$y_1 = 2x \wedge 3 - 6x \wedge 2 - 18x + 8$



7.

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

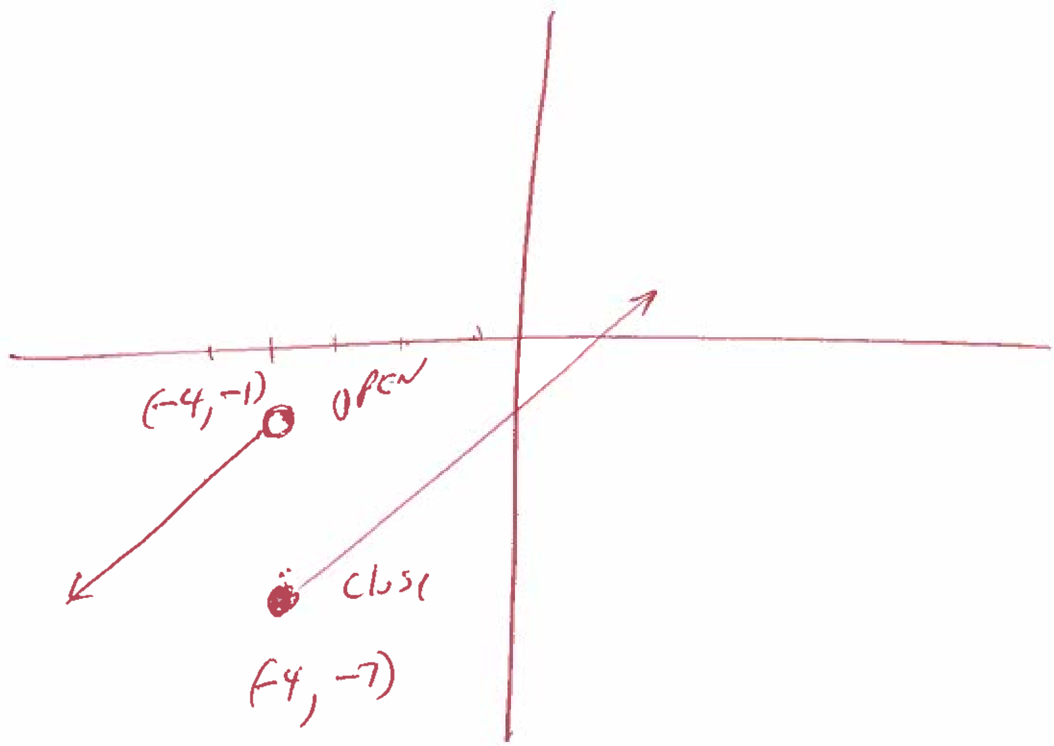
x-min = -12

x-max = 12

xscl = 1

y-min = -10

y-max = 10



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

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

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

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

$$\frac{x^2 + xh + xh + h^2 - 9x - 9h + 8 - x^2 + 9x - 8}{h} =$$

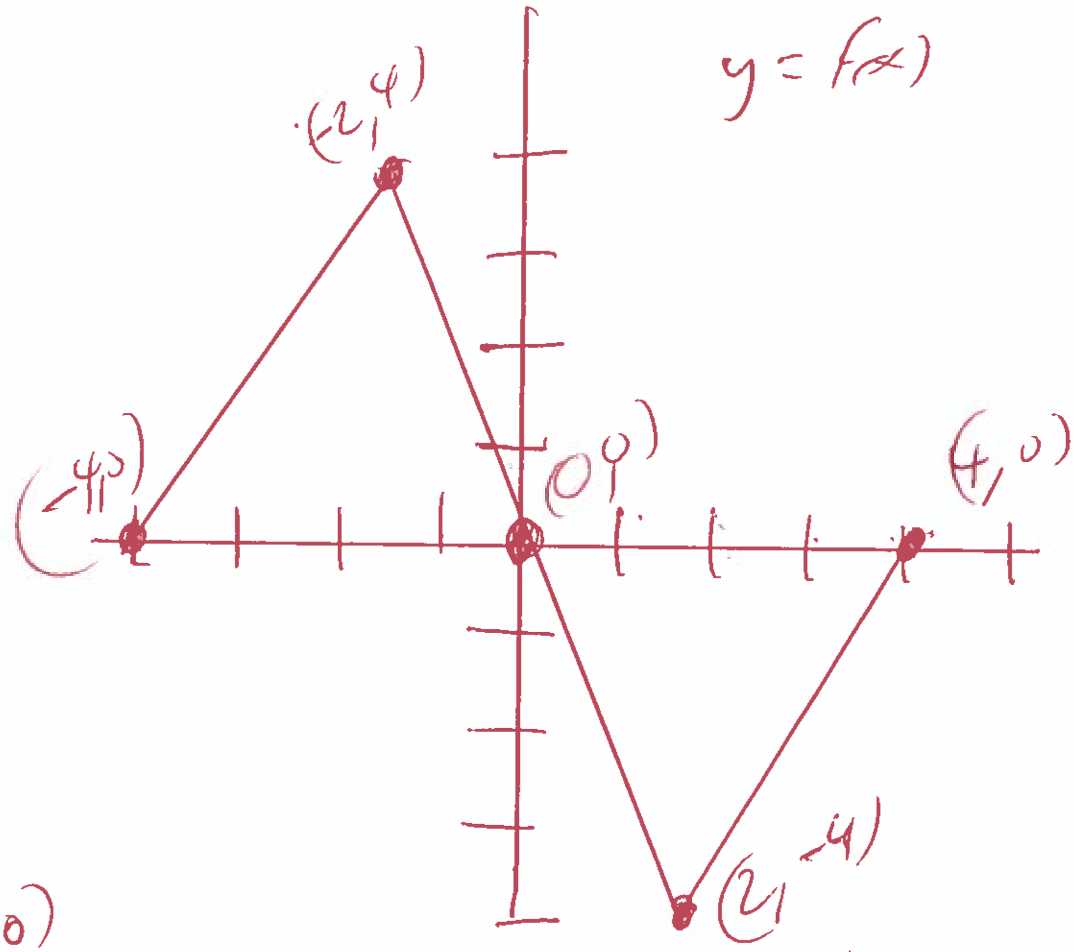
$$\frac{\cancel{x^2} + 2xh + h^2 \cancel{- 9x} - 9h \cancel{+ 8} \cancel{- x^2} \cancel{+ 9x} \cancel{- 8}}{h} =$$

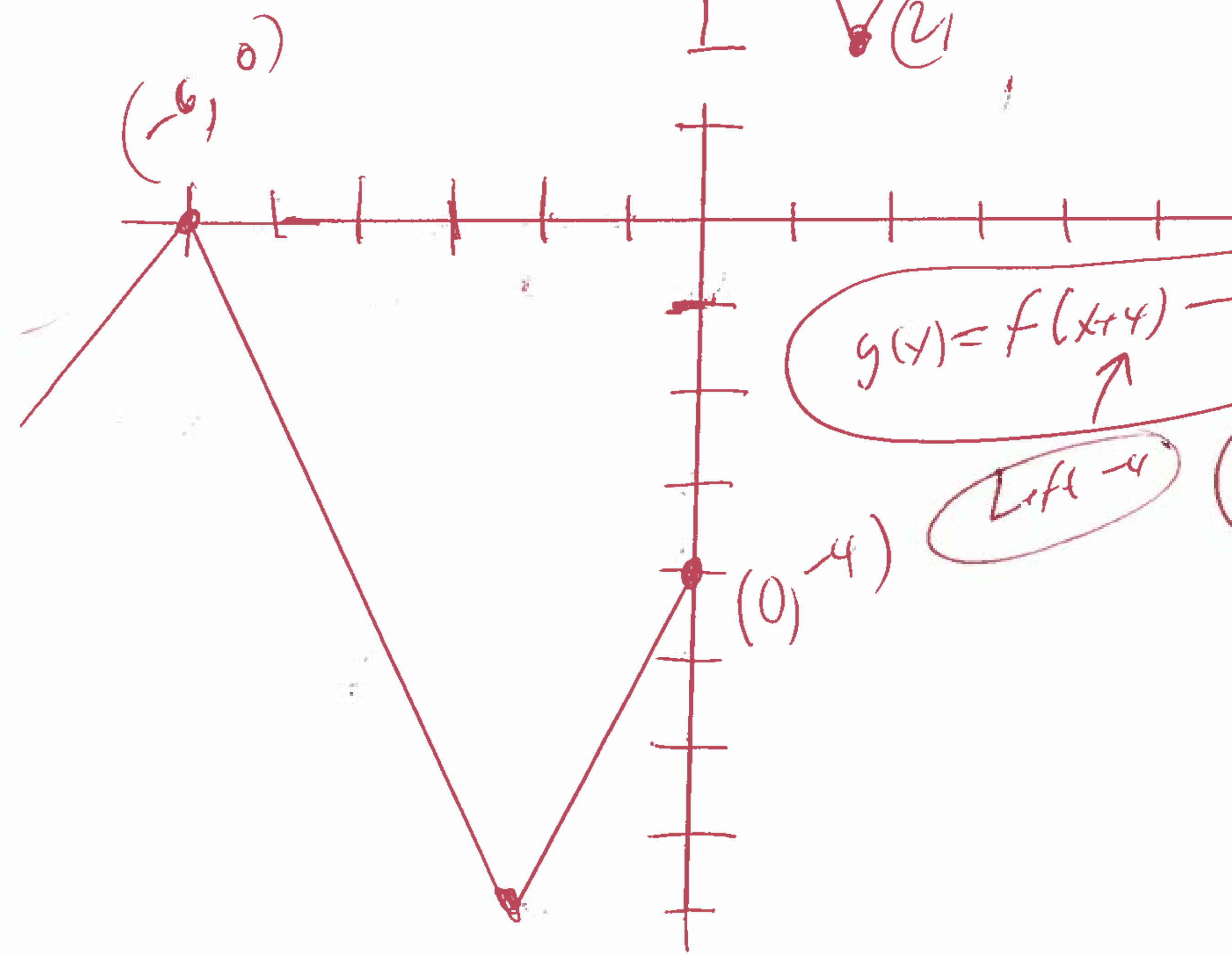
$$\frac{2xh + h^2 - 9h}{h} =$$

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

$$2x + h - 9 =$$

9.





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

Left −4

down −4

(10.)

$f(x) = \sqrt{14 - 2x}$

domain

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

set $Ax + B \geq 0$

set $14 - 2x \geq 0$

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

$-2x \geq -14$

$\frac{-2x}{-2} \leq \frac{-14}{-2}$ divide by a negative and turn the alligator around

$x \leq 7$

$(-\infty, 7]$

(11) $f(x) = 4x^2 + 15x + 14 \qquad g(x) = x + 2$

$(f+g)(x) =$

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

$(4x^2 + 15x + 14) + (x+2) =$

$4x^2 + 15x + 14 + x + 2 =$

$4x^2 + 16x + 16 =$ domain $(-\infty, \infty)$

$(f-g)(x) =$

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

$(4x^2 + 15x + 14) - (x+2) =$

$4x^2 + 15x + 14 - x - 2 =$

$4x^2 + 14x + 12 =$ domain $(-\infty, \infty)$

$(fg)(x) =$

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

$(4x^2 + 15x + 14)(x+2) =$

$4x^3 + 8x^2 + 15x^2 + 30x + 14x + 28 =$

$4x^3 + 23x^2 + 44x + 28 =$ domain $(-\infty, \infty)$

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

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

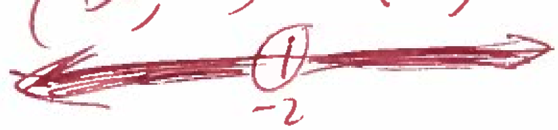
Note $\rightarrow$ $x + 2 \neq 0$
$x + 2 - 2 \neq 0 - 2$
$x \neq -2$

$\frac{4x^2 + 15x + 14}{x+2} =$

$\frac{(4x+7)\cancel{(x+2)}}{\cancel{(x+2)}} =$

$4x + 7 =$

domain
$(-\infty, -2) \cup (-2, \infty)$



(12.) $f(x) = 1 - x$ and $g(x) = 4x^2 + x + 2$

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

$f(g(x)) =$

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

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

$1 - 4x^2 - x - 2 =$

$-4x^2 - x - 1 =$

$(f \circ g)(x) = -4x^2 - x - 1$

$(f \circ g)(2) = -4(2)^2 - (2) - 1$

$(f \circ g)(2) = -4(2)(2) - (2) - 1$

$(f \circ g)(2) = -4(4) - 2 - 1$

$(f \circ g)(2) = -16 - 2 - 1$

$(f \circ g)(2) = -19$

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

$g(f(x)) =$

$g(1 - x) =$

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

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

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

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

$4 - 8x + 4x^2 + 1 - x + 2 =$

$4x^2 - 9x + 7 =$

$(g \circ f)(x) = 4x^2 - 9x + 7$

$(g \circ f)(2) = 4(2)^2 - 9(2) + 7$

$(g \circ f)(2) = 4(2)(2) - 9(2) + 7$

$(g \circ f)(2) = 4(4) - 9(2) + 7$

$(g \circ f)(2) = 16 - 18 + 7$

$(g \circ f)(2) = 5$

13

distance between the points

$(4, 6)$ and $(10, 14)$
$x_1 \; y_1 \quad\quad x_2 \; y_2$

$$d = \sqrt{(x_1 - x_2)^2 + (y_1 - y_2)^2}$$

$$d = \sqrt{((4) - (10))^2 + ((6) - (14))^2}$$

$$d = \sqrt{(4-10)^2 + (6-14)^2}$$

$$d = \sqrt{(-6)^2 + (-8)^2}$$

$$d = \sqrt{36 + 64}$$

$$d = \sqrt{100}$$

$$d = 10$$

14

find Midpoint

$(2, 8)$ and $(6, 4)$

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

$$\text{midpoint} = \left(\frac{x_1+x_2}{2}, \frac{y_1+y_2}{2}\right)$$

$$\text{midpoint} = \left(\frac{(2)+(6)}{2}, \frac{(8)+(4)}{2}\right)$$

$$\text{midpoint} = \left(\frac{2+6}{2}, \frac{8+4}{2}\right)$$

$$\text{midpoint} = \left(\frac{8}{2}, \frac{12}{2}\right)$$

$$\text{midpoint} = (4, 6)$$

15

$$x^2+y^2+6x+10y+30=0$$

$$x^2+6x+y^2+10y=-30$$ rewrite

$$x^2+6x+\left(\tfrac{1}{2}(6)\right)^2+y^2+10y+\left(\tfrac{1}{2}(10)\right)^2=-30+\left(\tfrac{1}{2}(6)\right)^2+\left(\tfrac{1}{2}(10)\right)^2$$

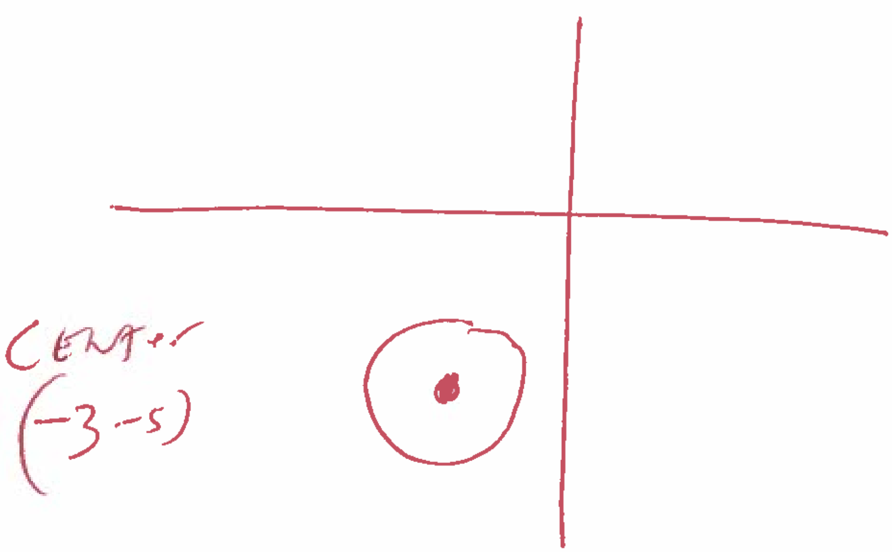
$$x^2+6x+(3)^2+y^2+10y+(5)^2=-30+(3)^2+(5)^2$$

$$\underbrace{x^2+6x+9}+y^2+10y+25=-30+9+25$$

$$(x+3)(x+3)+(y+5)(y+5)=4$$

$$(x+3)^2+(y+5)^2=4$$

CENTER $=(-3,-5)$ Radius $=\sqrt{4}=2$



(16.) Find Vertex

$f(x) = 3x^2 + 18x + 9$

$a = 3, \quad b = 18, \quad c = 9$

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

$\text{Vertex} = \left(-\frac{(18)}{2(3)}, f\left(-\frac{(18)}{2(3)}\right)\right)$

$\text{Vertex} = \left(-\frac{18}{6}, f\left(-\frac{18}{6}\right)\right)$

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

$\text{Vertex} = (-3, 3(-3)^2 + 18(-3) + 9)$

$\text{Vertex} = (-3, 3(-3)(-3) + 18(-3) + 9)$

$\text{Vertex} = (-3, 3(9) + 18(-3) + 9)$

$\text{Vertex} = (-3, 27 - 54 + 9)$

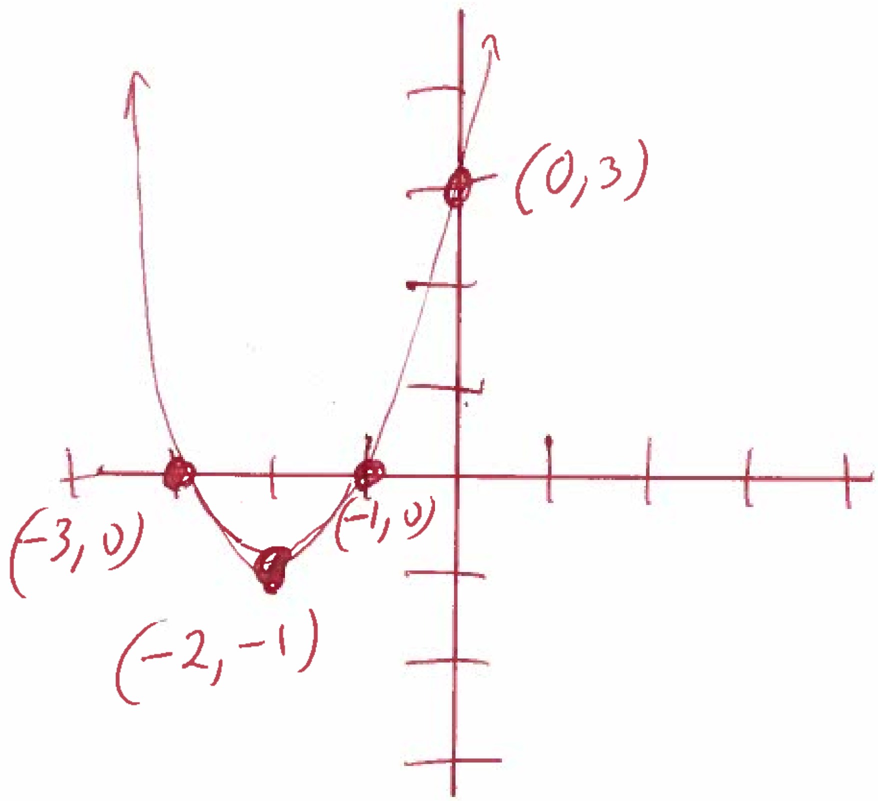
$\text{Vertex} = (-3, -27 + 9)$

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

17. $f(x) = (x+2)^2 - 1$

Use graphing calculator

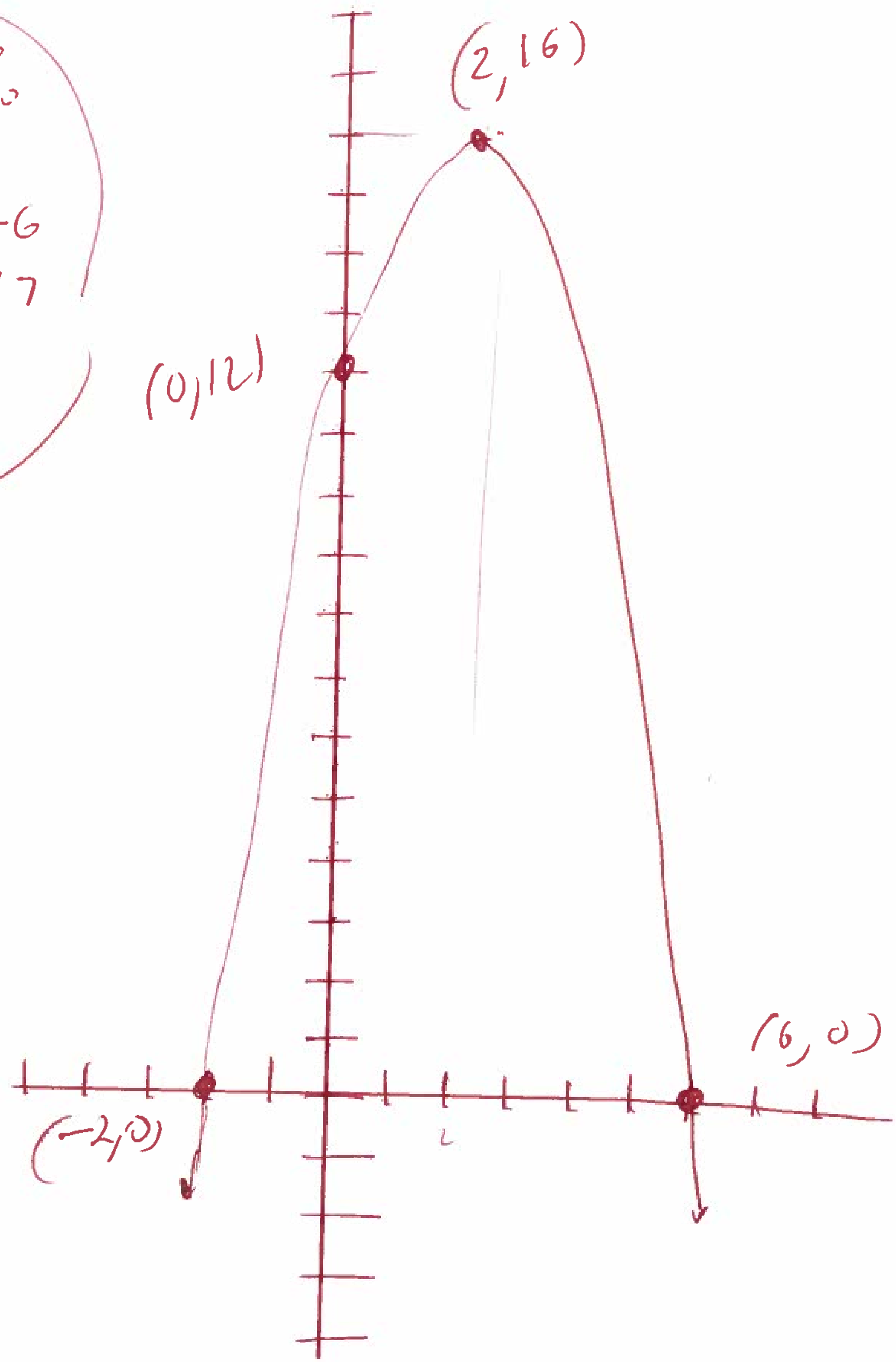
$y_1 = (x+2)^2 - 1$



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

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

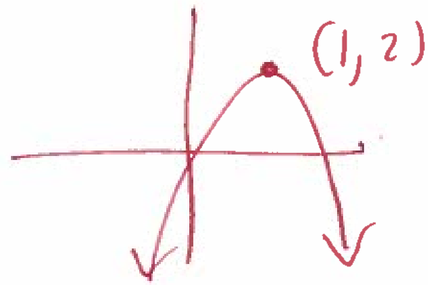
Xmin = -10
Xmax = 10
Xscl = 1
ymin = -6
ymax = 17
yscl = 1



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

$a = -3, \quad b = 6, \quad c = -1$

graph open down max



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

$\text{Vertex} = \left(\frac{-(6)}{2(-3)}, f\left(\frac{-(6)}{2(-3)}\right)\right)$

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

$\text{Vertex} = (1, f(1))$

$\text{Vertex} = (1, -3(1)^2 + 6(1) - 1)$

$\text{Vertex} = (1, -3(1)(1) + 6(1) - 1)$

$\text{Vertex} = (1, -3(1) + 6(1) - 1)$

$\text{Vertex} = (1, -3 + 6 - 1)$

$\text{Vertex} = (1, 3 - 1)$

$\text{Vertex} = (1, 2)$ Max

domain $(-\infty, \infty)$

range $(-\infty, 2]$

bottom of graph

TOP of graph

(20) Solve

$1x^3 - 5x^2 + 2x + 8 = 0$

$x = -1$ is a zero

use synthetic division

$$\begin{array}{r|rrrr} -1 & 1 & -5 & 2 & 8 \\ & & -1 & 6 & -8 \\ \hline & 1 & -6 & 8 & 0 \end{array}$$

0 rem

Possible

$8 \cdot 1$

$2 \cdot 4$

$x^2 - 6x + 8 = 0$

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

set $x - 2 = 0$ OR $x - 4 = 0$

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

$x = 2$ or $x = 4$

$$\boxed{x = -1, \quad x = 2, \quad x = 4}$$

(21) Solve

$f(x) = 3x^3 - 7x^2 - 75x + 175 = 0$, $\frac{\text{Last}}{\text{first}} = \frac{\pm 175}{3}$

Possible Solutn

$\pm 1, \pm 5, \pm 25, \pm 7, \pm 35, \pm 175, \pm \frac{1}{3}, \pm \frac{5}{3}, \pm \frac{25}{3}, \pm \frac{7}{3}, \pm \frac{35}{3}, \pm \frac{175}{3}$

$3x^3 - 7x^2 - 75x + 175 = 0$

use Synthetic division

$$\begin{array}{r|rrrr} -5 & 3 & -7 & -75 & 175 \\ & & -15 & 110 & -175 \\ \hline & 3 & -22 & 35 & 0 \end{array}$$

0 rem

$3 \cdot 1$, $35 \cdot 1$, $7 \cdot 5$

$3x^2 - 22x + 35 = 0$

$(3x - 7)(x - 5) = 0$

sub $3x - 7 = 0$ OR $x - 5 = 0$

$3x - 7 + 7 = 0 + 7$ OR $x - 5 + 5 = 0 + 5$

$3x = 7$ OR $x = 5$

$\frac{3x}{3} = \frac{7}{3}$ OR

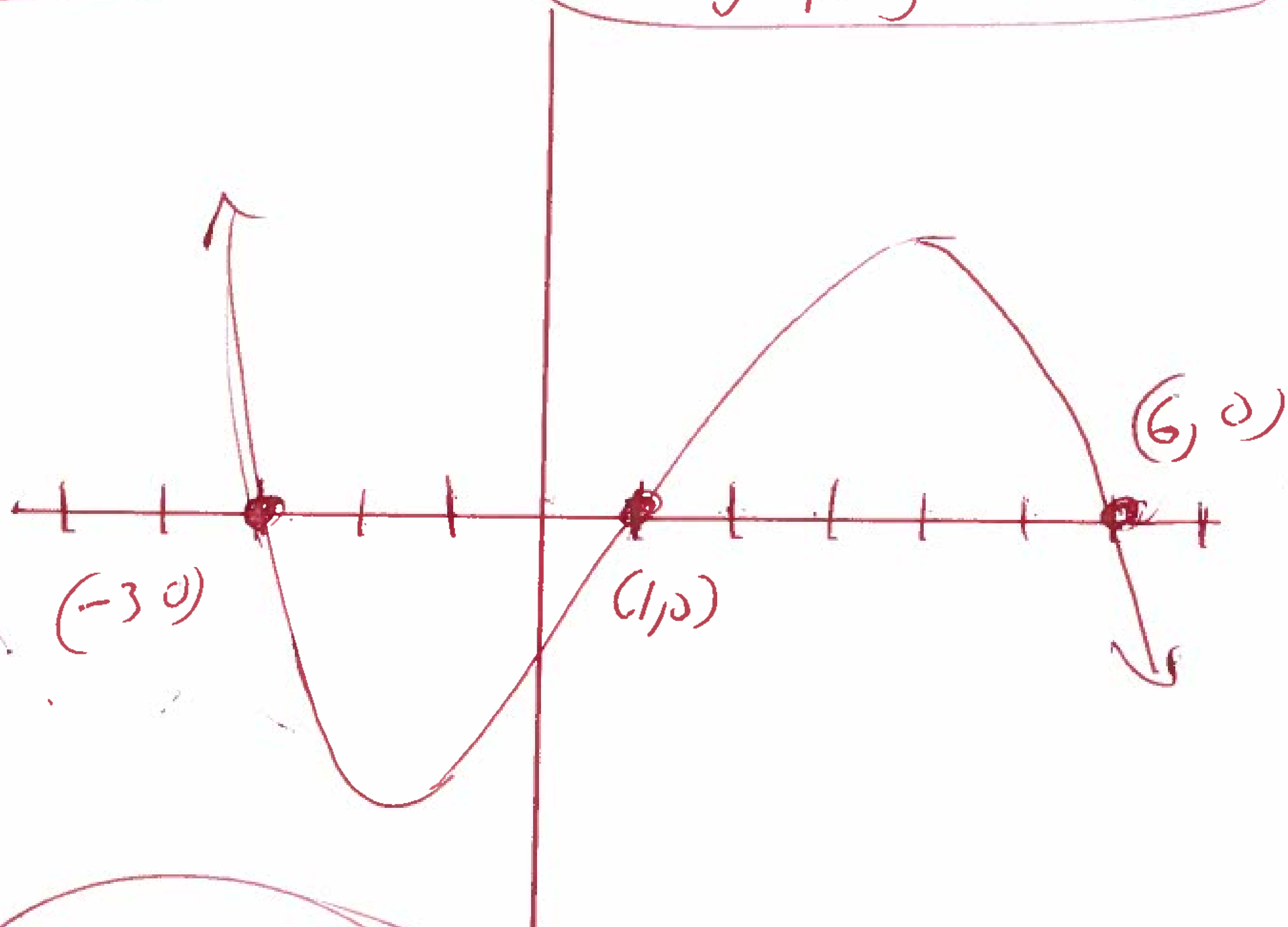
$x = \frac{7}{3}$

$\boxed{x = -5, \; x = \frac{7}{3}, \; x = 5}$

22. $f(x) = -x^3 + 4x^2 + 15x - 18$

$y_1 = -x \wedge 3 + 4x \wedge 2 + 15x - 18$

use graphing calculator



X-min = -12
X-max = 12
X Scl = 1
Y min = -65
Y max = 60
Y Scl = 1

23

$$f(x) = \frac{6x^2 - 3x + 4}{x - 6}$$

Find slant asymptote use synthetic division

opp

$$\begin{array}{r|rrr} 6 & 6 & -3 & 4 \\ & & 36 & 198 \\ \hline & 6 & 33 & 202 \end{array}$$

rem

$y = 6x + 33$

24

$f(x) = \dfrac{x}{x+3}$ find vertical asymptote

let $x+3=0$

$x+3-3=0-3$

$x=-3$

vertical asymptote

$x=-3$

25

$$f(x) = \frac{x-6}{x^2-8x+12}$$

find vertical asymptote

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

$$f(x) = \frac{1\cancel{(x-6)}}{(x-2)\cancel{(x-6)}}$$

simplify

hole at $x-6=0$

$x-6+6=0+6$

$x=6$

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

set $x-2=0$

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

$x=2$

$x=2$ vertical asymptote

$x=6$ hole

26.

$f(x) = \frac{14x}{2x^2+5}$

find horizontal asymptote

$\lim_{x \to \infty} \frac{14x}{2x^2+5} =$

$\lim_{x \to \infty} \frac{(14x)}{(2x^2+5)}\left(\frac{\frac{1}{x^2}}{\frac{1}{x^2}}\right) =$ mult

$\lim_{x \to \infty} \frac{\frac{14x}{x^2}}{\frac{2x^2}{x^2}+\frac{5}{x^2}} =$

$\lim_{x \to \infty} \frac{\frac{14}{x}}{2+\frac{5}{x}} =$

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

$\frac{0}{2} =$

$0 =$

$y=0$ horizontal asymptote

27.

$$g(x) = \frac{14x^2}{7x^2+3}$$

find horizontal asymptote

$$\lim_{x\to\infty} \frac{14x^2}{7x^2+3} =$$

$$\lim_{x\to\infty} \left(\frac{14x^2}{7x^2+3}\right)\frac{\frac{1}{x^2}}{\frac{1}{x^2}} =$$

$$\lim_{x\to\infty} \frac{\frac{14\cancel{x^2}}{\cancel{x^2}}}{\frac{7\cancel{x^2}}{\cancel{x^2}} + \frac{3}{x^2}} =$$

$$\lim_{x\to\infty} \frac{14}{7+\frac{3}{x^2}}$$

$$\frac{14}{7+0} =$$

$$\frac{14}{7} =$$

$$2 =$$

$y = 2$ horizontal asymptote

(28) find domain

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

set $8 - x > 0$

$\cancel{8} - x - \cancel{8} > 0 - 8$

$-x > -8$

$\frac{-x}{-1} < \frac{-8}{-1}$ divide by a negative and turn alligator around

$x < 8$

$(-\infty, 8)$

domain formula

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

set $Ax + B > 0$

29

expand

$$\log_b\left(\frac{x^2y}{z^6}\right) =$$

$$\log_b(x^2y) - \log_b(z^6) =$$

$$\log_b(x^2) + \log_b(y) - \log_b(z^6) =$$

$$2\log_b(x) + \log_b(y) - 6\log_b(z) =$$

formula

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

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

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

30

$$\ln\left(\frac{x^6\sqrt{x^2+2}}{(x+2)^7}\right) =$$ expand

$$\ln\left(x^6\sqrt{x^2+2}\right) - \ln(x+2)^7 =$$

$$\ln(x^6) + \ln\sqrt{x^2+2} - \ln(x+2)^7 =$$

$$\ln(x^6) + \ln(x^2+2)^{\frac{1}{2}} - \ln(x+2)^7 =$$

$$6\ln(x) + \frac{1}{2}\ln(x^2+2) - 7\ln(x+2) =$$

formulas

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

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

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

(31) $9^{x+5} = 243^{x-4}$ Solve Prime 2, 3, 5, 7, 9, 11, 13

$3 \,|\, 9$
$3 \,|\, 3$
1

$3 \,|\, 243$
$3 \,|\, 81$
$3 \,|\, 27$
$3 \,|\, 9$
$3 \,|\, 3$
1

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

$3^{2x+10} = 3^{5x-20}$

$\cancel{3}^{2x+10} = \cancel{3}^{5x-20}$

$2x+10 = 5x-20$

$2x \cancel{+10} \cancel{-10} = 5x-20-10$

$2x = 5x-30$

$2x-5x = 5x-30-5x$

$-3x = -30$

$\frac{-3x}{-3} = \frac{-30}{-3}$

$x = 10$

Formula

$A^m = A^n$

$m = n$

Solve

32

$$4e^{7x} = 1840$$

$$\frac{\cancel{4}e^{7x}}{\cancel{4}} = \frac{1840}{4}$$

$$e^{7x} = 460$$

$$\ln(e^{7x}) = \ln(460)$$

$$7x \ln(e) = \ln(460)$$

$$7x(1) = \ln(460)$$

$$7x = \ln(460)$$

$$\frac{\cancel{7}x}{\cancel{7}} = \frac{\ln(460)}{7}$$

$$x = \frac{\ln(460)}{7}$$

OR

$$x = .8758894985$$

OR

$$x = .88$$ Round

Formula

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

$$\ln(e) = 1$$

33. Solve

$$9^{x-1} = 250$$

$$\ln(9^{x-1}) = \ln(250)$$

$$(x-1)\ln(9) = \ln(250)$$

$$\frac{(x-1)\cancel{\ln(9)}}{\cancel{\ln(9)}} = \frac{\ln(250)}{\ln(9)}$$

$$x-1 = \frac{\ln(250)}{\ln(9)}$$

$$x\cancel{-1}\cancel{+1} = \frac{\ln(250)}{\ln(9)} + 1$$

$$x = \frac{\ln(250)}{\ln(9)} + 1$$

OR

$$x = 3.512925158$$

OR Round

$$x = 3.51$$

formula

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

(34) $\log_2(x+21)=4$

Solve

$2^4 = x+21$ rewrite

Formula

$\log_b(y)=x$

then $b^x=y$

$2\cdot2\cdot2\cdot2 = x+21$

$16 = x+21$

$16-21 = x+21-21$

$-5 = x$

Check

$\log_2(x+21)=4$

$\log_2(-5+21)=4$

$\log_2(16)=4$

Good

38)

$\log_6(x) + \log_6(5x-1) = 1$

Solve

formula

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

$\log_6(x(5x-1)) = 1$

$6^1 = x(5x-1)$ rewrite

$6 = 5x^2 - x$

Possible

5.1

6.1

2.3

$0 = 5x^2 - x - 6$

$0 = (5x-6)(x+1)$

Let $5x - 6 = 0$ OR $x+1=0$

$5x \cancel{-6} + 6 = 0 + 6$ OR $x+1-1 = 0-1$

$5x = 6$ OR $x = -1$

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

$x = 6/5$

check

$\left\{ \frac{6}{5} \right\}$

answer

$\log_6\left(\frac{6}{5}\right) + \log_6\left(5\left(\frac{6}{5}\right) - 1\right) = 1$

$\log_6\left(\frac{6}{5}\right) + \log_6(6-1) = 1$

$\log_6\left(\frac{6}{5}\right) + \log_6(5) = 1$

Good Good

$\log_6(-1) + \log_6(5(-1)-1) = 1$

$\log_6(-1) + \log_6(-5-1) = 1$

$\log_6(-1) + \log_6(-6) = 1$

BAD BAD

(36)

$\log_4(x+2) + \log_4(x+62) = 4$

Solve formula

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

$\log_4 (x+2)(x+62) = 4$

$4^4 = (x+2)(x+62)$

$4 \cdot 4 \cdot 4 \cdot 4 = x^2 + 62x + 2x + 124$

$256 = x^2 + 64x + 124$

$0 = x^2 + 64x + 124 - 256$

$0 = x^2 + 64x - 132$

$0 = (x-2)(x+66)$

$x - 2 = 0$ OR $x + 66 = 0$

$x - 2 + 2 = 0 + 2$ OR $x + 66 - 66 = 0 - 66$

$x = 2$ OR $x = -66$

$\{2\}$ answer

Check

$\log_4(x+2) + \log_4(x+62) = 4$

$\log_4(2+2) + \log_4(2+62) = 4$

$\log_4(4) + \log_4(64) = 4$

Good Good

$\log_4(-66+2) + \log_4(-66+62) = 4$

$\log_4(-64) + \log_4(-4) = 4$

BAD BAD

(37) $\log_5(x+19) - \log_5(x-5) = 2$

Solve

$\log_5\left(\frac{x+19}{x-5}\right) = 2$

~~formula~~

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

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

$5^2 = \frac{x+19}{x-5}$

$5 \cdot 5 = \frac{x+19}{x-5}$

$\frac{25}{1} = \frac{x+19}{x-5}$

$25(x-5) = 1(x+19)$

$25x - 125 = 1x + 19$

$25x - \cancel{125} + \cancel{125} = 1x + 19 + 125$

$25x = 1x + 144$

$25x - 1x = 1x + 144 - 1x$

$24x = 144$

$\frac{24x}{24} = \frac{144}{24}$

Check

$x = 6$

$\log_5(x+19) - \log_5(x-5) = 2$

$\log_5(6+19) - \log_5(6-5) = 2$

$\log_5(25) - \log_5(1) = 2$

Good

(38.)

Solve

$\log(x) + \log(x-6) = \log(27)$

$\log(x)(x-6) = \log(27)$

possibly

$27 \cdot 1$

$3 \cdot 9$

$x(x-6) = 27$

$x^2 - 6x = 27$

formula

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

$\log(A) = \log(B)$ then $A = B$

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

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

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

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

$x=-3$ OR $x=9$

$\{9\}$

answer

Check

$\log(x) + \log(x-6) = \log(27)$

$\log(-3) + \log(-3-6) = \log(27)$

$\underset{BAD}{\log(-3)} + \underset{BAD}{\log(-9)} = \log(27)$

$\log(9) + \log(9-6) = \log(27)$

$\underset{Good}{\log(9)} + \underset{Good}{\log(3)} = \underset{Good}{\log(27)}$

(39) $A = P\left(1+\frac{r}{N}\right)^{Nt}$

Solve

$\$22000 = \$14500\left(1+\frac{.0475}{2}\right)^{2t}$

$\frac{22000}{14500} = \frac{\cancel{14500}\left(1+\frac{.0475}{2}\right)^{2t}}{\cancel{14500}}$

formula

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

$N\ln(A) =$

$1.517241 = \left(1+\frac{.0475}{2}\right)^{2t}$

$1.517241 = (1+.02375)^{2t}$

$1.517241 = (1.02375)^{2t}$

$\ln(1.517241) = \ln(1.02375)^{2t}$

$\ln(1.517241) = 2t\ln(1.02375)$

$\frac{\ln(1.517241)}{\ln(1.02375)} = \frac{2t\cancel{\ln(1.02375)}}{\cancel{\ln(1.02375)}}$

$17.76104413 = 2t$

$\frac{17.76104413}{2} = \frac{\cancel{2}t}{\cancel{2}}$

$8.880522065 = t$

OR Round

$8.9 = t$

40

$A = Pe^{rt}$

$\$12000 = \$6000\,e^{.08t}$

$$\frac{12000}{6000} = \frac{\cancel{6000}e^{.08t}}{\cancel{6000}}$$

$2 = e^{.08t}$

$\ln(2) = \ln(e^{.08t})$

$\ln(2) = .08t\ln(e)$

$\ln(2) = .08t(1)$

$\ln(2) = .08t$

$$\frac{\ln(2)}{.08} = \frac{\cancel{.08}t}{\cancel{.08}}$$

$8.664339757 = t$

OR

Round

$8.7 = t$

Sole

formula

$\ln(A^N) =$

$N\ln(A) =$

$\ln(e) = 1$

(41)

$A = A_0 e^{-0.000121t}$

Solve

$22 = 100 e^{-0.000121t}$

$\frac{22}{100} = \frac{\cancel{100} e^{-0.000121t}}{\cancel{100}}$

$.22 = e^{-0.000121t}$

$\ln(.22) = \ln(e^{-0.000121t})$

$\ln(.22) = -0.000121t \ln(e)$

$\ln(.22) = -0.000121t(1)$

$\ln(.22) = -0.000121t$

$\frac{\ln(.22)}{-0.000121} = \frac{-\cancel{0.000121}t}{-\cancel{0.000121}}$

Formula

$12513.45234 = t$

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

OR Round

$\ln(e) = 1$

$12513 =$

(42)

$x + y + 3z = 9$

$x + y + 6z = 18$

$x + 5y + 4z = 8$

Use graphing calculator

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

$$[A] = \begin{bmatrix} 1 & 1 & 3 & 9 \\ 1 & 1 & 6 & 18 \\ 1 & 5 & 4 & 8 \end{bmatrix}$$

2ND Quit

2ND, matrix, math, ↓, rref( )

rref([A]) enter

2ND matrix

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

answer

$(x, y, z) = (1, -1, 3)$

(43) $a_n = \frac{2n}{n+7}$ Find first four terms of the sequence

$$a_1 = \frac{2(1)}{(1)+7} = \frac{2}{1+7} = \frac{2}{8} = \frac{\cancel{2}(1)}{\cancel{2}(4)} = \frac{1}{4}$$

$$a_2 = \frac{2(2)}{(2)+7} = \frac{4}{2+7} = \frac{4}{9}$$

$$a_3 = \frac{2(3)}{(3)+7} = \frac{6}{10} = \frac{\cancel{2}(3)}{\cancel{2}(5)} = \frac{3}{5}$$

$$a_4 = \frac{2(4)}{(4)+7} = \frac{8}{4+7} = \frac{8}{11}$$

(44)

$$\sum_{i=1}^{3} i(i+4)$$

$(1)(1+4) + (2)(2+4) + (3)(3+4) =$

$(1)(5) + (2)(6) + (3)(7) =$

$5 + 12 + 21 =$

$17 + 21 =$

$38 =$

OR use Graphing Calculator

Math, summation Σ(, enter

$$\sum_{\square=\square}^{\square} \boxed{}$$

45 $(2x-1)^3 =$

${}_3C_0(2x)^3(-1)^0 + {}_3C_1(2x)^2(-1)^1 + {}_3C_2(2x)^1(-1)^2 + {}_3C_3(2x)^0(-1)^3 =$

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

$(1)(8x^3)(1) + (3)(4x^2)(-1) + (3)(2x)(1) + (1)(1)(-1) =$

$8x^3 - 12x^2 + 8x - 1 =$

3, math, Prb, nCr, enter, 0, enter = 1

3, math, Prb, nCr, enter, 1, enter = 3

3, math, Prb, nCr, enter, 2, enter = 3

3, math, Prb, nCr, enter, 3, enter = 1