1. $9x^2+21x-8=0$

9.1 | 8.1
3.3 | 2.4

Math 131/451 step
08-30-18

$(3x-1)(3x+8)$

$3x-1=0$ or $3x+8=0$

$3x-1+1=0+1$ or $3x+\cancel{8}-\cancel{8}=0-8$

$3x=1$ or $3x=-8$

$\frac{3x}{3}=\frac{1}{3}$ or $\frac{\cancel{3}x}{\cancel{3}}=\frac{-8}{3}$

$x=\frac{1}{3}$ or $x=\frac{-8}{3}$

Or use Quad form

$9x^2+21x-8=0$

$a=9,\ b=21,\ c=-8$

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

$x=\frac{-(21)\pm\sqrt{(21)^2-4(9)(-8)}}{2(9)}$

$x=\frac{-21\pm\sqrt{441+288}}{18}$

$x=\frac{-21\pm\sqrt{729}}{18}$

$x=\frac{-21\pm 27}{18}$

$x=\frac{-21+27}{18}$ or $x=\frac{-21-27}{18}$

$x=\frac{6}{18}$ or $x=\frac{-48}{18}$

$x=\frac{\cancel{6}(1)}{\cancel{6}(3)}$ or $x=\frac{\cancel{6}(-8)}{\cancel{6}(3)}$

$x=\frac{1}{3}$ or $x=\frac{-8}{3}$

② $2x^2 = 9x + 18$

$2 \cdot 1$ $18 \cdot 1$ Possible $9 \cdot 2$ $6 \cdot 3$

$2x^2 - 9x - 18 = 0$

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

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

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

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

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

$x = \frac{-3}{2}$ or use Quad form

$2x^2 - 9x - 18 = 0$

$a=2,\ b=-9,\ c=-18$

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

$x = \frac{-(-9) \pm \sqrt{(-9)^2 - 4(2)(-18)}}{2(2)}$

$x = \frac{9 \pm \sqrt{81+144}}{4}$

$x = \frac{9 \pm \sqrt{225}}{4}$

$x = \frac{9 \pm 15}{4}$

$x = \frac{9-15}{4}$ or $x = \frac{9+15}{4}$

$x = \frac{-6}{4}$ or $x = \frac{24}{4}$

$x = \frac{\cancel{2}(-3)}{\cancel{2}(2)}$ or $x = 6$

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

3. $1x^2 - 8x + 20 = 0$

$a = 1,\ b = -8,\ c = 20$

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

$$x = \frac{-(-8) \pm \sqrt{(-8)^2 - 4(1)(20)}}{2(1)}$$

$$x = \frac{8 \pm \sqrt{64 - 80}}{2}$$

$$x = \frac{8 \pm \sqrt{-16}}{2}$$

$$x = \frac{8 \pm 4i}{2}$$

$x = 4 \pm 2i$

$x = 4 + 2i$ or $x = 4 - 2i$

(4) $2x^2-20x+50=0$

$2(x^2-10x+25)=0$

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

set $\cancel{2=0}$ or $x-5=0$ or $x-5=0$

$x\cancel{-5}\cancel{+5}=0+5$ or $x-5+5=0+5$

$x=5$ or $x=5$

Or use Quad formula

$2x^2-20x+50=0$

$a=2,\ b=-20,\ c=50$

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

$$x=\frac{-(-20)\pm\sqrt{(-20)^2-4(2)(50)}}{2(2)}$$

$$x=\frac{20\pm\sqrt{400-400}}{4}$$

$$x=\frac{20\pm\sqrt{0}}{4}$$

$$x=\frac{20\pm 0}{4}$$

$x=\frac{20+0}{4}$ or $x=\frac{20-0}{4}$

$x=\frac{20}{4}$ or $x=\frac{20}{4}$

$x=5$ or $x=5$

5 $\sqrt{3x+25} = x+7$

$(\sqrt{3x+25})^2 = (x+7)^2$

$3x+25 = (x+7)(x+7)$

$3x+25 = x^2+7x+7x+49$

$3x+25 = x^2+14x+49$

$0 = x^2+14x+49-3x-25$

$0 = x^2+11x+24$

$0 = (x+3)(x+8)$

and $x+3=0$ or $x+8=0$

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

$x=-3$ or $\cancel{x=-8}$

CK

Possible

24 · 1

12 · 2

6 · 4

3 · 8

answer

$\boxed{-3}$

$\sqrt{3x+25} = x+7$

$\sqrt{3(-3)+25} = (-3)+7$

$\sqrt{-9+25} = -3+7$

$\sqrt{16} = 4$

$4 = 4$ ✓

Good

$\sqrt{3x+25} = x+7$

$\sqrt{3(-8)+25} = (-8)+7$

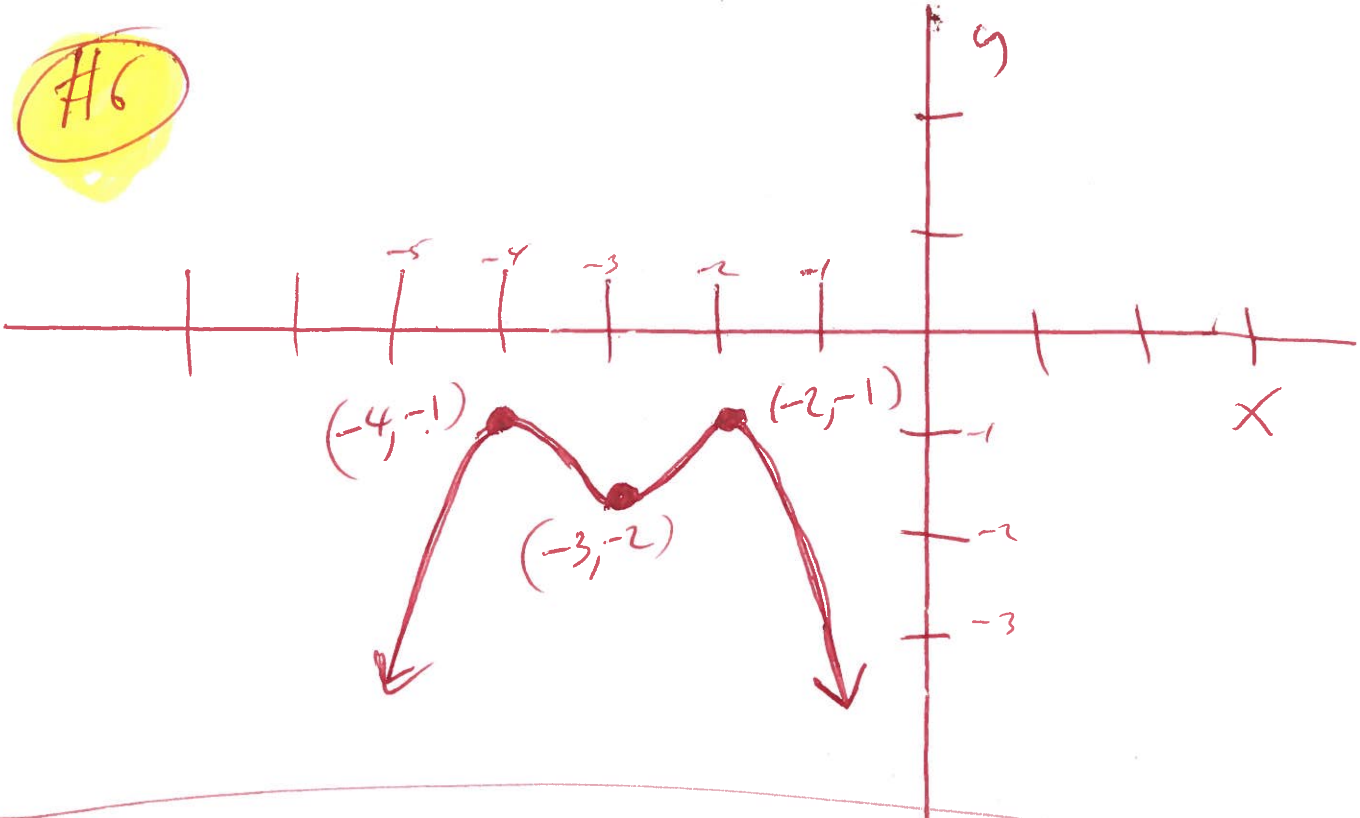
$\sqrt{-24+25} = -8+7$

$\sqrt{1} = -1$

$1 \neq -1$

BAD X

#6



increasing $(-\infty, -4)$, $(-3, -2)$

decreasing $(-4, -3)$, $(-2, \infty)$

function is never constant

#7

$f(x) = 2x^3 - 3x^2 - 12x + 5$

$y_1 = 2x^3 - 3x^2 - 12x + 5$

use graphing calculator.

window

Xmin = −5

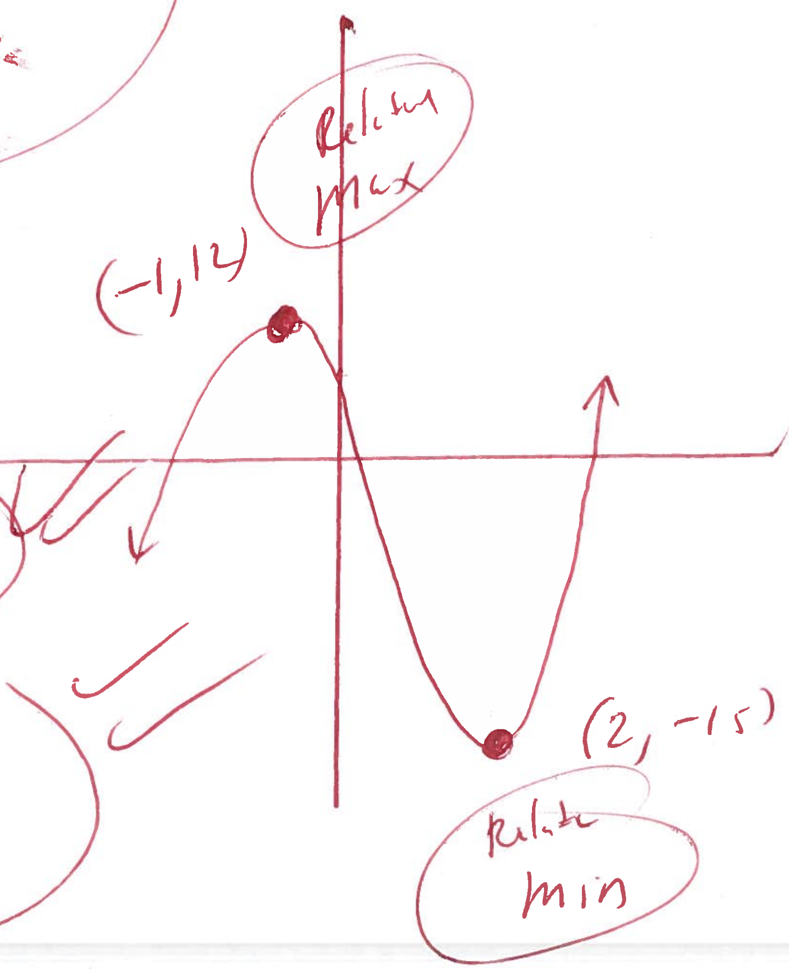
Xmax = 5

Xscl = 1

ymin = −18

ymax = 18

yscl = 2



relative maximum

$x = -1$

relative minimum

$x = 2$

8.

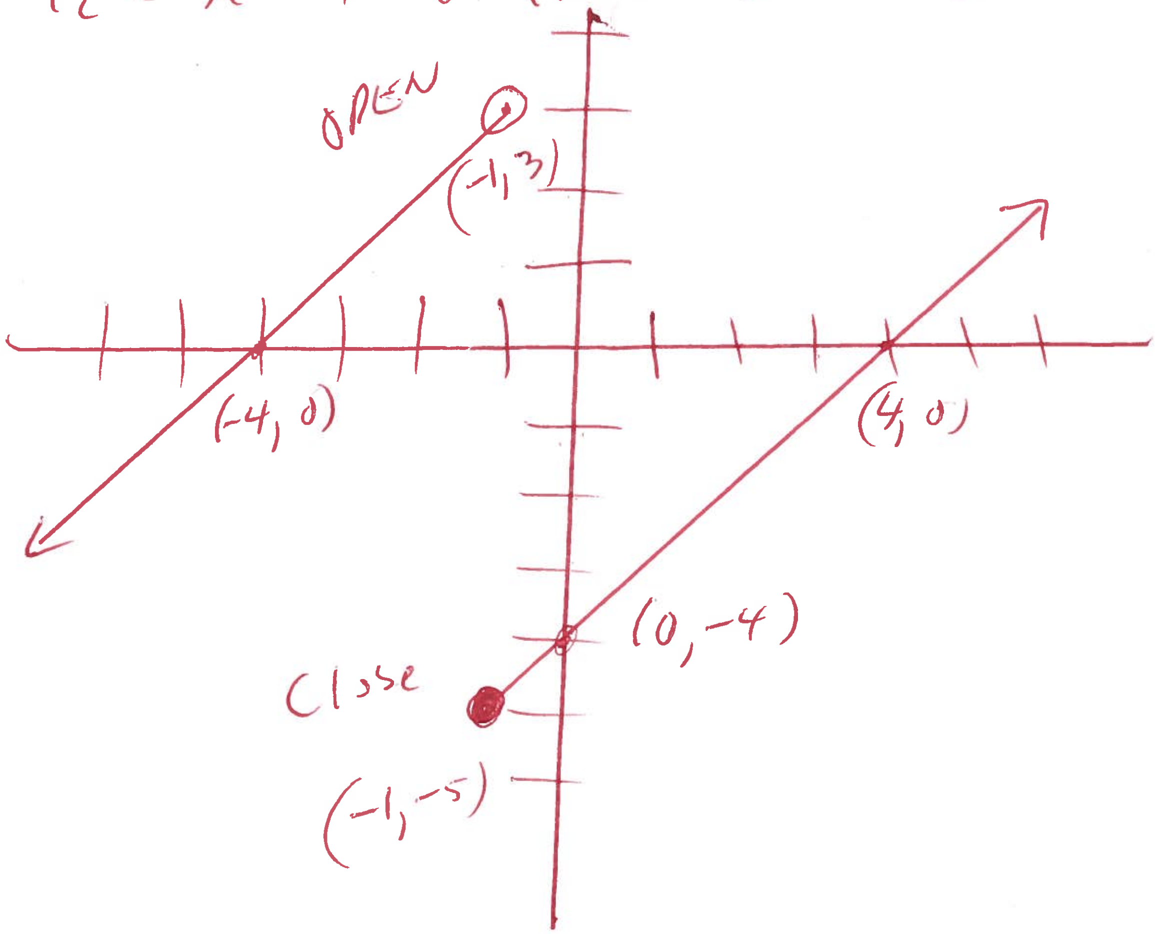
$$f(x) = \begin{cases} x+4 & \text{if } x < -1 \\ x-4 & \text{if } x \geq -1 \end{cases}$$

Graph

use a graphing calculator

$y_1 = x+4 \div (x < -1)$ open

$y_2 = x-4 \div (x \geq -1)$ close



9. $f(x) = x^2 - 7x + 6$

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

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

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

$$\frac{x^2 + xh + xh + h^2 - 7x - 7h + 6 - x^2 + 7x - 6}{h} =$$

$$\frac{\cancel{x^2} + 2xh + h^2 \cancel{- 7x} - 7h \cancel{+ 6} \cancel{- x^2} \cancel{+ 7x} \cancel{- 6}}{h} =$$

$$\frac{2xh + h^2 - 7h}{h} =$$

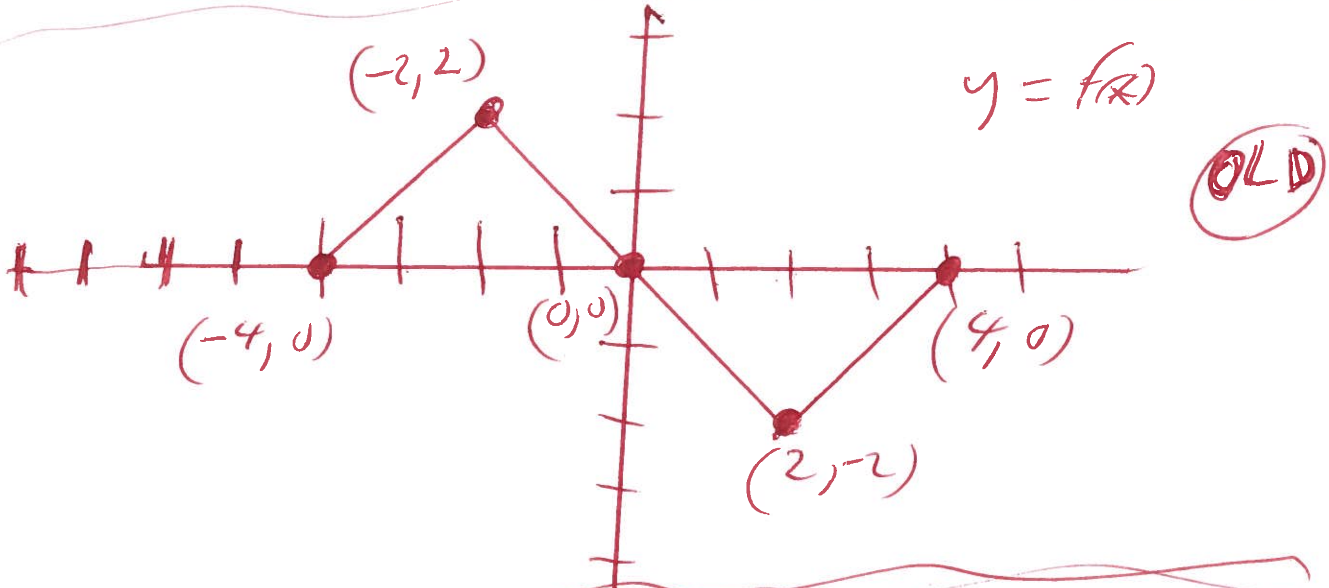
$$\frac{\cancel{h}(2x + h - 7)}{\cancel{h}} =$$

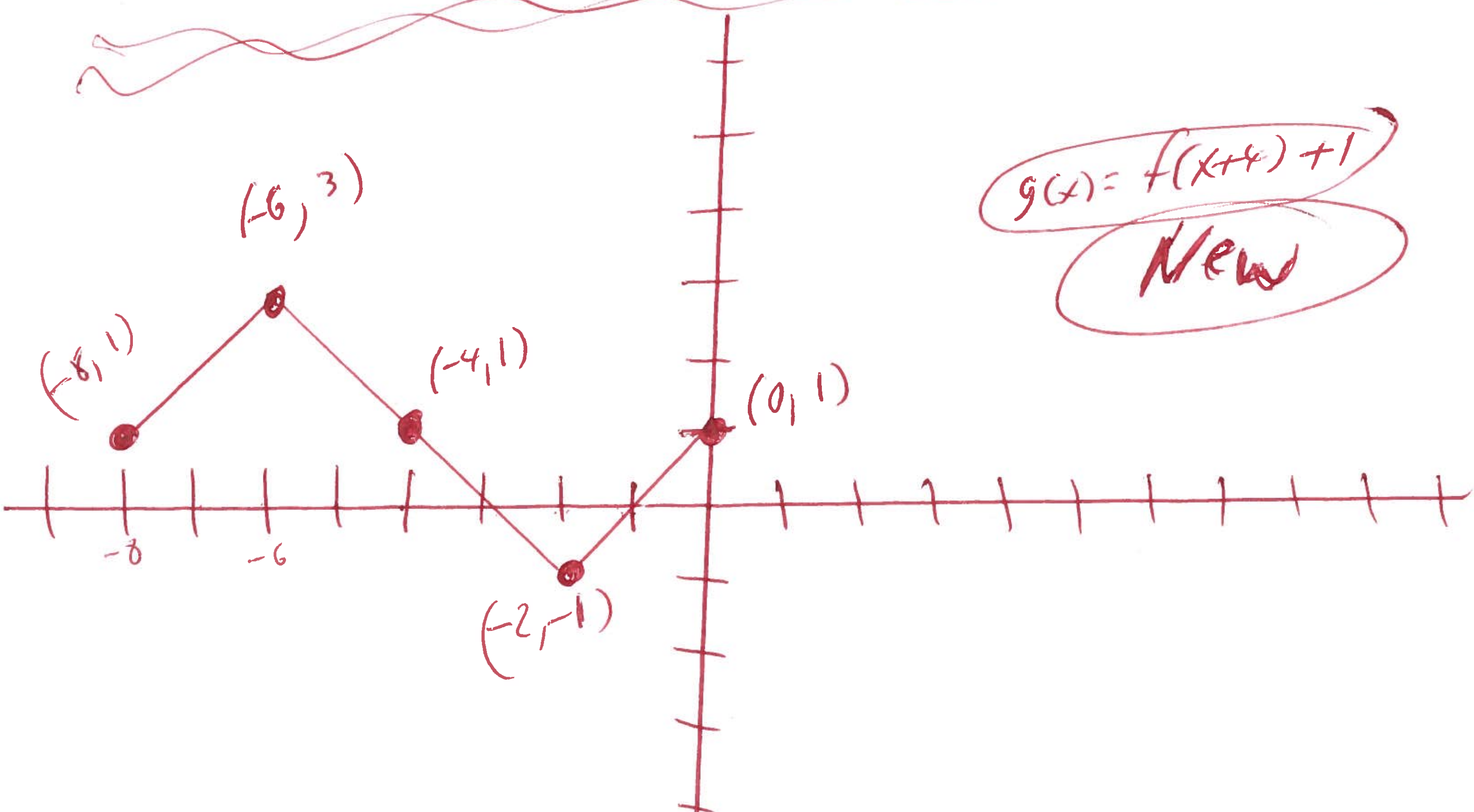
$$2x + h - 7 =$$

(10) Use the graph of $y = f(x)$ to graph the function $g(x) = f(x+4) + 1$

Shift left -4

Shift up 1





11. $f(x)=\sqrt{28-4x}$

set $28-4x \geq 0$

$\cancel{28}-4x-\cancel{28} \geq 0-28$

$-4x \geq -28$

$\frac{-4x}{-4} \leq \frac{-28}{-4}$

divide by a negative
turn the alligator around

$x \leq 7$

$(-\infty, 7]$

formula
domain
$f(x)=\sqrt{Ax+B}$
set $Ax+B \geq 0$

12. $f(x) = 3x^2+6x-9$ and $g(x) = x-1$

$(f+g)(x) =$

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

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

$3x^2+6x-9+x-1 =$

$3x^2+7x-10 =$ domain $(-\infty, \infty)$

$(f-g)(x) =$

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

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

$3x^2+6x-9-x+1 =$

$3x^2+5x-8 =$ domain $(-\infty, \infty)$

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

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

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

$3x^3-3x^2+6x^2-6x-9x+9 =$

$3x^3+3x^2-15x+9 =$ domain $(-\infty, \infty)$

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

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

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

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

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

$3(x+3) =$

or

$3x+9 =$

domain $= (-\infty, 1) \cup (1, \infty)$

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

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

$f(g(x)) =$

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

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

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

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

$g(f(x)) =$

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

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

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

$2(16 - 8x + x^2) + (4-x) + 5 =$

$32 - 16x + 2x^2 + 4 - x + 5 =$

$2x^2 - 17x + 41 =$

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

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

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

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

$(f \circ g)(2) = -8 - 2 - 1$

$(f \circ g)(2) = -11$

$(g \circ f)(x) = 2x^2 - 17x + 41$

$(g \circ f)(2) = 2(2)^2 - 17(2) + 41$

$(g \circ f)(2) = 2(2)(2) - 17(2) + 41$

$(g \circ f)(2) = 2(4) - 17(2) + 41$

$(g \circ f)(2) = 8 - 34 + 41$

$(g \circ f)(2) = 15$

14 $(4, 7)$ and $(13, 19)$ distance

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

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

$$d = \sqrt{((4) - (13))^2 + ((7) - (19))^2}$$

$$d = \sqrt{(4 - 13)^2 + (7 - 19)^2}$$

$$d = \sqrt{(-9)^2 + (-12)^2}$$

$$d = \sqrt{81 + 144}$$

$$d = \sqrt{225}$$

$$d = 15$$

15.

$(6,4)$ and $(8,10)$
$x_1 \quad y_1 \qquad x_2 \quad y_2$

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

$$\text{Midpoint} = \left(\frac{(6)+(8)}{2}, \frac{(4)+(10)}{2}\right)$$

$$\text{Midpoint} = \left(\frac{6+8}{2}, \frac{4+10}{2}\right)$$

$$\text{Midpoint} = \left(\frac{14}{2}, \frac{14}{2}\right)$$

$$\text{Midpoint} = (7, 7)$$

(16) $x^2+y^2+10x+8y+37=0$ graph

$x^2+10x+y^2+8y=-37$ rewrite

Complete the Square

$$x^2+10x+\left(\tfrac{1}{2}(10)\right)^2+y^2+8y+\left(\tfrac{1}{2}(8)\right)^2=-37+\left(\tfrac{1}{2}(10)\right)^2+\left(\tfrac{1}{2}(8)\right)^2$$

$$x^2+10x+(5)^2+y^2+8y+(4)^2=-37+(5)^2+(4)^2$$

$$\underbrace{x^2+10x+25}+\underbrace{y^2+8y+16}=-37+25+16$$

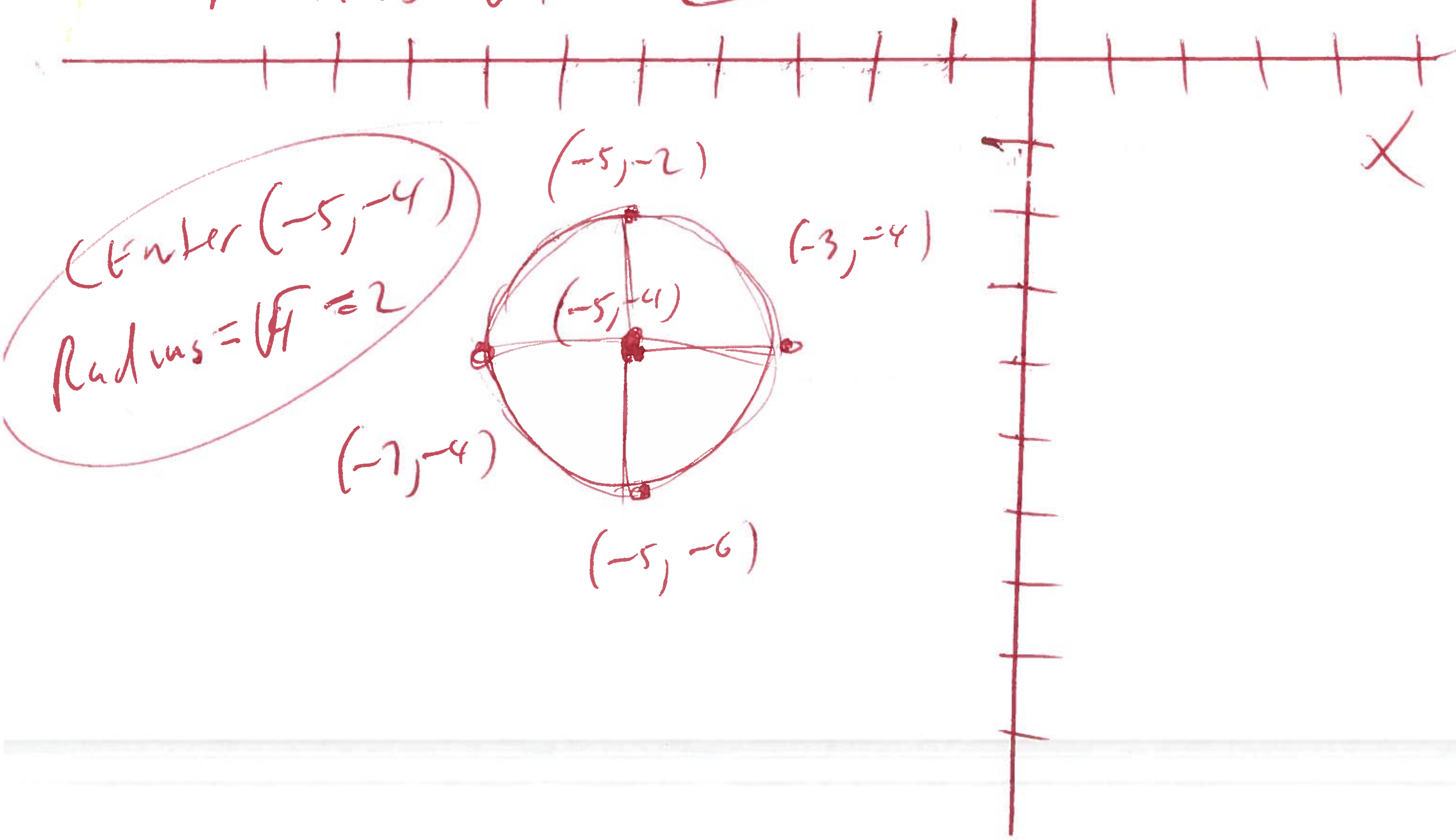
$$(x+5)(x+5)+(y+4)(y+4)=4$$

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

opp opp

Center $=(-5,-4)$

Radius $=\sqrt{4}=2$



17. $f(x) = 3x^2 + 6x + 1$

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

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

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

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

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

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

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

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

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

(18.) $f(x) = -x^2 - 2x + 10$

$a = -1, \quad b = -2, \quad c = 10$

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

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

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

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

$\text{Vertex} = (-1, \ -(-1)^2 - 2(-1) + 10)$

$\text{Vertex} = (-1, \ -(-1)(-1) - 2(-1) + 10)$

$\text{Vertex} = (-1, \ -1 + 2 + 10)$

$\text{Vertex} = (-1, \ 1 + 10)$

$\text{Vertex} = (-1, \ 11)$

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

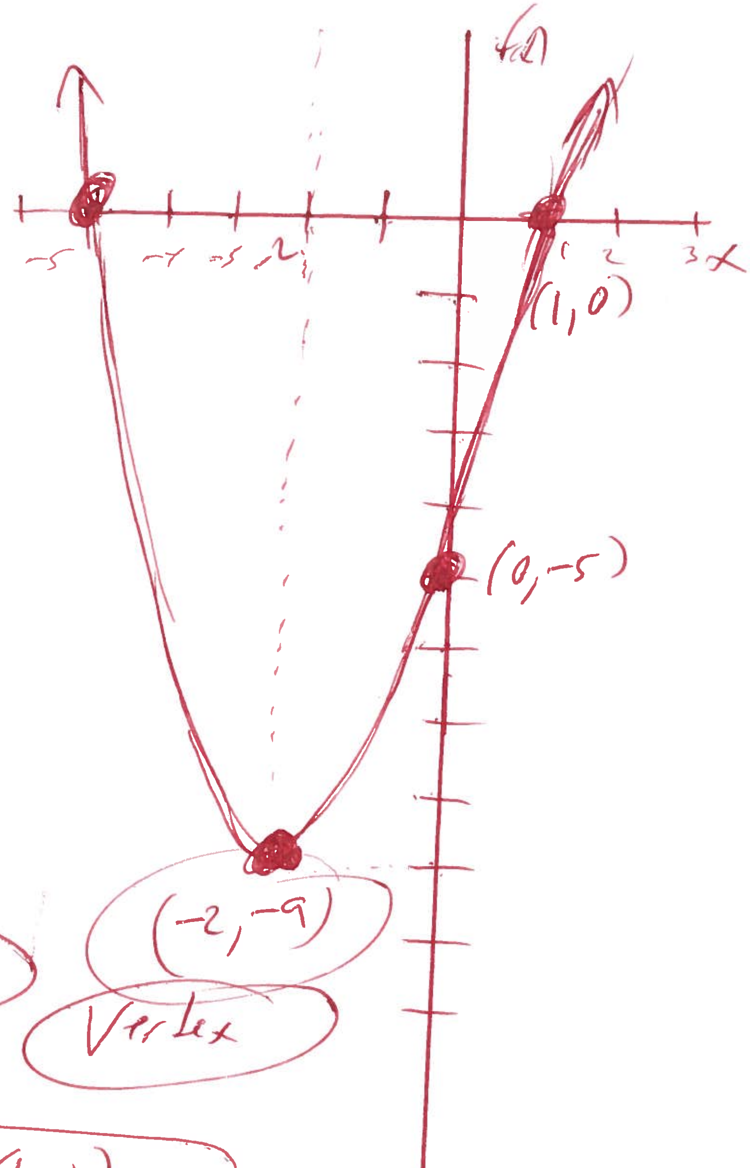
use graphing calculator

shift left -2

shift down -9

$(-5,0)$

$x = -2$ axis of symmetry



domain $(-\infty, \infty)$

range $[-9, \infty)$

x-intercepts = $(-5,0)$ and $(1,0)$

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

Vertex = $(-2,-9)$

20

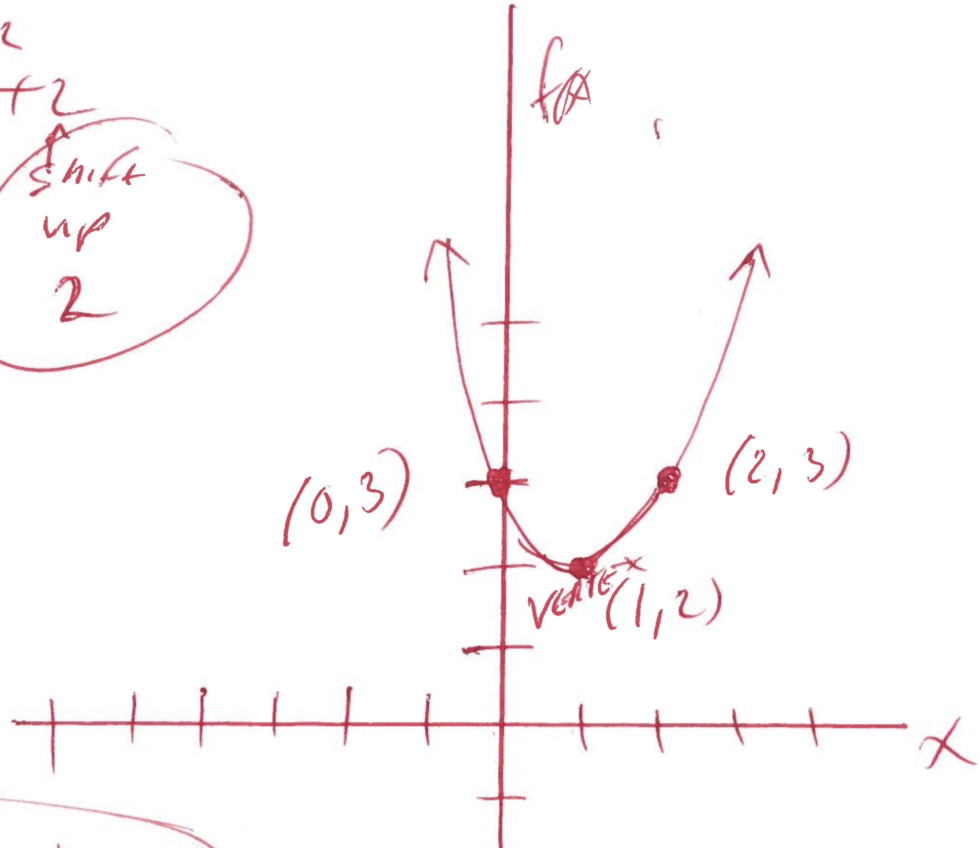
use graphing calculator

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

Shift right 1

Shift up 2

axis of symmetry $x = 1$



domain $(-\infty, \infty)$

range $[2, \infty)$

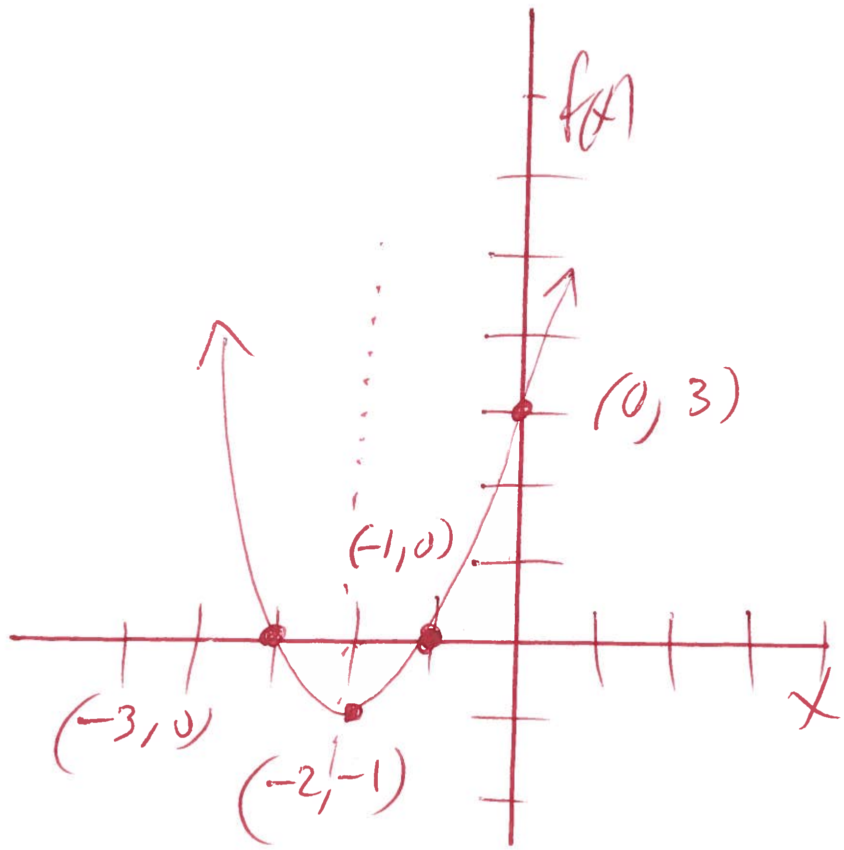
y-intercept = (0, 3)

No x-intercepts

Vertex = (1, 2)

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

Use graphing Calculator



axis of symmetry

$x = -2$

$(-\infty, \infty)$ domain

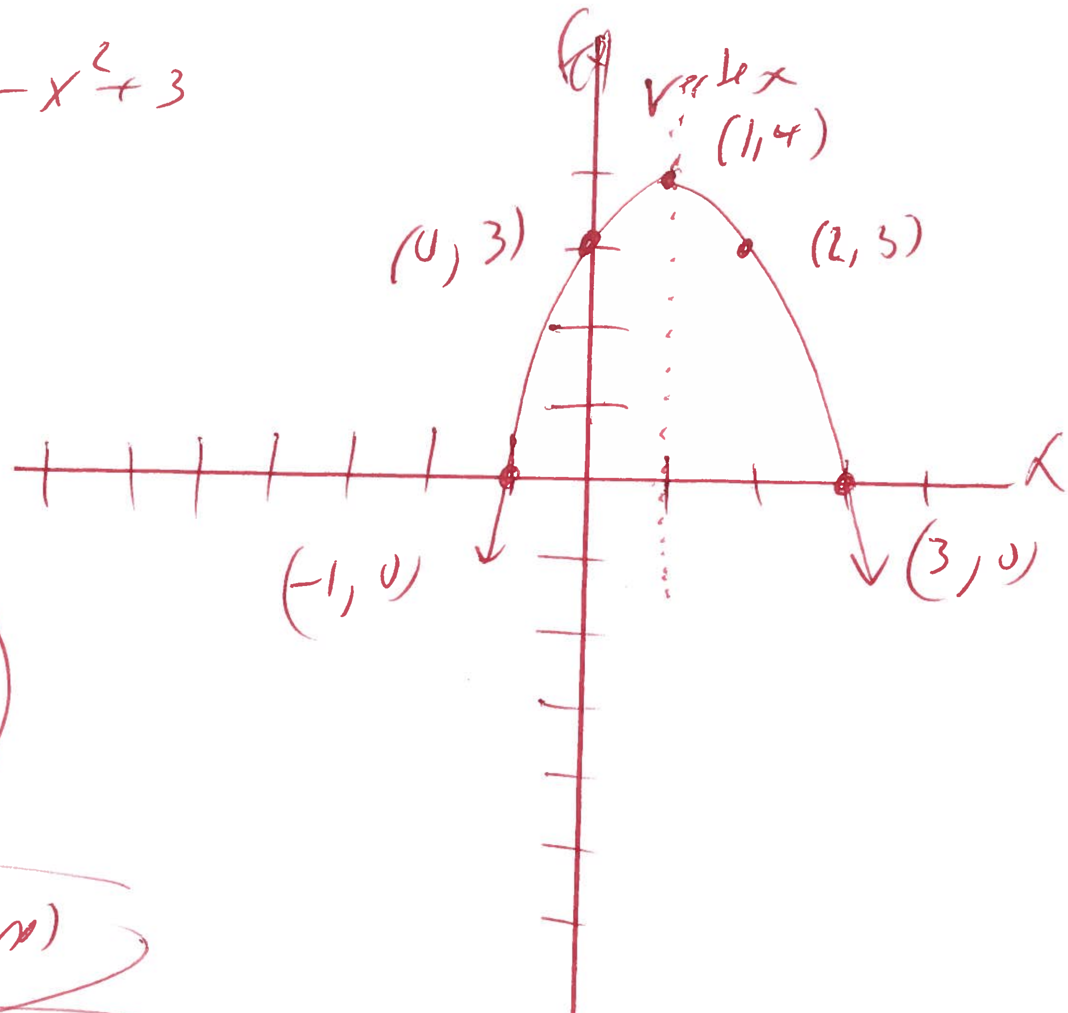
$[-1, \infty)$ range

x-intercepts = $(-3, 0)$ and $(-1, 0)$

y-intercept = $(0, 3)$

Vertex = $(-2, -1)$

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



axis of symmetry

$x = 1$

domain $(-\infty, \infty)$

range $(-\infty, 4]$

x-intercept = $(-1, 0)$ and $(3, 0)$

y-intercept = $(0, 3)$

Vertex = $(1, 4)$

23) $x^3+2x^2-5x-6=0$ given $x=2$ is a zero

use synthetic division

$$\begin{array}{r|rrrr} 2 & 1 & 2 & -5 & -6 \\ & & 2 & 8 & 6 \\ \hline & 1 & 4 & 3 & 0 \end{array}$$ rem

$x^2+4x+3=0$

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

let $x+1=0$ OR $x+3=0$

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

$x=-1$ OR $x=-3$

$\boxed{2, \; -1, \; -3}$

(24)

$f(x) = 7x^3 - 5x^2 - 63x + 45$

List possible rational roots

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

$\frac{45}{7} = \frac{\pm 45, \pm 15, \pm 5, \pm 9, \pm 3, \pm 1}{7}$

$\pm 1, \pm 3, \pm 9, \pm 5, \pm 15, \pm 45, \pm \frac{1}{7}, \pm \frac{3}{7}, \pm \frac{9}{7}, \pm \frac{5}{7}, \pm \frac{15}{7}, \pm \frac{45}{7}$

good

3	7	-5	-63	45
		21	48	-45
	7	16	-15	0 rem

$7x^2 + 16x - 15 = 0$

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

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

$7x - \cancel{5} + \cancel{5} = 0 + 5$ OR $x + 3 - 3 = 0 - 3$

$7x = 5$

$\frac{7x}{7} = \frac{5}{7}$ OR $x = -3$ good ✓

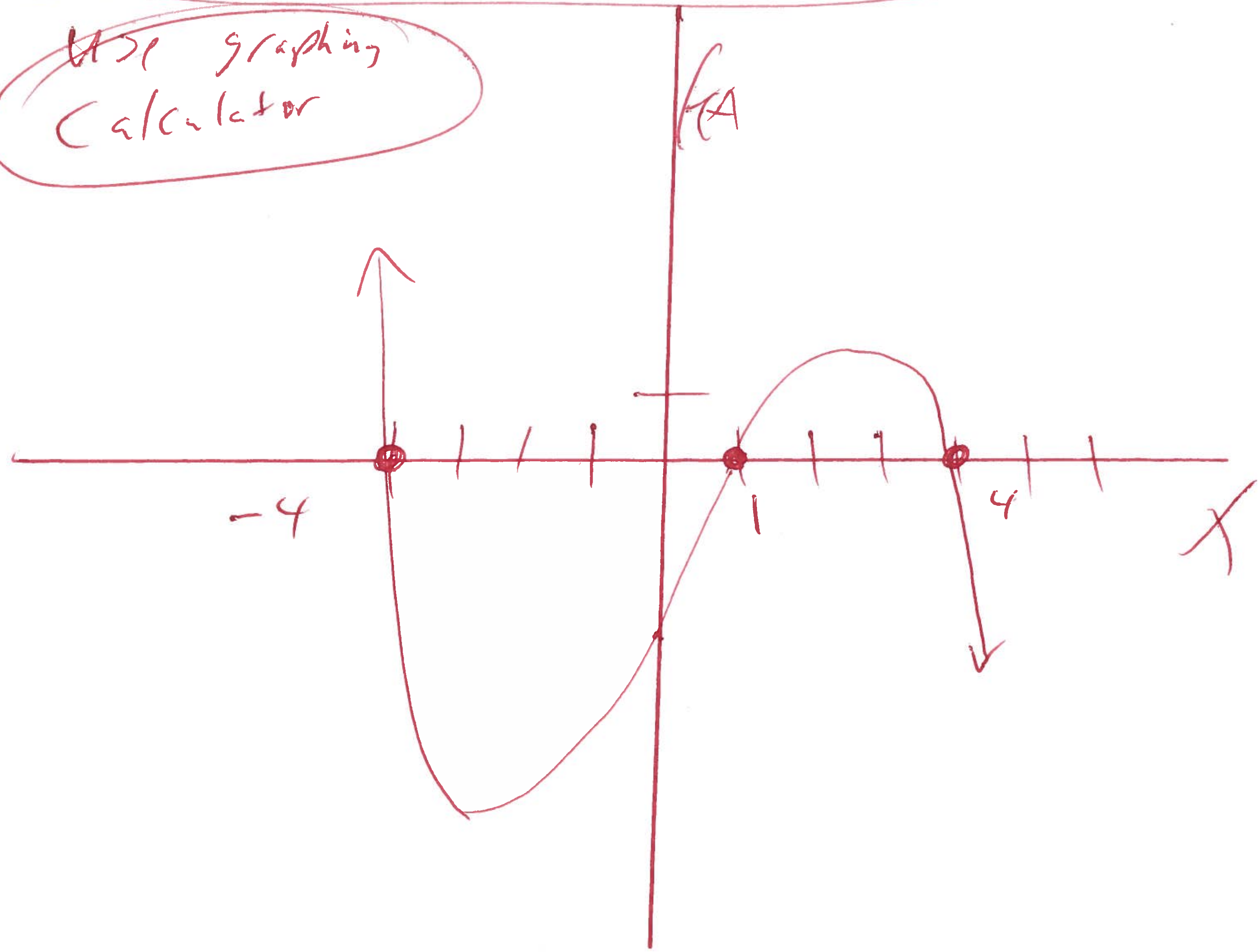
$x = \frac{5}{7}$ good

$\boxed{3, \frac{5}{7}, -3}$

25

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

Use graphing Calculator



26

$$f(x) = \frac{2x^2 - 7x + 3}{x - 6}$$

find slant asymptote

use synthetic division

$$\begin{array}{r|rrr} 6 & 2 & -7 & 3 \\ & & 12 & 30 \\ \hline & 2 & 5 & 33 \end{array}$$

$y = 2x + 5$ Slant Asym

27

$f(x) = \frac{x}{x-3}$ find Vertical asymptote

set $x - 3 = 0$

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

$x = 3$

Vertical asymptote

(28) $f(x) = \dfrac{x-6}{x^2-11x+30}$ find vertical asymptote,

$f(x) = \dfrac{x-6}{(x-5)(x-6)}$

$f(x) = \dfrac{1\cancel{(x-6)}}{(x-5)\cancel{(x-6)}}$

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

hole of graph

$x=6$ hole

$f(x) = \dfrac{1}{x-5}$

set $x-5=0$

$x-5+5=0+5$

$x=5$ vertical asymptote

29.

$f(x) = \dfrac{11x}{3x^2+7}$ find horizontal asymptote

$$\lim_{x\to\infty} \frac{11x}{3x^2+7}$$

$$\lim_{x\to\infty} \left(\frac{11x}{3x^2+7}\right)\frac{\frac{1}{x^2}}{\frac{1}{x^2}}$$ mult

$$\lim_{x\to\infty} \frac{\frac{11x}{x^2}}{\frac{3x^2}{x^2}+\frac{7}{x^2}} =$$

formula

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

$$\lim_{x\to\infty} \frac{\frac{11}{x}}{3+\frac{7}{x^2}}$$

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

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

$0 =$

$y = 0$ horizontal asymptote

30 $g(x) = \dfrac{28x^2}{7x^2+8}$ find horizontal asymptote

$$\lim_{x\to\infty}\left(\frac{28x^2}{7x^2+8}\right) =$$

$$\lim_{x\to\infty}\left(\frac{28x^2}{7x^2+8}\right)\frac{\frac{1}{x^2}}{\frac{1}{x^2}} =$$ Mult

$$\lim_{x\to\infty}\frac{\frac{28x^2}{x^2}}{\frac{7x^2}{x^2}+\frac{8}{x^2}} =$$

formula

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

$$\lim_{x\to\infty}\frac{28}{7+\frac{8}{x^2}} =$$

$$\frac{28}{7+0} =$$

$$\frac{28}{7} =$$

$$4 =$$

$y = 4$ horizontal asymptote

31. $f(x) = \log(13 - x)$

set $13 - x > 0$

$\cancel{13} - x - \cancel{13} > 0 - 13$

$-x > -13$

$\frac{-x}{-1} < \frac{-13}{-1}$ divide by a negative and turn alligator around

$x < 13$

$(-\infty, 13)$

formula domain

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

set $Ax+B > 0$

32

$\log_b\left(\frac{x^2y}{z^3}\right) =$ Expand

$\log_b(x^2y) - \log_b(z^3) =$

$\log_b(x^2) + \log_b(y) - \log_b(z^3) =$

$2\log_b(x) + \log_b(y) - 3\log_b(z) =$

formulas

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

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

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

33. $\ln\left(\frac{x^7\sqrt{x^2+4}}{(x+4)^5}\right) =$

$\ln\left(x^7\sqrt{x^2+4}\right) - \ln(x+4)^5 =$

$\ln(x^7) + \ln\sqrt{x^2+4} - \ln(x+4)^5 =$

$\ln(x^7) + \ln(x^2+4)^{1/2} - \ln(x+4)^5 =$

$7\ln(x) + \frac{1}{2}\ln(x^2+4) - 5\ln(x+4) =$

formulas

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

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

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

34

$27^{x+1} = 243^{x-7}$

$(3^3)^{x+1} = (3^5)^{x-7}$

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

$3x+3 = 5x-35$

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

$3x = 5x-38$

$3x-5x = \cancel{5x}-38-\cancel{5x}$

$-2x = -38$

$\frac{-2x}{-2} = \frac{-38}{-2}$

$x = 19$

formula

$A^x = A^y$

$x = y$

35.

$$9e^{5x} = 1251$$

$$\frac{\cancel{9}e^{5x}}{\cancel{9}} = \frac{1251}{9}$$

$$e^{5x} = \frac{1251}{9}$$

$$\ln\left(e^{5x}\right) = \ln\left(\frac{1251}{9}\right)$$

$$(5x)\ln(e) = \ln\left(\frac{1251}{9}\right)$$

$$(5x)(1) = \ln\left(\frac{1251}{9}\right)$$

$$5x = \ln\left(\frac{1251}{9}\right)$$

$$\frac{\cancel{5}x}{\cancel{5}} = \frac{\ln\left(\frac{1251}{9}\right)}{5}$$

$$x = \frac{\ln\left(\frac{1251}{9}\right)}{5}$$

OR

$$x = \frac{\ln(139)}{5}$$

OR

$$x = 0.9868947866$$

formulas

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

$$\ln(e) = 1$$

OR Round $x = 0.99$

36

$$3^{x+2} = 469$$

formula

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

$$\ln(3^{x+2}) = \ln(469)$$

$$(x+2)\ln(3) = \ln(469)$$

$$\frac{(x+2)\cancel{\ln(3)}}{\cancel{\ln(3)}} = \frac{\ln(469)}{\ln(3)}$$

$$x+2 = \frac{\ln(469)}{\ln(3)}$$

$$x+\cancel{2}-\cancel{2} = \frac{\ln(469)}{\ln(3)} - 2$$

$$x = \frac{\ln(469)}{\ln(3)} - 2$$

OR

$$x = 3.598519907$$

OR

$$x \approx 3.60$$

37

$\log_2(x+20)=2$

format

$\log_b(y)=x$

$b^x=y$

$2^2=x+20$ rewrite

$4=x+20$

$4-20=x+\cancel{20}-\cancel{20}$

$-16=x$

Chk

$\log_2(x+20)=2$

$\log_2(-16+20)=2$

$\log_2(4)=2$

$2^2=4$

$4=4$ ✓ Good

(38.) $\log_8(x) + \log_8(7x-1) = 1$

$\log_8 (x)(7x-1) = 1$

$8^1 = x(7x-1)$

$8 = 7x^2 - x$

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

$0 = (7x-8)(x+1)$

ant $7x - 8 = 0$ OR $x+1=0$

$7x - \cancel{8} + \cancel{8} = 0 + 8$ OR $x+1-1 = 0-1$

$7x = 8$ OR $\cancel{x = -1}$

$\frac{7x}{7} = \frac{8}{7}$

$x = \frac{8}{7}$

$$\boxed{x = \frac{8}{7}}$$

Formula

$\log_8(A) + \log_8(B) =$
$\log_8(AB) =$

$\log_b(y) = x$
$b^x = y$

Ck

$\log_8(x) + \log_8(7x-1) = 1$

$\log_8\left(\frac{8}{7}\right) + \log_8\left(\cancel{7}\left(\frac{8}{\cancel{7}}\right) - 1\right) = 1$

$\log_8\left(\frac{8}{7}\right) + \log_8(8-1) = 1$

$\log_8\left(\frac{8}{7}\right) + \log_8(7) = 1$

Good Good

$\log_8(-1) + \log_8(7(-1)-1) = 1$

$\log_8(-1) + \log_8(-7-1) = 1$

$\log_8(-1) + \log_8(-8) = 1$

BAD BAD

39

$\log_5(x+1) + \log_5(x+121) = 4$

$\log_5 (x+1)(x+121) = 4$

formula:

$\log_5(A) + \log_5(B)$

$\log_5(AB)$

$\log_b(y) = x$

$b^x = y$

$5^4 = (x+1)(x+121)$

$625 = x^2 + 121x + 1x + 121$

$625 = x^2 + 122x + 121$

$0 = x^2 + 122x + 121 - 625$

$0 = x^2 + 122x - 504$

$0 = (x-4)(x+126)$

$x - 4 = 0$ OR $x + 126 = 0$

$x - 4 + 4 = 0 + 4$ OR $x + 126 - 126 = 0 - 126$

$x = 4$ Good OR $\cancel{x = -126}$ BAD

Ck $\log_5(x+1) + \log_5(x+121) = 4$

$\log_5(4+1) + \log_5(4+121) = 4$

$\log_5(5) + \log_5(126) = 4$

Good Good ✓

$\boxed{x = 4}$

$\log_5(-126+1) + \log_5(-126+121) = 4$

$\cancel{\log_5(-125) + \log_5(-5) = 4}$

BAD BAD

40.

$\log_4(x+11) - \log_4(x-4) = 2$

$\log_4\left(\frac{x+11}{x-4}\right) = 2$

Formula

$\log_4(A) - \log_4(B) =$

$\log_4\left(\frac{A}{B}\right) =$

$\log_b(y) = x$

$b^x = y$

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

$16 = \frac{x+11}{x-4}$

$\frac{16}{1} = \frac{x+11}{x-4}$

$16(x-4) = 1(x+11)$

$16x - 64 = 1x + 11$

$16x \cancel{-64+64} = 1x + 11 + 64$

$16x = 1x + 75$

$16x - 1x = \cancel{1x} + 75 \cancel{-1x}$

$15x = 75$

$\frac{15x}{15} = \frac{75}{15}$

$x = 5$

Good

ck

$\log_4(5+11) - \log_4(5-4) = 2$

$\log_4(16) - \log_4(1) = 2$

Good Good

Good

41

$\log(x) + \log(x+2) = \log(63)$

$\log(x)(x+2) = \log(63)$

$x(x+2) = 63$

$x^2 + 2x = 63$

$x^2 + 2x - 63 = 0$

$(x-7)(x+9) = 0$

set $x - 7 = 0$ or $x + 9 = 0$

$x - 7 + 7 = 0 + 7$ or $x + \cancel{9} - \cancel{9} = 0 - 9$

$x = 7$ Good or ~~$x = -9$ BAD~~

Ck

$\log(x) + \log(x+2) = \log(63)$

$\log(7) + \log(7+2) = \log(63)$

$\log(7) + \log(9) = \log(63)$

Good Good Good

$\boxed{x = 7}$

formulas

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

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

$A = B$

$\log_b(y) = x$

$b^x = y$

$\log(-9) + \log(-9+2) = \log(63)$

~~$\log(-9) + \log(-7) = \log(63)$~~

BAD BAD

(42) $A = 15.7e^{0.0409t}$

$A = 15.7e^{(0.0409(0))}$

$A = 15.7$

Since YEAR 2000 is 0

population of State in 2000

15.7 million

$18.7 = 15.7e^{0.0409t}$

$\frac{18.7}{15.7} = \frac{\cancel{15.7}e^{0.0409t}}{\cancel{15.7}}$

Formula $\ln(e) = 1$

$1.191082803 = e^{0.0409t}$

$\ln(1.191082803) = \ln(e^{0.0409t})$

$\ln(1.191082803) = 0.0409t \ln(e)$

$\ln(1.191082803) = 0.0409t(1)$

$\ln(1.191082803) = 0.0409t$

$\frac{\ln(1.191082803)}{0.0409} = \frac{\cancel{0.0409}t}{\cancel{0.0409}}$

$4.275374374 = t$

YEAS

~~add~~ to 2000

$$\begin{array}{r} 2000 \\ +\ 4 \\ \hline 2004 \end{array}$$

YEAR

43

$A = P\left(1+\frac{r}{n}\right)^{nt}$

Formula

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

$23000 = 14500\left(1+\frac{.045}{2}\right)^{2t}$

$23000 = 14500(1+.0225)^{2t}$

$23000 = 14500(1.0225)^{2t}$

$\frac{23000}{14500} = \frac{\cancel{14500}(1.0225)^{2t}}{\cancel{14500}}$

$1.5862068 = (1.0225)^{2t}$

$\ln(1.5862068) = \ln(1.0225)^{2t}$

$\ln(1.5862068) = 2t\ln(1.0225)$

$\frac{\ln(1.5862068)}{\ln(1.0225} = \frac{2t\cancel{\ln(1.0225)}}{\cancel{\ln(1.0225)}}$

$20.73406202 = 2t$

$\frac{20.73406202}{2} = \frac{2t}{2}$

$10.36703101 = t$

OR

$10.4 = t$ Round

44

$A = 16e^{-0.000121t}$

$t = 9692$

2ND LN

$A = 16\,e^{\wedge}(-0.000121(9692))$

$A = 4.952322816$

OR

$A \equiv 5$ round

Use graphing calculator

45

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

$29 = 100 e^{-0.000121t}$

$\frac{29}{100} = \frac{\cancel{100} e^{-0.000121t}}{\cancel{100}}$

$.29 = e^{-0.000121t}$

$\ln(.29) = \ln(e^{-0.000121t})$

$\ln(.29) = -0.000121t \ln(e)$

$\ln(.29) = -0.000121t\,(1)$

$\ln(.29) = -0.000121t$

$\frac{\ln(.29)}{-0.000121} = \frac{\cancel{-0.000121} t}{\cancel{-0.000121}}$

$10230.36658 = t$

OR Round

$10,230 = t$

formula

$\ln(A^N)$

$N \ln(A)$

$\ln(e) =$

$1 =$

46

$A = 3e^{0.003t}$

double time formula

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

$\ln(e) = 1 =$

$6 = 3e^{0.003t}$

$\frac{6}{3} = \frac{3e^{0.003t}}{3}$

$2 = e^{0.003t}$

$\ln(2) = \ln(e^{0.003t})$

$\ln(2) = 0.003t \ln(e)$

$\ln(2) = 0.003t\ (1)$

$\ln(2) = 0.003t$

$\frac{\ln(2)}{0.003} = \frac{\cancel{0.003}t}{\cancel{0.003}}$

$231.0490602 = t$

OR Round

$231 = t$

(47)

$$x+y+8z=-22$$
$$x+y+4z=-10$$
$$x-7y+7z=-11$$

2ND
matrix
edit
$[A] =$
3x4

$$\begin{bmatrix} 1 & 1 & 8 & -22 \\ 1 & 1 & 4 & -10 \\ 1 & -7 & 7 & -11 \end{bmatrix}$$

2ND
matrix
Math
↓
rref

Use a graphing Calculator

$\text{rref}([A]) =$

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

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

48

$$a_n = \frac{2n}{n+5}$$

$$a_1 = \frac{2(1)}{(1)+5} = \frac{2}{1+5} = \frac{2}{6} = \frac{\cancel{2}(1)}{\cancel{2}(3)} = \frac{1}{3}$$

$$a_2 = \frac{2(2)}{(2)+5} = \frac{4}{2+5} = \frac{4}{7}$$

$$a_3 = \frac{2(3)}{(3)+5} = \frac{6}{3+5} = \frac{6}{8} = \frac{\cancel{2}(3)}{\cancel{2}(4)} = \frac{3}{4}$$

$$a_4 = \frac{2(4)}{(4)+5} = \frac{8}{4+5} = \frac{8}{9}$$

49

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

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

$1(2) + 2(3) + 3(4) + 4(5) =$

$2 + 6 + 12 + 20 =$

$40 =$

OR use a graphing Calculator

50

$(3x-2)^3 =$

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

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

$(1)(27x^3)(1) + (3)(9x^2)(-2) + (3)(3x)(4) + (1)(1)(-8) =$

$27x^3 - 54x^2 + 36x - 8$

Useing graphing calculator

3, math, Prb, ncr, 0 = 1

3, math, Prb, ncr, 1 = 3

3, math, Prb, ncr, 2 = 3

3, math, Prb, ncr, 3 = 1

51.

$(x+7)^6$

${}_6C_0(x)^6(7)^0 + {}_6C_1(x)^5(7)^1 + {}_6C_2(x)^4(7)^2 =$

$(1)(x^6)(1) + (6)(x^5)(7) + (15)(x^4)(49) =$

$x^6 + 42x^5 + 735x^4 =$

Use a graphing Calculator

6, Math, Prb, ncr, 0 = 1

6, Math, Prb, ncr, 1 = 6

6, Math, Prb, ncr, 2 = 15