1. $x^2-5x-36=0$

$(x+4)(x-9)=0$

let $x+4=0$ OR $x-9=0$

$x+4-4=0-4$ OR $x-9+9=0+9$

$x=-4$ OR $x=9$

361
18.2
12.3
4.9

Ross s.64

www.wwe Math 13/1457 step 0324180

Use Quadratic formula

$1x^2-5x-36=0$

$a=1,\ b=-5,\ c=-36$

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

$$x=-\frac{(-5)\pm\sqrt{(-5)^2-4(1)(-36)}}{2(1)}$$

$$x=\frac{5\pm\sqrt{25+144}}{2}$$

$$x=\frac{5\pm\sqrt{169}}{2}$$

$$x=\frac{5\pm 13}{2}$$

$x=\frac{5+13}{2}$ or $x=\frac{5-13}{2}$

$x=\frac{18}{2}$ or $x=\frac{-8}{2}$

$x=9$ OR $x=-4$

$\{9,-4\}$

2. $x^2 = 3x + 40$

$x^2 - 3x - 40 = 0$

$(x + 5)(x - 8) = 0$

$x + 5 = 0$ or $x - 8 = 0$

$x + 5 - 5 = 0 - 5$ or $x - 8 + 8 = 0 + 8$

$x = -5$ or $x = 8$

40 · 1
20 · 2
10 · 4
8 · 5
Possible

USE Quadratic formula

$1x^2 - 3x - 40 = 0$

$a = 1, b = -3, c = -40$

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

$$x = \frac{-(-3) \pm \sqrt{(-3)^2 - 4(1)(-40)}}{2(1)}$$

$$x = \frac{3 \pm \sqrt{9 + 160}}{2}$$

$$x = \frac{3 \pm \sqrt{169}}{2}$$

$$x = \frac{3 \pm 13}{2}$$

$x = \frac{3 - 13}{2}$ or $x = \frac{3 + 13}{2}$

$x = \frac{-10}{2}$ or $x = \frac{16}{2}$

$x = -5$ or $x = 8$

$\{-5, 8\}$

3. $9x^2+21x-8=0$

$(3x-1)(3x+8)=0$

Possible: $9\cdot1, 3\cdot3$ / $8\cdot1, 2\cdot4$

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

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

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

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

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

$\left\{\frac{1}{3}, -\frac{8}{3}\right\}$

Use Quadratic formula

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

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

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

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

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

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

$x=\frac{-21\pm27}{18}$

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

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

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

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

(4) $8x^2+10x-7=0$ (8.1) (7.1) Possible (4.2)

$(4x+7)(2x-1)=0$

Let $4x+7=0$ or $2x-1=0$

$4x+7-7=0-7$ or $2x-1+1=0+1$

$4x=-7$ or $2x=1$

$\frac{4x}{4}=\frac{-7}{4}$ or $\frac{2x}{2}=\frac{1}{2}$

$x=\frac{-7}{4}$ or $x=\frac{1}{2}$

$\left\{\frac{-7}{4}, \frac{1}{2}\right\}$

Use Quadratic formula

$8x^2+10x-7=0$

$a=8,\ b=10,\ c=-7$

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

$x=\frac{-(10)\pm\sqrt{(10)^2-4(8)(-7)}}{2(8)}$

$x=\frac{-10\pm\sqrt{100+224}}{16}$

$x=\frac{-10\pm\sqrt{324}}{16}$

$x=\frac{-10\pm 18}{16}$

$x=\frac{-10-18}{16}$ or $x=\frac{-10+18}{16}$

$x=\frac{-28}{16}$ OR $x=\frac{8}{16}$

$x=\frac{4(-7)}{4(4)}$ OR $x=\frac{8(1)}{8(2)}$

$x=\frac{-7}{4}$ OR $x=\frac{1}{2}$

5. $2x^2 = 3x + 35$

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

$(2x + 7)(x - 5) = 0$

Let $2x + 7 = 0$ or $x - 5 = 0$

$2x + 7 - 7 = 0 - 7$ OR $x - 5 + 5 = 0 + 5$

$2x = -7$ OR $x = 5$

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

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

2, 1 — 35, 1 — 7, 5 — Possible

$\{-\frac{7}{2}, 5\}$

Use Quadratic Formula

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

$a = 2, \; b = -3, \; c = -35$

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

$x = \frac{-(-3) \pm \sqrt{(-3)^2 - 4(2)(-35)}}{2(2)}$

$x = \frac{3 \pm \sqrt{9 + 280}}{4}$

$x = \frac{3 \pm \sqrt{289}}{4}$

$x = \frac{3 \pm 17}{4}$

$x = \frac{3 - 17}{4}$ or $x = \frac{3 + 17}{4}$

$x = -\frac{14}{4}$ or $x = \frac{20}{4}$

$x = \frac{2(-7)}{2(2)}$ or $x = 5$

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

(6) $4x^2 = 15x + 25$

$4x^2 - 15x - 25 = 0$

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

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

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

$4x=-5$ OR $x=5$

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

$x = -5/4$

4, 1 — 2, 2 — 25, 1 — 5, 5 Possible

$\{-\frac{5}{4}, 5\}$

Use Quadratic formula

$4x^2 - 15x - 25 = 0$

$a=4,\ b=-15,\ c=-25$

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

$x = \frac{-(-15) \pm \sqrt{(-15)^2 - 4(4)(-25)}}{2(4)}$

$x = \frac{15 \pm \sqrt{225+400}}{8}$

$x = \frac{15 \pm \sqrt{625}}{8}$

$x = \frac{15 \pm 25}{8}$

$x = \frac{15-25}{8}$ OR $x = \frac{15+25}{8}$

$x = \frac{-10}{8}$ OR $x = \frac{40}{8}$

$x = \frac{1}{2}(-5)$ OR $x = 5$

$x = -5/4$

7. $7x^2+14x=0$

Possible 7.2

$7x(x+2)=0$

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

$\frac{7x}{7}=\frac{0}{7}$ or $x+2-2=0-2$

$x=0$ or $x=-2$

$\{0,-2\}$

Use Quadratic Formula

$7x^2+14x+0=0$ rewrite

$a=7,\ b=14,\ c=0$

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

$x=\frac{-(14)\pm\sqrt{(14)^2-4(7)(0)}}{2(7)}$

$x=\frac{-14\pm\sqrt{196-0}}{14}$

$x=\frac{-14\pm\sqrt{196}}{14}$

$x=\frac{-14\pm14}{14}$

$x=\frac{-14+14}{14}$ or $x=\frac{-14-14}{14}$

$x=\frac{0}{14}$ or $x=\frac{-28}{14}$

$x=0$ or $x=\frac{14(-2)}{14(1)}$

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

$x=-2$

8. $x^2 - 4x = -2$

$1x^2 - 4x + 2 = 0$

$a=1,\ b=-4,\ c=2$

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

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

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

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

$$x = \frac{4 \pm \sqrt{4 \cdot 2}}{2}$$

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

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

$x = 2 \pm 1\sqrt{2}$

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

$x = 2 + \sqrt{2}$ or $x = 2 - \sqrt{2}$

Primes 2, 3, 5, 7, ...

2 | 8
2 | 4
2 | 2
1

$\{2+\sqrt{2},\ 2-\sqrt{2}\}$

⑦ $1x^2 - 10x + 61 = 0$

$a = 1,\ b = -10,\ c = 61$

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

$$x = \frac{-(-10) \pm \sqrt{(-10)^2 - 4(1)(61)}}{2(1)}$$

$$x = \frac{10 \pm \sqrt{100 - 244}}{2}$$

$$x = \frac{10 \pm \sqrt{-144}}{2}$$

$$x = \frac{10 \pm 12i}{2}$$

$$x = 5 \pm 6i$$

$\{5+6i,\ 5-6i\}$

$x = 5 + 6i$ or $x = 5 - 6i$

10. $3x^2-42x+147=0$

$3(x^2-14x+49)=0$

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

$3=0$ or $x-7=0$ or $x-7=0$

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

$x=7$ or $x=7$

possible 49, 1, 7, 7

Use Quadratic formula

$3x^2-42x+147=0$

$a=3,\ b=-42,\ c=147$

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

$$x=\frac{-(-42)\pm\sqrt{(-42)^2-4(3)(147)}}{2(3)}$$

$$x=\frac{42\pm\sqrt{1764-1764}}{6}$$

$$x=\frac{42\pm\sqrt{0}}{6}$$

$$x=\frac{42\pm0}{6}$$

$$x=\frac{42-0}{6} \text{ or } x=\frac{42+0}{6}$$

$$x=\frac{42}{6} \text{ or } x=\frac{42}{6}$$

$x=7$ or $x=7$

$\{7\}$

11. $\sqrt{5x+46} = x+8$

$(\sqrt{5x+46})^2 = (x+8)^2$

$5x+46 = (x+8)(x+8)$

$5x+46 = x^2+8x+8x+64$

$5x+46 = x^2+16x+64$

$0 = x^2+16x+64-5x-46$

$0 = x^2+11x+18$

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

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

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

$x = -2$ OR $x = -9$

18.1
9.2
6.3
Possible

{-2}

Ck $x=-2$ Good

$\sqrt{5x+46} = x+8$

$\sqrt{5(-2)+46} = (-2)+8$

$\sqrt{-10+46} = -2+8$

$\sqrt{36} = 6$

$6 = 6$ ✓

Good

Ck $x=-9$ BAD

$\sqrt{5x+46} = x+8$

$\sqrt{5(-9)+46} = (-9)+8$

$\sqrt{-45+46} = -9+8$

$\sqrt{1} = -1$

$1 \neq -1$

BAD

12. $f(x) = \begin{cases} x+2 \text{ if } x<4 \\ x-2 \text{ if } x \geq 4 \end{cases}$ graph

$f(0) = (0)+2$
$F(0) = 0+2$
$F(0) = 2$

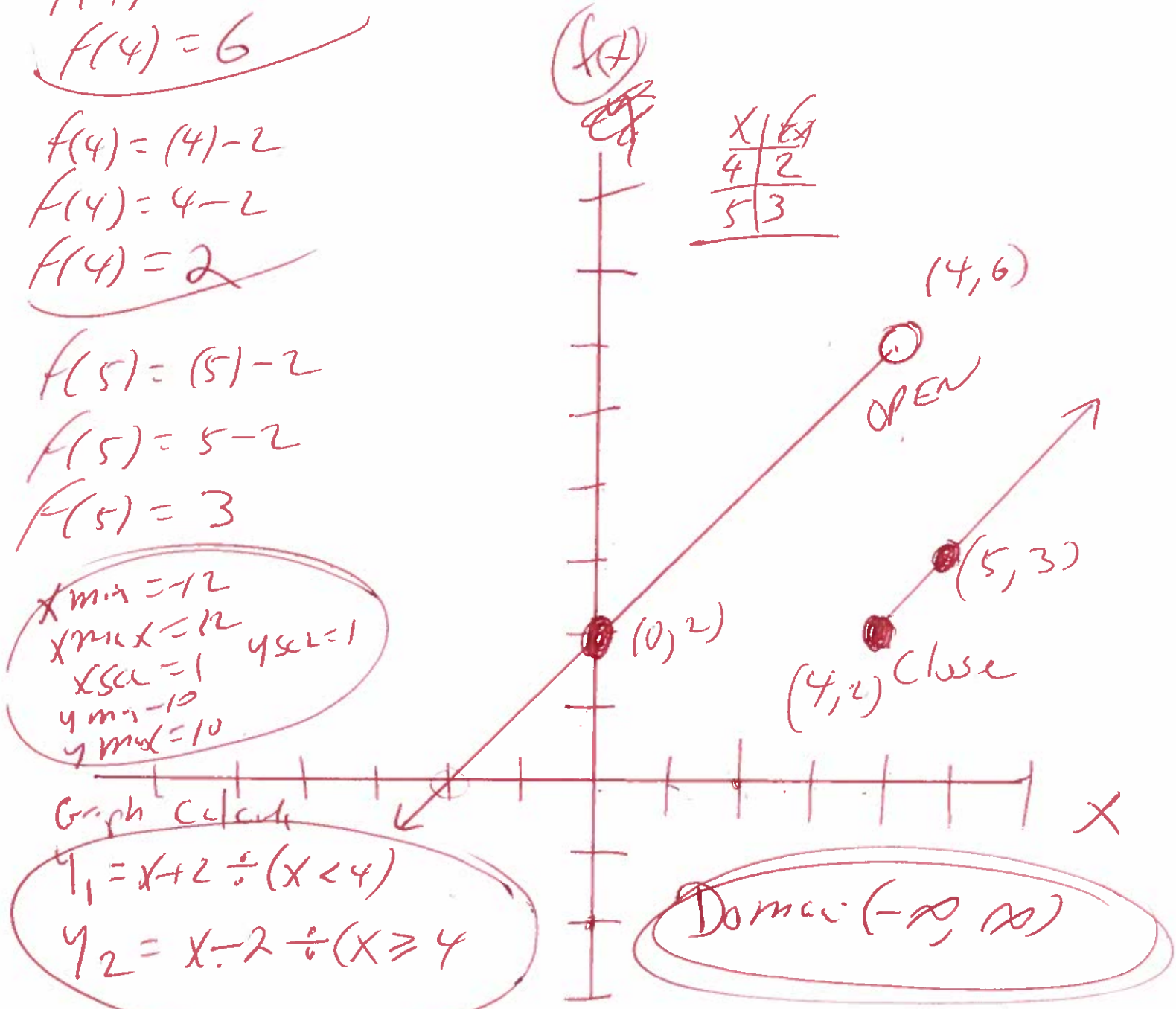
$f(4) = (4)+2$
$f(4) = 4+2$
$f(4) = 6$

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

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

x	f(x)	
0	2	
4	6	NOT / OPEN

x	f(x)
4	2
5	3



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

Graph Calculator
$Y_1 = X+2 \div (X<4)$
$Y_2 = X-2 \div (X \geq 4$

Domain $(-\infty, \infty)$

13 $f(x) = x^2 - 2x + 2$

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

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

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

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

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

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

$$2x + h - 2 =$$

14. $f(x) = \sqrt{20 - 4x}$ find domain

let

$20 - 4x \geq 0$

$20 - 4x - 20 \geq 0 - 20$

$-4x \geq -20$

$\frac{-4x}{-4} \leq \frac{-20}{-4}$

$x \leq 5$

$(-\infty, 5]$

formula

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

let $Ax + B \geq 0$

15. $f(x) = 2x^2 + 24x + 64$, $g(x) = x + 8$

find $f+g$, $f-g$, fg, $\frac{f}{g}$

$(f+g)(x) =$

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

$(2x^2 + 24x + 64) + (x + 8) =$

$2x^2 + 24x + 64 + x + 8 =$

$2x^2 + 25x + 72 =$ domain $(-\infty, \infty)$

$(f-g)(x) =$

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

$(2x^2 + 24x + 64) - (x + 8) =$

$2x^2 + 24x + 64 - x - 8 =$

$2x^2 + 23x + 56 =$ domain $(-\infty, \infty)$

$(fg)(x) =$

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

$(2x^2 + 24x + 64)(x + 8) =$

$2x^3 + 16x^2 + 24x^2 + 192x + 64x + 512 =$

$2x^3 + 40x^2 + 256x + 512 =$ domain $(-\infty, \infty)$

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

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

$\frac{2x^2 + 24x + 64}{x + 8} =$

$\frac{2(x^2 + 12x + 32)}{x + 8} =$

$\rightarrow \frac{2(x+4)(x+8)}{(x+8)} =$

$2(x+4) =$

$2x + 8 =$

$x \neq -8$

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

motio

16) $f(x) = 1 - x$ and $g(x) = 2x^2 + x + 2$

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

$f(g(x)) =$

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

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

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

$-2x^2 - x - 1 =$ ✓

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

$g(f(x)) =$

$g(1 - x) =$

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

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

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

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

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

$2x^2 - 5x + 5 =$ ✓

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

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

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

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

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

$(f \circ g)(2) = -10 - 1$

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

$(g \circ f)(x) = 2x^2 - 5x + 5$

$(g \circ f)(2) = 2(2)^2 - 5(2) + 5$

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

$(g \circ f)(2) = 2(4) - 5(2) + 5$

$(g \circ f)(2) = 8 - 10 + 5$

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

$(g \circ f)(2) = 3$

(17) (4, 5) and (16, 14) Find distance

$x_1\ y_1 \qquad x_2\ y_2$

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

$$d = \sqrt{((4) - (16))^2 + ((5) - (14))^2}$$

$$d = \sqrt{(4 - 16)^2 + (5 - 14)^2}$$

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

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

$$d = \sqrt{225}$$

$$d = 15$$

18. $(4, 10)$ and $(2, 8)$ Find Midpoint

$x_1 \; y_1 \qquad x_2 \; y_2$

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

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

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

$$\text{Midpoint} = \left(\frac{6}{2}, \frac{18}{2} \right)$$

$$\text{Midpoint} = (3, 9)$$

19

$x^2+y^2+4x+6y+9=0$ Graph

$x^2+4x+y^2+6y = -9$

$x^2+4x+\left(\frac{1}{2}(4)\right)^2+y^2+6y+\left(\frac{1}{2}(6)\right)^2 = -9+\left(\frac{1}{2}(4)\right)^2+\left(\frac{1}{2}(6)\right)^2$

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

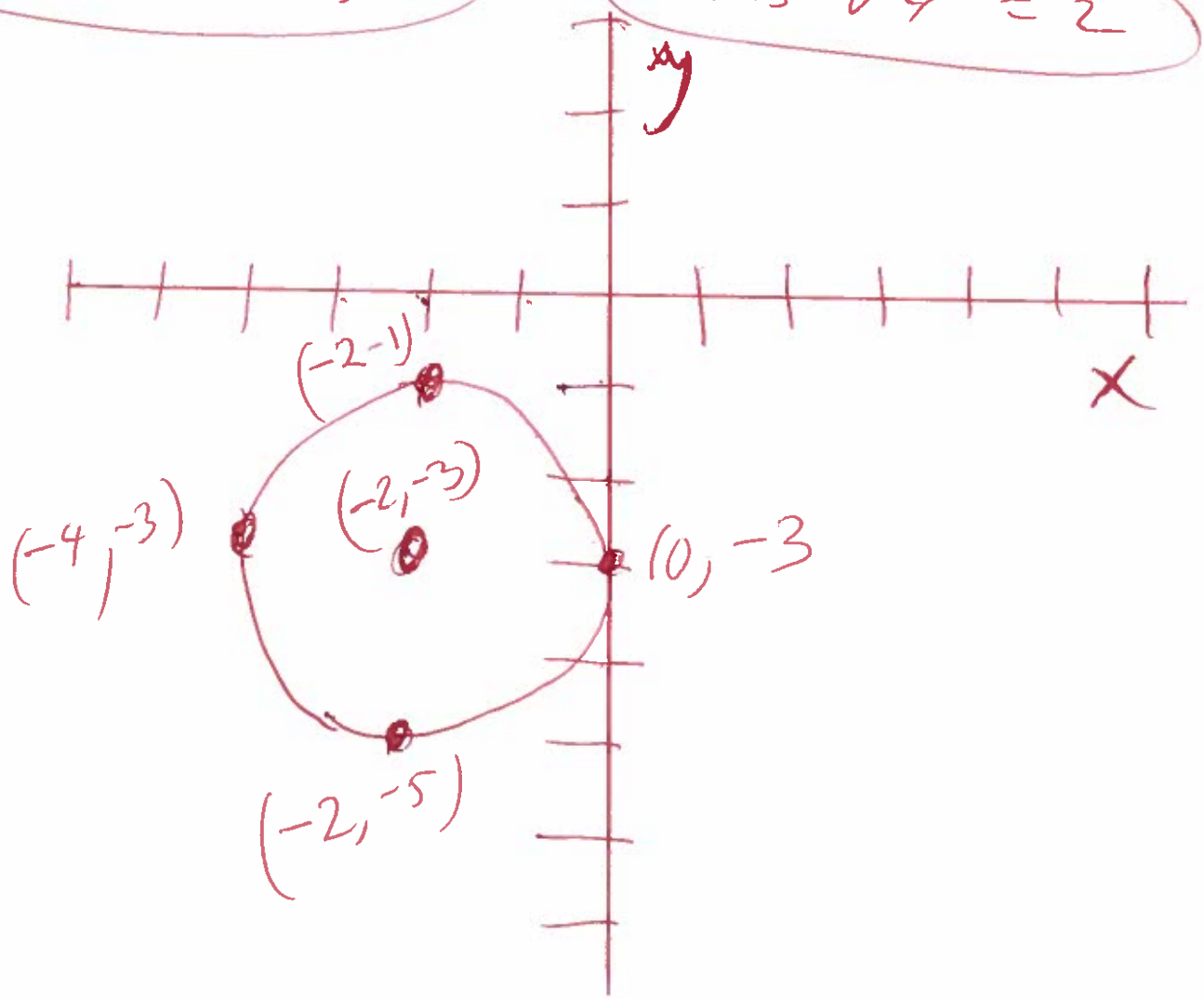
$x^2+4x+4+y^2+6y+9 = -9+4+9$

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

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

CENTER $= (-2,-3)$

Radius $= \sqrt{4} = 2$



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

Graph

shift right 2

shift up 3

x	f(x)
1	4
2	3
3	4

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

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

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

$f(1) = 1 + 3$

$f(1) = 4$

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

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

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

$f(2) = 0 + 3$

$f(2) = 3$

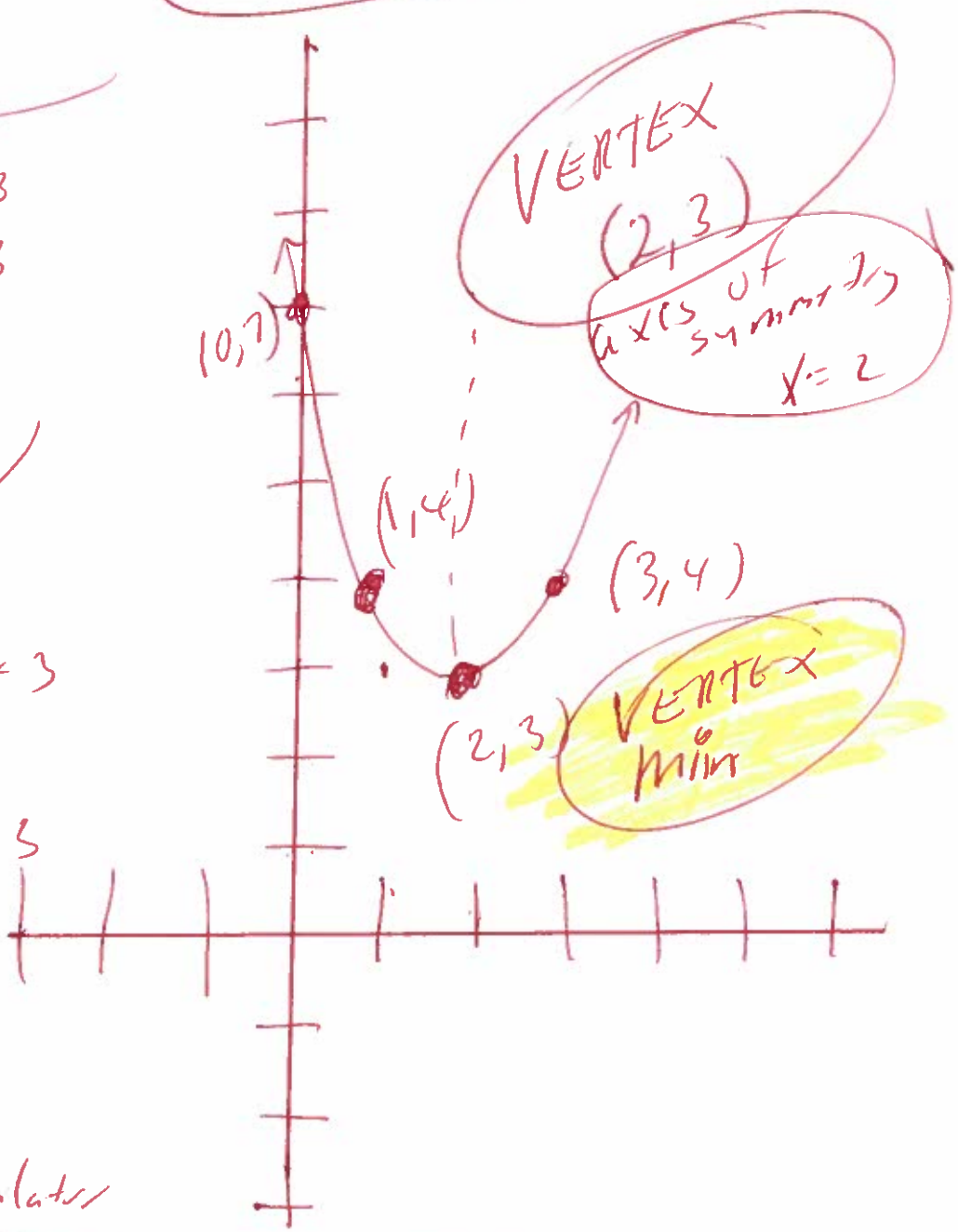
$f(3) = (3-2)^2 + 3$

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

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

$f(3) = 1 + 3$

$f(3) = 4$



Use graphing calculator

$Y_1 = (X-2)^2 + 3$

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

21. $f(x) = 2(x-2)^2 - 2$ Graph

Shift Right 2
Shift down 2

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

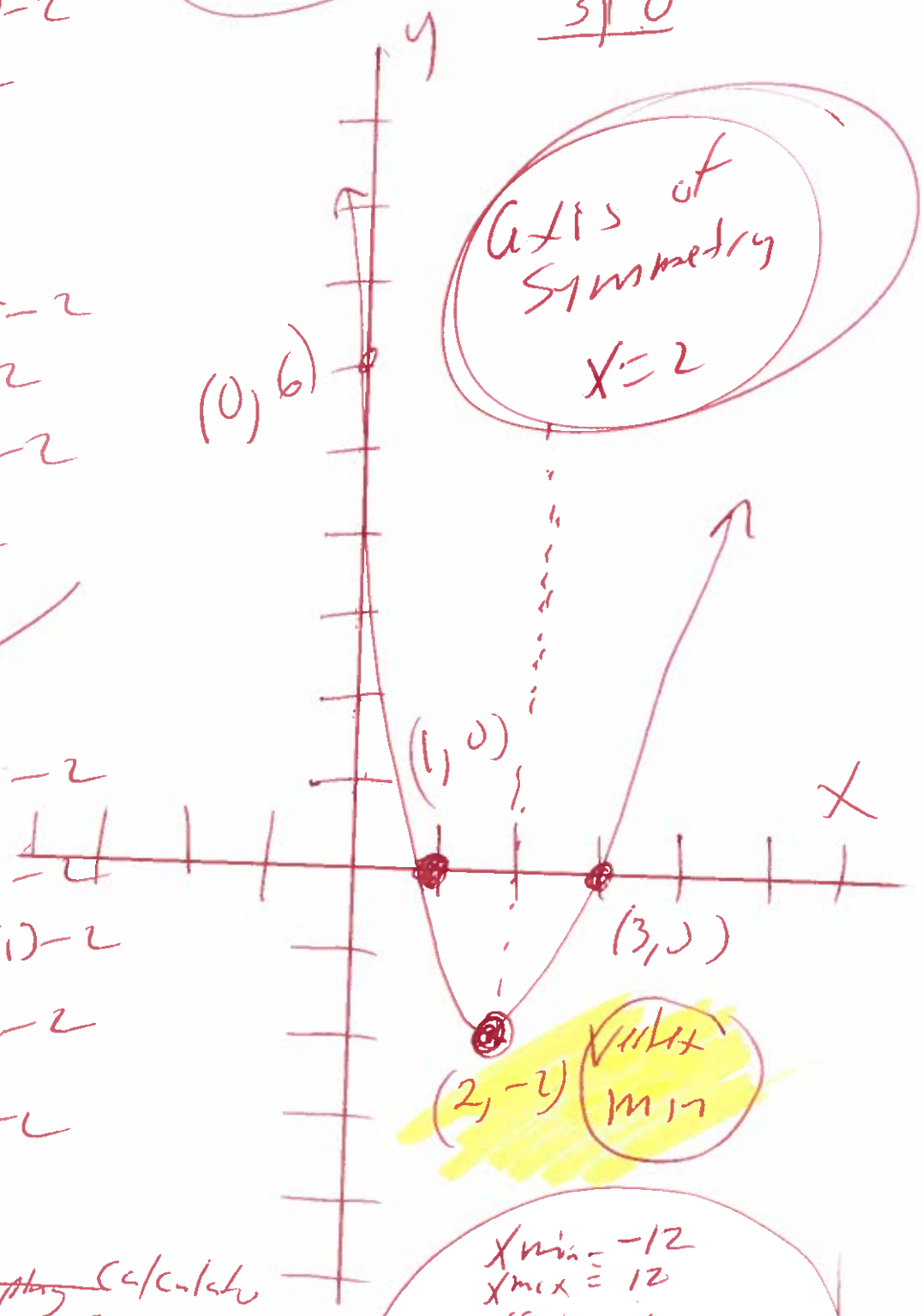
$f(1) = 2(1-2)^2 - 2$
$f(1) = 2(-1)^2 - 2$
$f(1) = 2(-1)(-1) - 2$
$f(1) = 2(1) - 2$
$f(1) = 2 - 2$
$f(1) = 0$

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

$f(3) = 2(3-2)^2 - 2$
$f(3) = 2(1)^2 - 2$
$f(3) = 2(1)(1) - 2$
$f(3) = 2(1) - 2$
$f(3) = 2 - 2$
$f(3) = 0$

use ~~Graphing~~ Calculator

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



Axis of Symmetry
$x = 2$

Domain $(-\infty, \infty)$
Range $[-2, \infty)$

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

(22) $f(x) = x^2 - 4x - 5$ Graph

Find x-intercept let $y = 0$

$y = 0 = f(x) = x^2 - 4x - 5$

$0 = x^2 - 4x - 5$

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

$x+1 = 0$ or $x-5 = 0$

$x+1-1 = 0-1$ OR $x-5+5 = 0+5$ ✓ x-intercept.

$x = -1$ or $x = 5$ $(-1, 0)$ $(5, 0)$

Find y-intercept let $x = 0$

$f(0) = (0)^2 - 4(0) - 5$

$f(0) = (0)(0) - 4(0) - 5$

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

$f(0) = -5$ $(0, -5)$ y-intercept ✓

Find VERTEX Vertex $(2, -9)$ ✓

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

$a = 1, b = -4, c = -5$

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

$\text{Vertex} = \left(\frac{-(-4)}{2(1)}, f\left(\frac{-(-4)}{2(1)}\right)\right)$

$\text{Vertex} = \left(\frac{4}{2}, f\left(\frac{4}{2}\right)\right)$

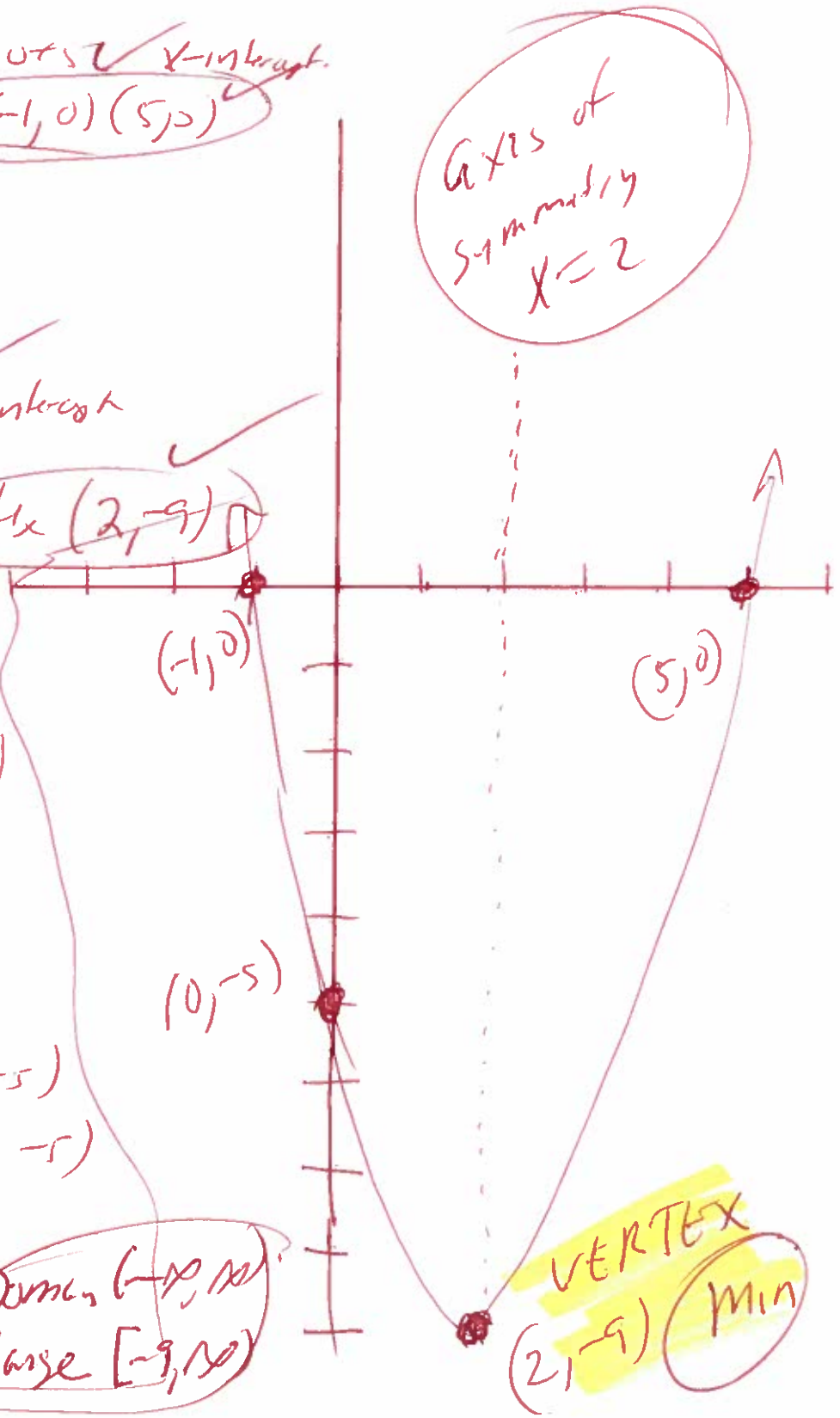
$\text{Vertex} = (2, f(2))$

$\text{Vertex} = (2, (2)^2 - 4(2) - 5)$

$\text{Vertex} = (2, (2)(2) - 4(2) - 5)$

$\text{Vertex} = (2, 4 - 8 - 5)$

$\text{Vertex} = (2, -4 - 5)$



Domain $(-\infty, \infty)$

Range $[-9, \infty)$

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

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

find x-intercept let $y = 0$

$y = 0 = f(x) = -x^2 + 4x + 5$

$0 = -1x^2 + 4x + 5$

$0 = -1(x^2 - 4x - 5)$

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

$-1 \neq 0$ $x+1 = 0$ or $x-5 = 0$

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

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

find y-intercept let $x = 0$

$f(0) = -(0)^2 + 4(0) + 5$

$f(0) = -(0)(0) + 4(0) + 5$

$f(0) = -(0) + 4(0) + 5$

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

$f(0) = 5$ $(0, 5)$ ✓

Find VERTEX

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

$a = -1, \ b = 4, \ c = 5$

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

$Vertex = \left(\frac{-(4)}{2(-1)}, f\left(\frac{-(4)}{2(-1)}\right)\right)$

$Vertex = \left(\frac{-4}{-2}, f\left(\frac{-4}{-2}\right)\right)$

$Vertex = (2, f(2))$

$Vertex = (2, -(2)^2 + 4(2) + 5)$

$Vertex = (2, -(2)(2) + 4(2) + 5)$

$Vertex = (2, -4 + 8 + 5)$

$Vertex = (2, 4 + 5)$

$Vertex = (2, 9)$

Axis of Symmetry $x = 2$

Vertex (2, 9) MAX

(0, 5)

(-1, 0)

(5, 0)

Domain $(-\infty, \infty)$

Range $(-\infty, 9]$

24. Solve $x^3+2x^2-5x-6=0$ given $x=2$ is a zero

use synthetic division

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

Set $x^2+4x+3=0$ (1.3) Possibly.

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

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

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

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

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

25. $f(x) = 3x^3 - 7x^2 - 75x + 175$

Possible

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

$\pm \frac{35}{3}, \pm \frac{175}{3}$

use synthetic division.

5	3	−7	−75	175
		15	40	−175
	3	8	−35	0 Rem

$3x^2 + 8x - 35 = 0$

3.1 35.1

7.5

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

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

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

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

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

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

$\left\{5, \frac{7}{3}, -5\right\}$

26) $1x^3 - 2x^2 - 25x + 50 = 0$

Possible
$\pm 50, \pm 25, \pm 10, \pm 5$
$\pm 2, \pm 1$

use synthetic division

5	1	−2	−25	50
		5	15	−50
	1	3	−10	0 rem

10.1
2.5
possible

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

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

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

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

$x = 2$ OR $x = -5$

$\{5, 2, -5\}$

27. $8x^3 - 46x^2 + 31x - 5 = 0$

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

use synthetic division

5	8	−46	31	−5
		40	−30	5
	8	−6	+1	0 rem

Possible: $8 \cdot 1$, $2 \cdot 4$, $1 \cdot 1$

$8x^2 - 6x + 1 = 0$

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

set $2x - 1 = 0$ or $4x - 1 = 0$

$2x - 1 + 1 = 0 + 1$ or $4x - 1 + 1 = 0 + 1$

$2x = 1$ or $4x = 1$

$\frac{2x}{2} = \frac{1}{2}$ or $\frac{4x}{4} = \frac{1}{4}$

$x = \frac{1}{2}$ or $x = \frac{1}{4}$

$\left\{5, \frac{1}{2}, \frac{1}{4}\right\}$

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

Possible
$\pm 6, \pm 3, \pm 2, \pm 1$

1)

-1	2	5	-6
	-1	1	6
-1	1	6	0 Rem

use synthetic division

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

6.1 Possible
2.3

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

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

set $-1 = 0$ OR $x+2 = 0$ OR $x-3 = 0$

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

$x = -2$ OR $x = 3$

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

Graph

use graphy Calculator

$y_1 = -x^3 + 2x^2 + 5x - 6$

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

29. $y = \dfrac{x-10}{3x^2+x+1}$ find horizontal asymptote

$$\lim_{x\to\infty}\left(\frac{x-10}{3x^2+x+1}\right) =$$

$$\lim_{x\to\infty}\left(\frac{x-10}{3x^2+x+1}\right)\frac{\frac{1}{x^2}}{\frac{1}{x^2}} =$$

$$\lim_{x\to\infty}\left(\frac{\frac{x}{x^2}-\frac{10}{x^2}}{\frac{3x^2}{x^2}+\frac{x}{x^2}+\frac{1}{x^2}}\right) =$$

$$\lim_{x\to\infty}\left(\frac{\frac{1}{x}-\frac{10}{x^2}}{3+\frac{x}{x}+\frac{1}{x^2}}\right)$$

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

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

$$0 =$$

$y = 0$ horizontal asymptote

30. $f(x) = \dfrac{2x^2-6x+4}{x-2}$ Find Slant

Use synthetic division

$$\begin{array}{r|rrr} 2 & 2 & -6 & 4 \\ & & 4 & -4 \\ \hline & 2 & -2 & 0 \end{array}$$ rem

$y = 2x - 2$

SLANT asymptote

31) $f(x) = \dfrac{x-7}{x^2-9x+14}$ Find Vertical asymptote

$f(x) = \dfrac{(x-7)}{(x-2)(x-7)}$

Possibly 14.1 2.7

$f(x) = \dfrac{1(x-7)}{(x-2)(x-7)}$

since $x-7 \neq 0$, $x-7+7 \neq 0+7$, $x \neq 7$

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

hole at $x=7$

set $x-2=0$

$x-2+2 = 0+2$

$x=2$ Vertical asymptote

32. $f(x) = \frac{18x}{3x^2+4}$ find horizontal asymptote

$$\lim_{x\to\infty}\left(\frac{18x}{3x^2+4}\right) =$$

$$\lim_{x\to\infty}\left(\frac{18x}{3x^2+4}\right)\frac{\frac{1}{x^2}}{\frac{1}{x^2}} =$$

$$\lim_{x\to\infty}\frac{\frac{18x}{x^2}}{\frac{3x^2}{x^2}+\frac{4}{x^2}} =$$

$$\lim_{x\to\infty}\frac{\frac{18}{x}}{3+\frac{4}{x^2}} =$$

formula

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

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

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

$$0 =$$

$y = 0$ horizontal asymptote

33. $g(x) = \dfrac{10x^2}{5x^2+3}$ find horizontal asymptote

$$\lim_{x\to\infty}\left(\frac{10x^2}{5x^2+3}\right) =$$

$$\lim_{x\to\infty}\left(\frac{10x^2}{5x^2+3}\right)\frac{\frac{1}{x^2}}{\frac{1}{x^2}} =$$

$$\lim_{x\to\infty}\frac{\frac{10x^2}{x^2}}{\frac{5x^2}{x^2}+\frac{3}{x^2}} =$$

$$\lim_{x\to\infty}\frac{10}{5+\frac{3}{x^2}} =$$

formula

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

$$\frac{10}{5+0} =$$

$$\frac{10}{5} =$$

$$2 =$$

$y = 2$ horizontal asymptote

34) $f(x) = 1000(0.5)^{\frac{x}{30}}$ find $f(80)$

$f(80) = 1000(0.5)^{\left(\frac{80}{30}\right)}$

$f(80) = 1000(0.5)^{1(80/30)}$

use graphing calculator

$f(80) = 157.490312$

$f(80) = 157.49 > 100$ 1982 YEARS
+ 80 YEARS

NOT SAFE 2062 YEAR

NO the area is not safe for human habitation since the radioactive element remaining is greater than 100.

$f(80) = 157.49$ Round

$f(80) = 157.5$

35. $f(x) = \log(9-x)$ Find domain

Formula

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

Let $Ax+B > 0$

Let $9-x > 0$

$9-x-9 > 0-9$

$-x > -9$

$\frac{-x}{-1} < \frac{-9}{-1}$

$x < 9$

9

$(-\infty, 9)$

36 $\log_b\left(\frac{x^3y}{z^7}\right)$ expand

$\log_b(x^3y) - \log_b(z^7) =$

$\log_b(x^3) + \log_b(y) - \log_b(z^7) =$

$3\log_b(x) + \log_b(y) - 7\log_b(z) =$

formula

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

$\log_b(A) - \log_b(B)$

$\log_b(AB) =$

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

$\log_b(A^N) =$

$N\log_b(A) =$

37. $\ln\left(\frac{x^4\sqrt{x^2+8}}{(x+6)^3}\right)$ Expand

$\ln\left(x^4\sqrt{x^2+8}\right) - \ln(x+6)^3 =$

$\ln(x^4) + \ln\sqrt{x^2+8} - \ln(x+6)^3 =$

$\ln(x^4) + \ln(x^2+8)^{1/2} - \ln(x+6)^3 =$

$4\ln(x) + \frac{1}{2}\ln(x^2+8) - 3\ln(x+6) =$

formula

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

$\ln(A) - \ln(B)$

$\ln(AB) =$

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

$\ln(A^N) =$

$N\ln(A) =$

38.

$9^{x+9} = 243^{x-3}$

$(3^2)^{x+9} = (3^5)^{x-3}$

$3^{2x+18} = 3^{5x-15}$

Formula

$x^a = x^b$

$a = b$

$2x + 18 = 5x - 15$

$2x + 18 - 18 = 5x - 15 - 18$

$2x = 5x - 33$

$2x - 5x = 5x - 33 - 5x$

$-3x = -33$

$\frac{-3x}{-3} = \frac{-33}{-3}$

$x = 11$

$\{11\}$

39. $2^{x+3} = 283$

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

$\ln(2^{x+3}) = \ln(283)$

$(x+3)\ln(2) = \ln(283)$

$\frac{(x+3)\ln(2)}{\ln(2)} = \frac{\ln(283)}{\ln(2)}$

$x+3 = \frac{\ln(283)}{\ln(2)}$

$x+3-3 = \frac{\ln(283)}{\ln(2)} - 3$

$x = 5.144658243$

OR

Round

$x = 5.14$

(40) $\log_7(x) + \log_7(6x-1) = 1$

$\log_7(x)(6x-1) = 1$

Formula
$\log_7(A) + \log_7(B)$
$\log_7(AB)$

$7^1 = x(6x-1)$

$7 = 6x^2 - x$

$0 = 6x^2 - x - 7$

$0 = (6x-7)(x+1)$

6.1 2.3 7.1

so $6x-7=0$ OR $x+1=0$

$6x-7+7=0+7$ OR $x+1-1=0-1$

$6x=7$ OR $x=-1$ BAD

$\frac{6x}{6} = \frac{7}{6}$

$x = \frac{7}{6}$ Good

$\left\{\frac{7}{6}\right\}$ ✓

Ck

$\log_7\left(\frac{7}{6}\right) + \log_7\left(6\left(\frac{7}{6}\right)-1\right) = 1$

$\log_7\left(\frac{7}{6}\right) + \log_7(7-1) = 1$

$\log_7\left(\frac{7}{6}\right) + \log_7(6) = 1$

Good Good

Ck

$\log_7(-1) + \log_7(6(-1)-1) = 1$

$\log_7(-1) + \log_7(-6-1) = 1$

$\log_7(-1) + \log_7(-7) = 1$

BAD BAD

41. $\log_3(x+7) + \log_3(x+25) = 5$

$\log_3(x+7)(x+25) = 5$

formula: $\log_3(A) + \log_3(B) = \log_b(AB)$

$3^5 = (x+7)(x+25)$

$243 = x^2 + 25x + 7x + 175$

$243 = x^2 + 32x + 175$

$0 = x^2 + 32x + 175 - 243$

$0 = x^2 + 32x - 68$

68.1
34.2
17.4

$0 = (x-2)(x+34)$

Let $x-2=0$ or $x+34=0$

$x-x+2=0+2$ or $x+34-34=0-34$

$x=2$ or $x=-34$

Good Ck — BAD

{2}

$\log_3(2+7) + \log_3(2+25) = 5$

$\log_3(9) + \log_3(27) = 5$

Good Good

Ck

$\log_3(-34+7) + \log_3(-34+25) = 5$

$\log_3(-27) + \log_3(-9) = 5$

BAD BAD

42. $\log_6(x+26) - \log_6(x-9) = 2$

$\log_6\left(\frac{x+26}{x-9}\right) = 2$

formula

$\log_6(A) - \log_6(B) = \log_{16}\left(\frac{A}{B}\right) =$

$6^2 = \frac{x+26}{x-9}$

$36 = \frac{x+26}{x-9}$

$\frac{36}{1} = \frac{x+26}{x-9}$

$36(x-9) = 1(x+26)$

$36x - 324 = 1x + 26$

$36x - 324 + 324 = 1x + 26 + 324$

$36x = 1x + 350$

$36x - 1x = 1x + 350 - 1x$

$35x = 350$

$\frac{35x}{35} = \frac{350}{35}$

$x = 10$ Good

£103

$\log_6(10+26) - \log_6(10-9) = 2$

$\log_6(36) - \log_6(1) = 2$

Good Good

43. $\log(x) + \log(x+6) = \log(7)$

$\log(x)(x+6) = \log(7)$

$x(x+6) = 7$

$x^2 + 6x = 7$

$x^2 + 6x - 7 = 0$

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

let $x-1=0$ OR $x+7=0$

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

$x = 1$ OR $x = -7$

CK Good BAD

$\{1\}$

formula

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

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

$\log(x) + \log(x+6) = \log(7)$

$\log(1) + \log(1+6) = \log(7)$

$\log(1) + \log(7) = \log(7)$

Good Good Good ✓

CK

$\log(-7) + \log(-7+6) = \log(7)$

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

BAD BAD

44. # $22000 = 12500\left(1+\frac{.0675}{2}\right)^{2x}$ #

$\frac{22000}{12500} = \frac{12500\left(1+\frac{.0675}{2}\right)^{2x}}{12500}$

$1.76 = \left(1+\frac{.0675}{2}\right)^{2x}$

$1.76 = (1+.03375)^{2x}$

$1.76 = (1.03375)^{2x}$

$\ln(1.76) = \ln(1.03375)^{2x}$

$\ln(1.76) = 2x\ln(1.03375)$

$\frac{\ln(1.76)}{\ln(1.03375)} = \frac{2x\ln(1.03375)}{\ln(1.03375)}$

$17.03113202 = 2x$

$\frac{17.03113202}{2} = \frac{2x}{2}$

$8.515556601 = x$ YEARS

OR Round

$8.5 = x$ YEARS

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

45.

$$1322 = 849.7e^{0.026x}$$

$$\frac{1322}{849.7} = \frac{849.7e^{0.026x}}{849.7}$$

$$1.555843239 = e^{0.026x}$$

$$\ln(1.555843239) = \ln\left(e^{0.026x}\right)$$

$$\ln(1.555843239) = 0.026x \ln(e)$$

$$\ln(1.555843239) = 0.026x(1)$$

$$\ln(1.555843239) = 0.026x$$

$$\frac{\ln(1.555843239)}{0.026} = \frac{0.026x}{0.026}$$

$$17.00067979 = x$$

Start 2003 YEAR

OR

Round

$$17 = x \text{ YEARS}$$

2003 YEARS
+ 17 YEARS

2020 YEAR ← Answer (ENDS)

46. $A = 16e^{-0.000121x}$

$A = 16e^{-0.000121(9536)}$

use graphing calculator

2nd Ln

$A = 16\, e^{\wedge}(-0.000121(9536))$

$A = 5.046690703$

or

Round

$A = 5$ grams left

47 $A = A_0 e^{-0.000121x}$

$39 = 100 e^{-0.000121x}$

$\frac{39}{100} = \frac{100 e^{-0.000121x}}{100}$

$.39 = e^{-0.000121x}$

$\ln(.39) = \ln(e^{-0.000121x})$

$\ln(.39) = -0.000121x \ln(e)$

$\ln(.39) = -0.000121x \ (1)$

$\ln(.39) = -0.000121x$

$\frac{\ln(.39)}{-0.000121} = \frac{-0.000121x}{-0.000121}$

$7781.887759 = x$ YEARS

OR Round

$7782 = x$ YEARS

$\ln(e) = 1$ formula $\ln(A^N) = N\ln(A)$

48.

$10 = 5e^{0.009x}$

$\frac{10}{5} = \frac{5e^{0.009x}}{5}$

$2 = e^{0.009x}$

$\ln(2) = \ln(e^{0.009x})$

$\ln(2) = 0.009x(\ln e)$

$\ln(2) = 0.009x(1)$

$\ln(2) = 0.009x$

$\frac{\ln(2)}{0.009} = \frac{0.009x}{0.009}$

$\frac{.693147806}{0.009} = x$

$77.01635\,34 = x$

Or Round

$77 = x$ YEARS

r = 0.9% to double

(49)

$$x+y+9z=22$$
$$x+y+3z=10$$
$$x+6y-6z=-3$$

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

$$[A]=\begin{bmatrix} 1 & 1 & 9 & 22 \\ 1 & 1 & 3 & 10 \\ 1 & 6 & -6 & -3 \end{bmatrix}$$

use graphing calculator

2nd, matrix, math, rref, enter

$$rref([A])=$$

$$\begin{bmatrix} 1 & 0 & 0 & 3 \\ 0 & 1 & 0 & 1 \\ 0 & 0 & 1 & 2 \end{bmatrix} \begin{matrix} x \\ y \\ z \end{matrix}$$

$$(x, y, z)=(3, 1, 2)$$

50.

$$3x+y = -9$$
$$x+y-z = -9$$
$$2x+3y+z = 0$$

2ND, Matrix, Edit, [A], 3x4

use graphing calculator

$$[A] = \begin{bmatrix} 3 & 1 & 0 & -9 \\ 1 & 1 & -1 & -9 \\ 2 & 3 & 1 & 0 \end{bmatrix}$$

2ND, Matrix, Math, rref, [A]

$$\text{rref}([A]) = \begin{bmatrix} 1 & 0 & 0 & -3 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 6 \end{bmatrix}$$

$$\begin{matrix} x \\ y \\ z \end{matrix}$$

$$(x, y, z) = (-3, 0, 6)$$

(5)

$$-3x - y = -7$$
$$y - 4z = -7$$
$$x - 2y + z = 2$$

2ND, Matrix, EDIT [A] 3 × 4

$$[A] = \begin{bmatrix} -3 & -1 & 0 & -7 \\ 0 & 1 & -4 & -7 \\ 1 & -2 & 1 & 2 \end{bmatrix}$$

Use graphing calculator

2ND, Matrix, Math, rref([A])

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

$$\begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} 2 \\ 1 \\ 2 \end{bmatrix}$$

$$(x, y, z) = (2, 1, 2)$$

52

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

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

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

$2 + 6 + 12 + 20 =$

40

Use graphing Calculator

Math

Summation Σ

53

$(x+4)^3 =$

$${}_3C_0(x)^3(4)^0 + {}_3C_1(x)^2(4)^1 + {}_3C_2(x)^1(4)^2 + {}_3C_3(x)^0(4)^3 =$$

$$(1)(x^3)(1) + (3)(x^2)(4) + (3)(x^1)(16) + (1)(1)(64) =$$

$$x^3 + 12x^2 + 48x + 64 =$$

3, Math, Prb, nCr, etc

2ND ENTER

3 nCr 0 = 1

3 nCr 1 = 3

3 nCr 2 = 3

3 nCr 3 = 1

54 $(2x+y)^3$

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

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

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

$$8x^3 + 12x^2y + 6xy^2 + y^3 =$$

3 math, Prb, nCr, enter

3 nCr 0 = 1

3 nCr 1 = 3

3 nCr 2 = 3

3 nCr 3 = 1

55 $(3x-2)^3$

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

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

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

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

Using graphing calculator

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

3 nCr 1 = 3

3 nCr 2 = 3

3 nCr 3 = 1

5) $(x+8)^6$ write the 1st three terms

$${}_6C_0(x)^6(8)^0 + {}_6C_1(x)^5(8)^1 + {}_6C_2(x)^4(8)^2 =$$

$$(1)(x^6)(1) + (6)(x^5)(8) + (15)(x^4)(64) =$$

$$x^6 + 48x^5 + 960x^4 =$$

6, Math Prb, nCr, enter, 0, = 1

6 nCr 6 =

6 nCr 1 5 =

~~6 nCr~~

57. $(x-2y)^{13}$ write the first 3 terms.

$$C_{13\,0}(x)^{13}(-2y)^{0} + C_{13\,1}(x)^{12}(-2y)^{1} + C_{13\,2}(x)^{11}(-2y)^{2} =$$

$$(1)(x^{13})(1) + (13)(x^{12})(-2y) + (78)(x^{11})(-2y)(-2y) =$$

$$(1)(x^{13})(1) + (13)(x^{12})(-2y) + (78)(x^{11})(4y^{2}) =$$

$$x^{13} - 26x^{12}y + 312x^{11}y^{2} =$$

13, Math, Prb, nCr, enter, 0, = 1

13 nCr 1 = 13

13 nCr 2 = 78