

① Solve
 $x^2 - 14x + 53 = 0$

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$$1x^2 - 14x + 53 = 0$$

$$a=1, b=-14, c=53$$

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

$$x = \frac{-(-14) \pm \sqrt{(-14)^2 - 4(1)(53)}}{2(1)}$$

$$x = \frac{14 \pm \sqrt{(-14)(-14) - 4(1)(53)}}{2}$$

$$x = \frac{14 \pm \sqrt{196 - 212}}{2}$$

$$x = \frac{14 \pm \sqrt{-16}}{2}$$

$$x = \frac{14 \pm 4i}{2}$$

$$x = 7 \pm 2i$$

$$x = 7 + 2i \quad \text{OR} \quad x = 7 - 2i$$



② Solve
 $\sqrt{22x+11} = x+6$

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$$(\sqrt{22x+11})^2 = (x+6)^2$$

$$22x+11 = (x+6)(x+6)$$

$$22x+11 = x^2 + 6x + 6x + 36$$

$$22x+11 = x^2 + 12x + 36$$

$$0 = x^2 + 12x + 36 - 22x - 11$$

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

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

Set $x-5=0$ OR $x-5=0$

$$x-5+5=0+5 \text{ OR } x-5+5=0+5$$

$$x=5 \text{ OR } x=5$$

Good

ck $\sqrt{22x+11} = x+6$

$$\sqrt{22(5)+11} = (5)+6$$

$$\sqrt{110+11} = 5+6$$

$$\sqrt{121} = 11$$

$$11 = 11$$

2

{ 5 }

3. Find the max and min

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

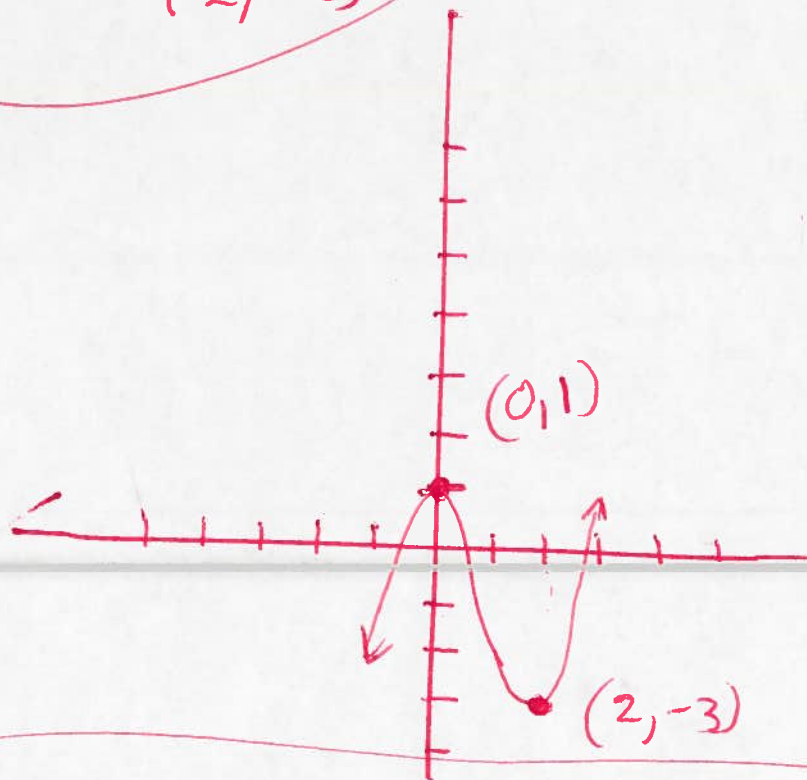
Use graphing calculator ↘

$$Y_1 = X^3 - 3X^2 + 1$$

3.f

Maximum (0, 1)

Minimum (2, -3)



Increasing $(-\infty, 0) \cup (2, +\infty)$

Decreasing $(0, 2)$

4 Graph

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$$f(x) = \begin{cases} x+1 & \text{if } x < 1 \\ -5 & \text{if } x \geq 1 \end{cases}$$

OPEN
CLOSED

X	f(x) = x+1
0	1
1	2

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

$$f(0) = 1$$

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

$$f(1) = 2$$

X	f(x) = -5
1	-5
2	-5

$$f(1) = -5$$

$$f(2) = -5$$

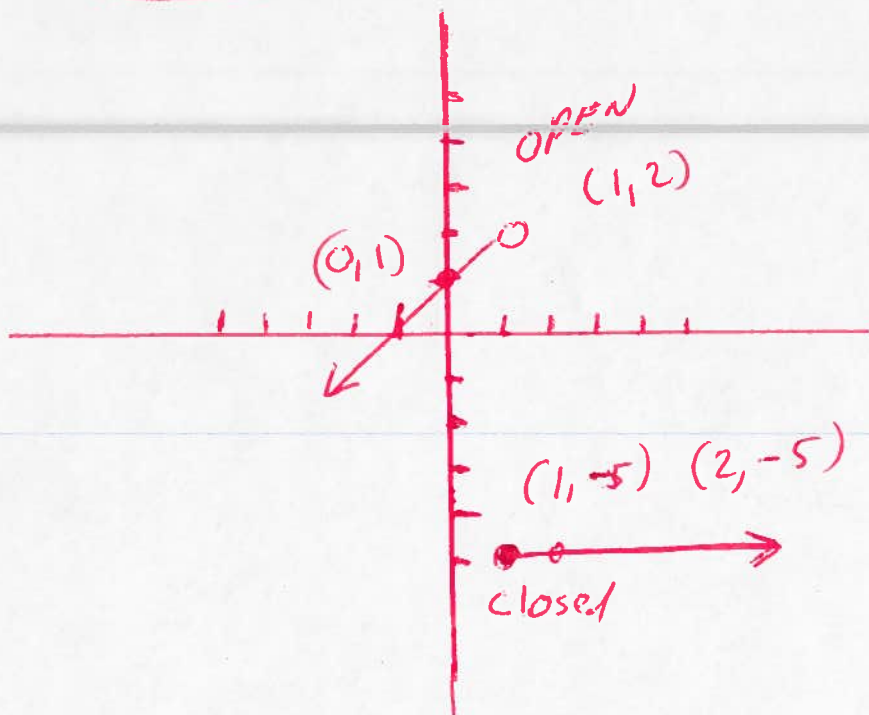
OR

$$Y_1 = x+1 \div (x < 1)$$

$$Y_2 = -5 \div (x \geq 1)$$

(Graphing
Calculator)

4



5. Find and simplify

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

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

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

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

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

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

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

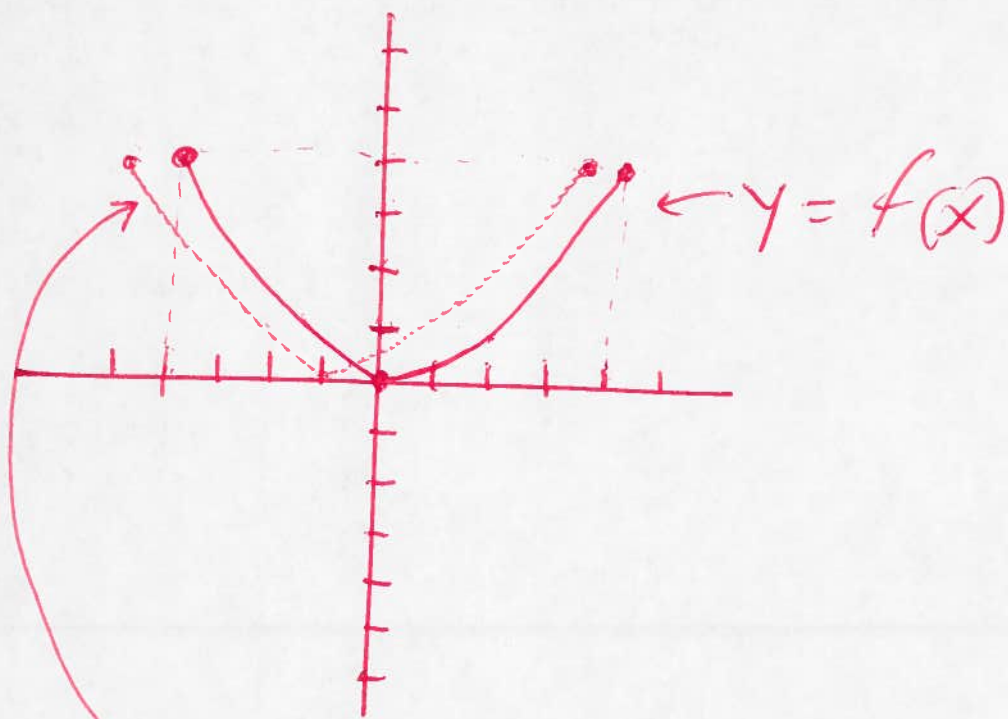
$$\boxed{2x + h + 9 =}$$

5



⑥ $g(x) = f(x+1)$

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⑥

$g(x) = f(x+1)$

Shift left -1 ✓

7. Find the domain of the function

$$f(x) = \sqrt{24-x}$$

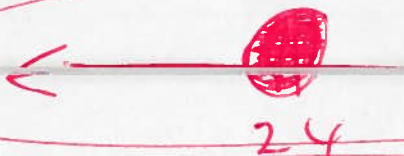
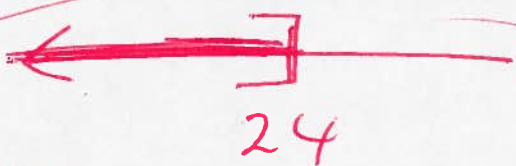
Set $24-x \geq 0$

$$24-x-24 \geq 0-24$$

$$-x \geq -24$$

$$\frac{-x}{-1} \leq \frac{-24}{-1}$$

$$x \leq 24$$



$$(-\infty, 24]$$

7.

OR ✓

OR ✓

OR ✓

✓

⑧

$$f(x) = 9x - 2 \quad \text{and} \quad g(x) = 4x - 7$$

Find $f - g =$

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

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

$$(9x - 2) - (4x - 7) =$$

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

$$5x + 5 =$$



⑧

$$\textcircled{9} \quad f(x) = 3x + 14 \text{ and } g(x) = 2x - 1$$

$$\text{Find } (f \circ g)(x) =$$

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

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

$$3(2x - 1) + 14 =$$

$$6x - 3 + 14 =$$

$$\boxed{6x + 11 =}$$



9.

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$$(10) f(x) = 4x^2 + 6x + 5 \text{ and } g(x) = 6x - 7$$

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

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

$$g(4x^2 + 6x + 5) =$$

$$6(4x^2 + 6x + 5) - 7 =$$

$$24x^2 + 36x + 30 - 7 =$$

$$24x^2 + 36x + 23 =$$

10.



11. Find the distance

$$\begin{array}{cc} (-1, -3) & \text{and} & (-5, 0) \\ x_1 & y_1 & x_2 & y_2 \end{array}$$

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

$$d = \sqrt{((-1) - (-5))^2 + ((-3) - (0))^2}$$

$$d = \sqrt{(-1 + 5)^2 + (-3 - 0)^2}$$

$$d = \sqrt{(4)^2 + (-3)^2}$$

$$d = \sqrt{(4)(4) + (-3)(-3)}$$

$$d = \sqrt{16 + 9}$$

$$d = \sqrt{25}$$

$$d = 5$$

11.

12 Find the midpoint

$$\begin{matrix} (5, 1) & \text{and} & (3, 0) \\ x_1, y_1 & & x_2, y_2 \end{matrix}$$

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

$$\text{Midpoint} = \left(\frac{(5) + (3)}{2}, \frac{(1) + (0)}{2} \right)$$

$$\text{Midpoint} = \left(\frac{5+3}{2}, \frac{1+0}{2} \right)$$

$$\text{Midpoint} = \left(\frac{8}{2}, \frac{1}{2} \right)$$

$$\text{Midpoint} = \left(4, \frac{1}{2} \right)$$

12

13. Graph the equation

$$x^2 + y^2 - 8x - 12y + 43 = 0$$

$$x^2 - 8x + y^2 - 12y = -43$$

$$x^2 - 8x + \left(\frac{1}{2}(-8)\right)^2 + y^2 - 12y + \left(\frac{1}{2}(-12)\right)^2 = -43 + \left(\frac{1}{2}(-8)\right)^2 + \left(\frac{1}{2}(-12)\right)^2$$

$$x^2 - 8x + (-4)^2 + y^2 - 12y + (-6)^2 = -43 + (-4)^2 + (-6)^2$$

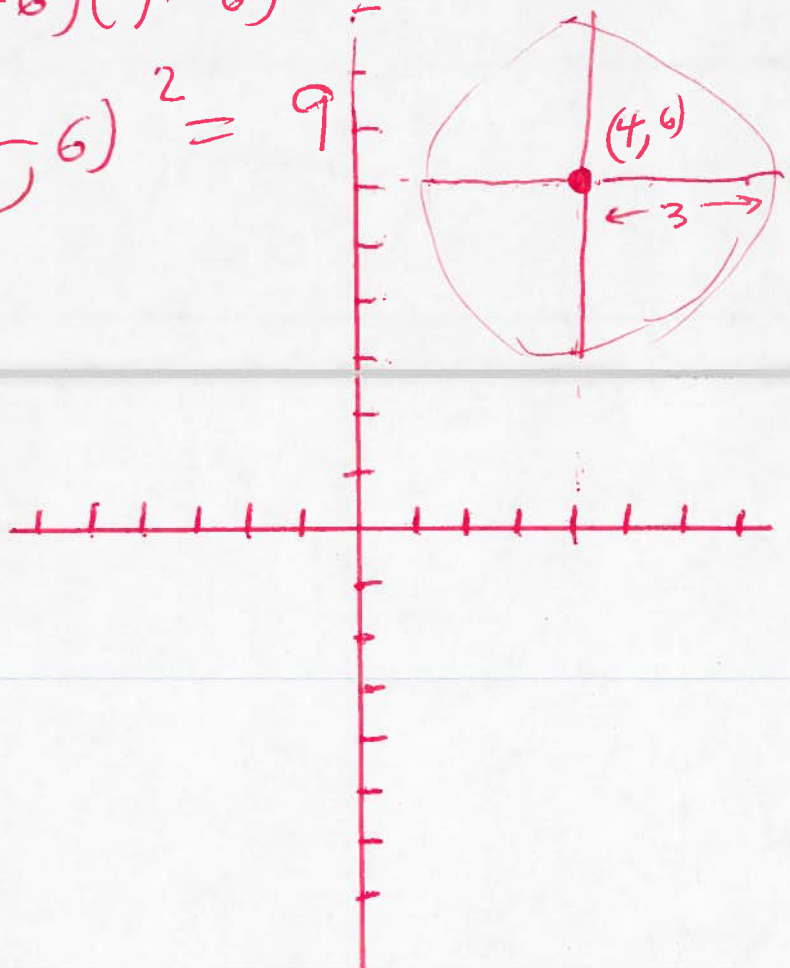
$$x^2 - 8x + 16 + y^2 - 12y + 36 = -43 + 16 + 36$$

$$(x-4)(x-4) + (y-6)(y-6) = -43 + 52$$

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

Center = (4, 6)

Radius = $\sqrt{9} = 3$



13.

(14) Graph $f(x) = -x^2 - 4x + 5$
 $a = -1, b = -4, c = 5$

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

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

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

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

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

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

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

$$\text{Vertex} = (-2, 9)$$

Find x-intercept let $y = 0$

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

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

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

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

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

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

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

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

$$(1, 0) \text{ OR } (-5, 0)$$

Find y-intercept let $x = 0$

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

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

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

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

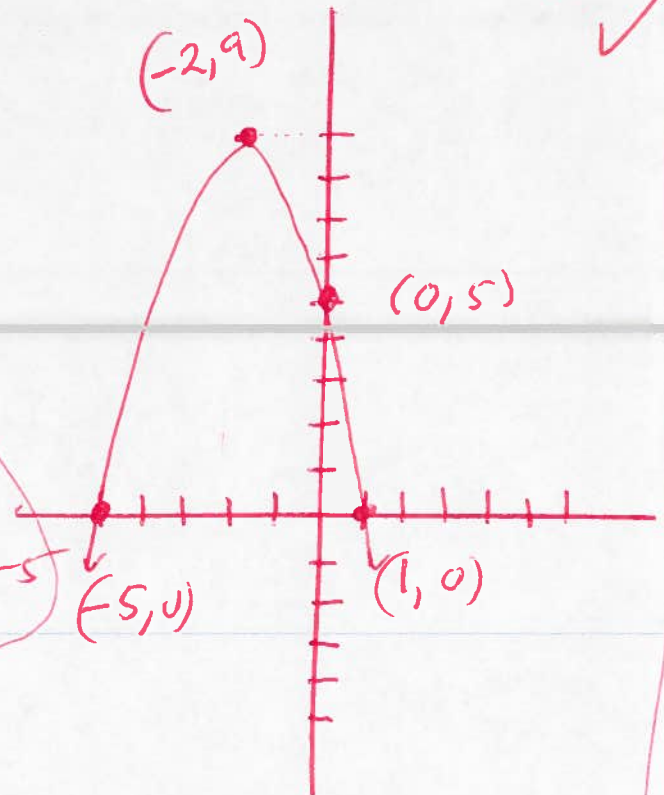
$$y = f(0) = 5$$

$$(0, 5)$$

14

Graphing calculator

$$Y_1 = -x^2 - 4x + 5$$



15 Find the Max

$$f(x) = -16x^2 + 160x$$

$$a = -16 \quad b = 160 \quad c = 0$$

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

$$\text{Max} = \text{Vertex} = \left(-\frac{(160)}{2(-16)}, f\left(-\frac{(160)}{2(-16)}\right) \right)$$

$$\text{Max} = \text{Vertex} = \left(\frac{-160}{-32}, f\left(\frac{-160}{-32}\right) \right)$$

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

$$\text{Max} = \text{Vertex} = (5, -16(5)^2 + 160(5))$$

$$\text{Max} = \text{Vertex} = (5, -16(5)(5) + 160(5))$$

$$\text{Max} = \text{Vertex} = (5, -16(25) + 160(5))$$

$$\text{Max} = \text{Vertex} = (5, -400 + 800)$$

$$\text{Vertex} = (5, 400)$$

$$\text{Max} = 400 \quad \checkmark$$

15

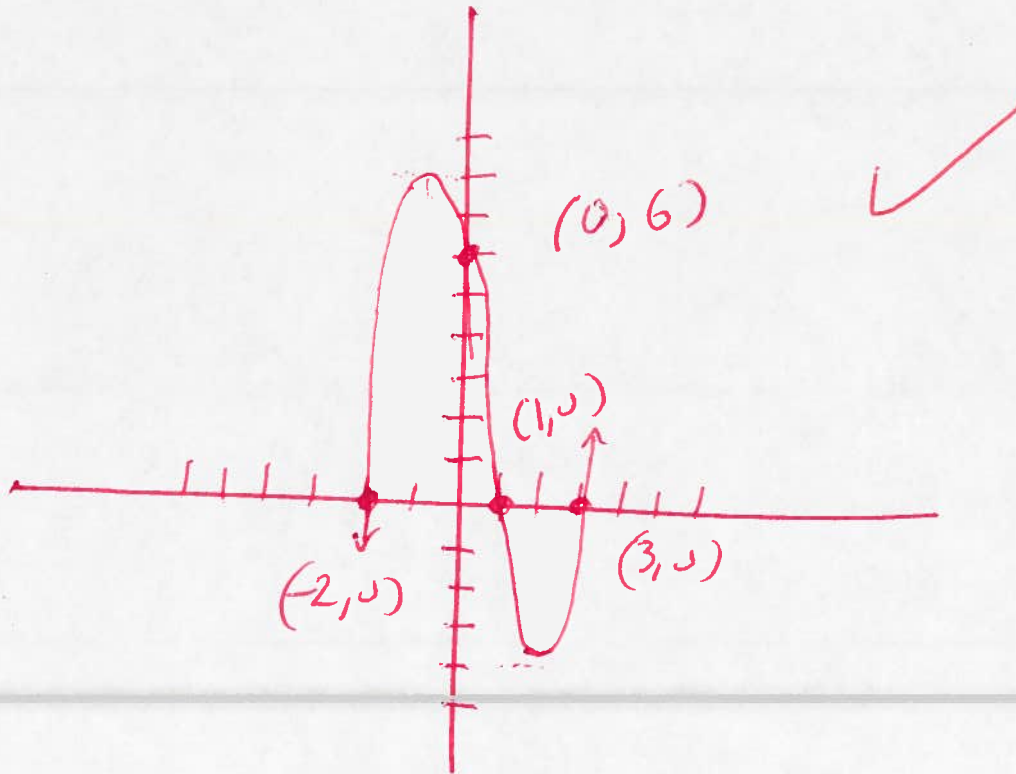
16 Graph

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

use graphing calculator

$$Y_1 = X^3 - 2X^2 - 5X + 6$$

16



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17

Solve

$$x^3 + 3x^2 - 4x - 12 = 0$$

use synthetic division

Possible rational roots
 $\pm 12, \pm 6, \pm 4, \pm 3, \pm 2, \pm 1$

$$\begin{array}{r|rrrr} -2 & 1 & 3 & -4 & -12 \\ & & -2 & -2 & 12 \end{array}$$

$$\begin{array}{cccc} 1 & 1 & -6 & 0 \text{ rem} \\ \downarrow & \downarrow & \downarrow & \\ & & & \end{array}$$

Set

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

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

$$x-2=0 \quad \text{OR} \quad x+3=0$$

$$x-2+2=0+2 \quad \text{OR} \quad x+3-3=0-3$$

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

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

17

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18 Solve

$$x^3 + 3x^2 - 8x + 10 = 0$$

Possible rational roots
 $\pm 10, \pm 5, \pm 2, \pm 1$

Use synthetic division

$$\begin{array}{r|rrrr} -5 & 1 & 3 & -8 & 10 \\ & & -5 & 10 & -10 \\ \hline & 1 & -2 & 2 & \boxed{0} \text{ rem} \end{array}$$

18.

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

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

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

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

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

$$x = 1 \pm i$$

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

$$x = 1 + i$$

$$\text{OR } x = 1 - i$$

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

$$\{-5, 1+i, 1-i\}$$

19) Find the vertical asymptotes

$$\frac{x-81}{x^2-15x+56}$$

Set $x^2-15x+56=0$

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

$$x-7=0 \quad \text{OR} \quad x-8=0$$

$$x-7+7=0+7 \quad \text{OR} \quad x-8+8=0+8$$

$$x=7 \quad \text{OR} \quad x=8 \quad \checkmark$$

Also notice that the horizontal asymptote

is $y=0$ \checkmark

Since $\lim_{x \rightarrow \infty} y = \lim_{x \rightarrow \infty} \frac{x}{x^2} = \lim_{x \rightarrow \infty} \frac{1}{x} = 0$ \checkmark

(20) Find the horizontal asymptote

$$g(x) = \frac{4x^2 - 7x - 5}{7x^2 - 3x + 7}$$

$$y = \frac{4x^2}{7x^2}$$

$$y = \frac{4}{7}$$

~~horizontal~~ asymptote

$$y = \frac{4}{7}$$



(20.)

21) Find the slant asymptote.

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

21

use synthetic division

$$\begin{array}{r|rrrr} 4 & 1 & 3 & -8 & \\ & & 4 & 28 & \\ \hline & 1 & 7 & 20 & \text{rem} \end{array}$$

↓ ↓

don't need the remainder

$$y = x + 7$$

SLANT

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22 Expand (use properties of Logarithms)

$$\log_a \left(\frac{x^4 \sqrt[3]{x+5}}{(x-2)^2} \right) =$$

$$\log_a (x^4 \sqrt[3]{x+5}) - \log_a (x-2)^2 =$$

$$\log_a (x^4) + \log_a \sqrt[3]{x+5} - \log_a (x-2)^2 =$$

$$\log_a (x^4) + \log_a (x+5)^{\frac{1}{3}} - \log_a (x-2)^2 =$$

$$4 \log_a (x) + \frac{1}{3} \log_a (x+5) - 2 \log_a (x-2) =$$

22

23 Solve the equation

$$4^{x+10} = 8^{x-2}$$

$$(2^2)^{x+10} = (2^3)^{x-2}$$

$$2^{2x+20} = 2^{3x-6}$$

Set $2x+20 = 3x-6$

$$2x + \cancel{20} - 20 = 3x - 6 - 20$$

$$2x = 3x - 26$$

$$2x - 3x = \cancel{3x} - 26 - \cancel{3x}$$

$$-1x = -26$$

$$\frac{-1x}{-1} = \frac{-26}{-1}$$

$$x = 26$$

23

24 Solve

$$\log_4 (x-4) + \log_4 (x-10) = 2$$

$$\log_4 (x-4)(x-10) = 2$$

$$4^2 = (x-4)(x-10)$$

$$16 = x^2 - 10x - 4x + 40$$

$$16 = x^2 - 14x + 40$$

$$0 = x^2 - 14x + 40 - 16$$

$$0 = x^2 - 14x + 24$$

$$0 = (x-2)(x-12)$$

Set $x-2=0$ OR $x-12=0$

$x-2+2=0+2$ OR $x-12+12=0+12$

~~$x=2$~~

ck BAD

OR $x=12$ maybe

check Good

$\log_4 (2-4) + \log_4 (2-10) = 2$ / $\log_4 (12-4) + \log_4 (12-10) = 2$

$\log_4 (-2) + \log_4 (-8) = 2$ / $\log_4 (8) + \log_4 (2) = 2$

BAD ↑

BAD ↑

Good ↑

Good ↑

24

{12}

25.

Solve

$$\log(x) + \log(x-1) = \log(12)$$

$$\log x(x-1) = \log(12)$$

$$x(x-1) = 12$$

$$x^2 - x = 12$$

$$x^2 - x - 12 = 0$$

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

Set $x+3=0$ OR $x-4=0$

$$x+3-3=0-3 \quad \text{OR} \quad x-4+4=0+4$$

~~$x = -3$~~

$x = 4$

check BAD

Good

$$\log(-3) + \log(-3-1) = \log(12)$$

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

BAD

BAD

check $\log(4) + \log(4-1) = \log(12)$

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

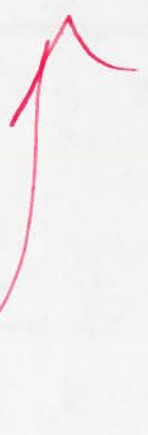
Good

Good

Good

25.

4



(26)

Solve

$$A = A_0 e^{-0.0077x}$$

$$A = 504$$

$$A_0 = 800$$

(26)

$$504 = 800 e^{-0.0077x}$$

$$\frac{504}{800} = \frac{800 e^{-0.0077x}}{800}$$

$$.63 = e^{-0.0077x}$$

$$\ln(.63) = \ln(e^{-0.0077x})$$

$$\ln(.63) = -0.0077x \ln(e)$$

$$\ln(.63) = -0.0077x (1)$$

$$\ln(.63) = -0.0077x$$

$$\frac{\ln(.63)}{-0.0077} = \frac{-0.0077x}{-0.0077}$$

$$-0.0077$$

$$60.00460514 = x$$

(27) Solve

$$A = Pe^{rt}$$

$$P = 100$$

$$A = 200$$

$$r = 2.5\%$$

$$200 = 100e^{.025x}$$

$$\frac{200}{100} = \frac{100e^{.025x}}{100}$$

$$2 = e^{.025x}$$

$$\ln(2) = \ln(e^{.025x})$$

$$\ln(2) = .025x \ln(e)$$

$$\ln(2) = .025x (1)$$

$$\ln(2) = .025x$$

$$\frac{\ln(2)}{.025} = \frac{.025x}{.025}$$

(27.72588722 = X) ✓



28 Solve

$$x + y + z = -6$$

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

$$3x + y + z = -14$$

28.

$$A = \begin{bmatrix} 1 & 1 & 1 & -6 \\ 1 & -1 & 3 & 2 \\ 3 & 1 & 1 & -14 \end{bmatrix}$$

Matrix

Matrix

Edit

A

3x4

$$A = \begin{bmatrix} 1 & 1 & 1 & -6 \\ 1 & -1 & 3 & 2 \\ 3 & 1 & 1 & -14 \end{bmatrix}$$

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

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

$$0 + y + 0 = -3$$

$$0 + 0 + z = 1 \checkmark$$

$$(x, y, z) = (-4, -3, 1)$$

2ND Quit

Matrix

Math

rref([A])

matrix

[A]

$$\textcircled{29.} \sum_{x=3}^5 (x^2 + 2) =$$

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

$$(9 + 2) + (16 + 2) + (25 + 2) =$$

$$(11) + (18) + (27) =$$

$$\textcircled{56 =}$$

✓

 $\textcircled{29.}$

Use graphing calculator

$$\text{sum}(\text{seq}(x^2 + 2, x, 3, 5, 1)) =$$

$$\textcircled{56 =}$$

✓

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30 Expand using the Binomial Theorem

20

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

$${}^3C_0(2x)^3(3)^0 + {}^3C_1(2x)^2(3)^1 + {}^3C_2(2x)^1(3)^2 + {}^3C_3(2x)^0(3)^3 =$$

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

$$8x^3 + 36x^2 + 54x + 27 \quad \checkmark$$