2) $4i(3i-2) = 12i^2 - 8i = -12 - 8i$

4) $(3-4i)^2 = (3-4i)(3-4i) = 9 - 24i + 16i^2 = 9 - 24i - 16 = -7 - 24i$

6) $\dfrac{6}{5+i} = \dfrac{6(5-i)}{(5+i)(5-i)} = \dfrac{30-6i}{25-i^2} = \dfrac{30-6i}{25+1} = \dfrac{30-6i}{26} = \dfrac{15}{13} - \dfrac{3i}{13}$

8) $\sqrt{-32} - \sqrt{-18} = i\sqrt{32} - i\sqrt{18} = i(\sqrt{32} - \sqrt{18}) = i(4\sqrt{2} - 3\sqrt{2}) = i\sqrt{2}$

10) $\dfrac{4+\sqrt{-8}}{2} = \dfrac{4+i\sqrt{8}}{2} = \dfrac{4+2i\sqrt{2}}{2} = \dfrac{4}{2} + \dfrac{2i\sqrt{2}}{2} = 2 + i\sqrt{2}$

12) $x = \dfrac{-b \pm \sqrt{b^2-4ac}}{2a} = \dfrac{-(-6) \pm \sqrt{(-6)^2 - 4(2)(5)}}{2(2)}$

$= \dfrac{6 \pm \sqrt{36-40}}{4}$

$= \dfrac{6 \pm \sqrt{-4}}{4} = \dfrac{6 \pm i\sqrt{4}}{4} = \dfrac{6}{4} \pm \dfrac{2}{4}i = \dfrac{3}{2} \pm \dfrac{1}{2}i$

14) VERTEX: $(-4,-2)$.

$f(0) = (0+4)^2 - 2 = 14$

y- INTERCEPT: $(0,14)$.

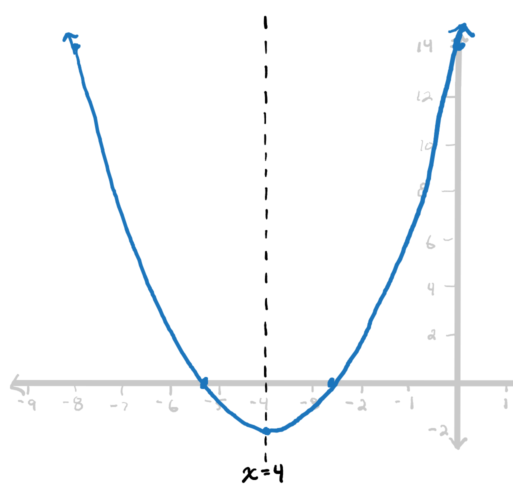
$(x+4)^2 - 2 = 0 \Rightarrow (x+4)^2 = 2$

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

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

X-INTERCEPTS: $(-4-\sqrt{2}, 0)$ AND $(-4+\sqrt{2}, 0)$.

AXIS OF SYMMETRY: $x = -4$.



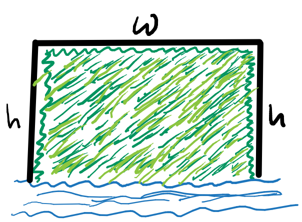
18) a) $f(x) = 2x^2 + 12x + 703$

$$= 2x^2 + 12x + 18 + 685$$
$$= 2(x^2 + 6x + 9) + 685$$
$$= 2(x+3)^2 + 685$$

$2 > 0$, SO PARABOLA OPENS UP. VERTEX IS $(-9, 685)$ AND IS MIN.

b) DOMAIN: $(-\infty, \infty)$

RANGE: $[685, \infty)$

20) 

$w + 2h = 1000 \Rightarrow w = 1000 - 2h$

$A = wh = (1000 - 2h)h$

$$= -2h^2 + 1000h$$
$$= -2h^2 + 1000h - 10\sqrt{10} + 10\sqrt{10}$$
$$= -2(h^2 - 500h + 5\sqrt{10}) + 10\sqrt{10}$$
$$= -2(h - 5\sqrt{10})^2 + 10\sqrt{10}$$

$-2 < 0$, SO PARABOLA OPENS DOWN; VERTEX $(5\sqrt{10}, 10\sqrt{10})$ IS A MAX.

DIMENSIONS: $h \times w = 5\sqrt{10}$ ft $\times$ $(1000 - 10\sqrt{10})$ ft ≈ 15.81 ft $\times$ 968.38 ft

$(5\sqrt{10})(1000 - 10\sqrt{10}) = 5000\sqrt{10} - 500$ ft^2 $\approx 15{,}311.39$ ft^2

24) f IS ODD DEGREE. LEADING COEFFICIENT IS -1. GRAPH IS c.

26) f IS ODD DEGREE. LEADING COEFFICIENT IS 1. GRAPH IS a.

28) NO. AS x GETS LARGE, $f(x)$ EVENTUALLY BECOMES NEGATIVE, AND WHAT DOES A "NEGATIVE NUMBER OF THEFTS" EVEN MEAN? ARE PEOPLE BREAKING IN AND LEAVING GIFTS?

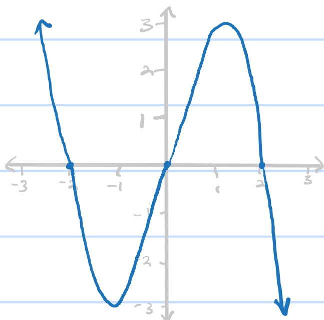
30) ZEROS ARE $x = -5, -2$, AND 1. CROSSES x-AXIS AT -5 AND 1. TOUCHES AND TURNS AROUND AT 2.

32) SINCE $f(1) = -2$ AND $f(2) = 3$, BY THE INTERMEDIATE VALUE THEOREM THERE IS SOME c IN THE INTERVAL $(1,2)$ SUCH THAT $f(c) = 0$.

34) a) f IS ODD. LEADING COEFFICIENT IS -1. LEFT END BEHAVIOR IS TENDING UPWARD. RIGHT END BEHAVIOR IS TENDING DOWNWARD.

b) $f(x) = 4x - x^3 = x(2+x)(2-x)$. GRAPH HAS ORIGIN SYMMETRY.

c)



42)

$$\boxed{2x^2 - 4x + 1 + \frac{10}{5x-3}}$$

$$
\begin{array}{r|l}
5x-3 & 10x^3 - 26x^2 + 17x - 13 \\
 & \underline{10x^3 - 6x^2} \\
 & \quad -20x^2 + 17x - 13 \\
 & \quad \underline{-20x^2 + 12x} \\
 & \qquad\qquad 5x - 13 \\
 & \qquad\qquad \underline{5x - 3} \\
 & \qquad\qquad\quad 10
\end{array}
$$

44)

-5	3	11	-20	7	35
		-15	20	0	-35
	3	-4	0	7	0

$\Rightarrow 3x^3 - 4x^2 + 7$

46) ASSUMING WE DON'T KNOW HOW TO PLUG IN -13, ... WE CAN USE SYNTHETIC DIVISION.

$$\begin{array}{r|rrrr} -13 & 2 & -7 & 9 & -3 \\ & & -26 & 429 & -5694 \\ \hline & 2 & -33 & 438 & -5697 \end{array}$$

THE REMAINDER THEOREM SAYS THEN THAT $f(-13) = -5697$.

48) SINCE 4 IS A ROOT, $x^3 - 17x + 4 = (x-4)(ax^2 + bx + c)$, SO USING SYNTHETIC DIVISION

$$\begin{array}{r|rrrr} 4 & 1 & 0 & -17 & 4 \\ & & 4 & 16 & -4 \\ \hline & 1 & 4 & -1 & 0 \end{array}$$

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

SO BY THE QUADRATIC FORMULA,

$\boxed{x = 4,\ -2 \pm \sqrt{5}}$

50) FACTORS OF CONSTANT TERM: $\pm 1, \pm 2, \pm 4, \pm 8$

FACTORS OF LEADING COEFF: $\pm 1, \pm 3$

POSSIBLE RATIONAL ZEROES: $\pm 1, \pm 2, \pm 4, \pm 8, \pm \frac{1}{3}, \pm \frac{2}{3}, \pm \frac{4}{3}, \pm \frac{8}{3}$.

52) $f(x) = 2x^5 - 3x^3 - 5x^2 + 3x - 1$

SIGN CHANGE SIGN CHANGE SIGN CHANGE

THERE ARE 3 SIGN CHANGES, SO THERE ARE EITHER 1 OR 3 POSITIVE REAL ROOTS.

$f(-x) = -2x^5 + 3x^3 - 5x^2 - 3x - 1$

SIGN CHANGE SIGN CHANGE

THERE ARE 2 SIGN CHANGES, SO THERE ARE EITHER 2 OR 0 NEGATIVE REAL ROOTS.

54) a) FACTORS OF CONSTANT TERM: $\pm 1, \pm 2, \pm 4$

FACTORS OF LEADING COEFFICIENT: ± 1

POSSIBLE RATIONAL ROOTS: $\pm 1, \pm 2, \pm 4$.

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

SIGN CHANGE

THERE IS 1 SIGN CHANGE, SO THERE IS 1 POSITIVE REAL ZERO

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

SIGN CHANGE SIGN CHANGE

THERE ARE 2 SIGN CHANGES, SO THERE ARE EITHER 2 OR 0 NEGATIVE REAL ZEROES.

c) SINCE WE KNOW THERE'S A POSITIVE ZERO, LET'S TRY THAT FIRST.

$$\begin{array}{c|cccc} 1 & 1 & 3 & 0 & -4 \\ & & 1 & 4 & 4 \\ \hline & 1 & 4 & 4 & 0 \end{array}$$

REMAINDER ZERO SAYS THAT $f(1)=0$, SO 1 IS OUR POSITIVE ZERO.

d) BY PART (c), $f(x) = x^3 + 3x^2 - 4 = (x-1)(x^2+4x+4) = (x-1)(x+2)^2$,

SO THE ZEROES ARE $x = 1, -2$.

62) SINCE i IS A ZERO AND COMPLEX ZEROES COME IN CONJUGATE PAIRS, $-i$ IS ALSO A ZERO. HENCE OUR POLYNOMIAL IS

$f(x) = a(x-i)(x+i)(x+3)^2 = a(x^4 + 6x^3 + 10x^2 + 6x + 9)$

SINCE $f(-1) = 16 = a((-1)^4 + 6(-1)^3 + 10(-1)^2 + 6(-1) + 9)$

$= a(1 - 6 + 10 - 6 + 9)$

$= a8$

$\Rightarrow a = 2$, SO

$$\boxed{f(x) = 2x^4 + 12x^3 + 20x^2 + 12x + 18}$$

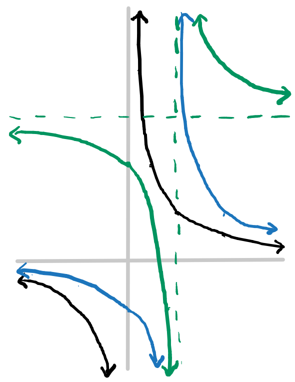
66) 3 REAL ZEROES, 2 COMPLEX ZEROES.

68) 1 REAL ZERO, 4 COMPLEX ZEROES.

70) $f(x) = \frac{1}{x}$

$g(x) = f(x-1) = \frac{1}{x-1}$ HORIZ SHIFT RIGHT

$h(x) = g(x) + 3 = \frac{1}{x-1} + 3$ VERT SHIFT UP



72) Vertical Asymptote: $x = -3$

Horizontal Asymptote: $y = 2$

Slant Asymptotes: NONE

74) Vertical Asymptote: $x = -2$

Horizontal Asymptote: $y = 1$

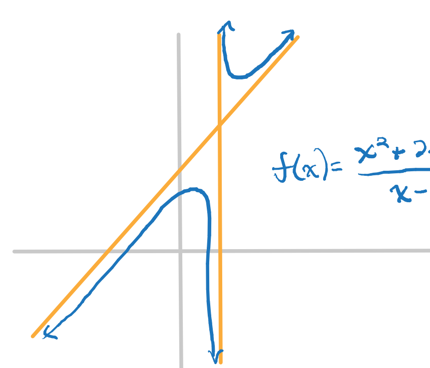
Slant Asymptote: NONE

76)
- Vertical Asymptote: $x = 3$

Horizontal Asymptote: NONE

- Slant Asymptote: $y = x + 5$

$$\begin{array}{r|rrr} 3 & 1 & 2 & -3 \\ & & 3 & 15 \\ \hline & 1 & 5 & 12 \end{array}$$



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