

MAT 142 Homework #5 Key

a. $f(x) = 2x^3 - 11x^2 + 7x - 5$

$f(4) = -25$

$$\begin{array}{r} 2x^2 - 3x - 5 \\ x-4 \overline{) 2x^3 - 11x^2 + 7x - 5} \\ \underline{-2x^3 + 8x^2} \\ -3x^2 + 7x - 5 \\ \underline{+3x^2 - 12x} \\ -5x - 5 \\ \underline{+5x + 20} \\ -25 \end{array}$$

b. $f(x) = 4x^3 + 5x^2 - 6x - 4$

$f(-2) = -4$

c. $f(x) = x^4 - 5x^3 + 5x^2 + 5x - 6$

$f(2) = 0$

$$\begin{array}{r} -2 \overline{) 4 \quad 5 \quad -6 \quad -4} \\ \underline{-8 \quad 6 \quad 0} \\ 4 \quad -3 \quad 0 \quad -4 \end{array}$$

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

$\pm 1, \pm 2, \pm 4$

$$\begin{array}{r} 2 \overline{) 1 \quad -5 \quad 5 \quad 5 \quad -6} \\ \underline{2 \quad -6 \quad -2 \quad 6} \\ 1 \quad -3 \quad -1 \quad 3 \quad 0 \end{array}$$

b. $f(x) = 3x^4 - 11x^3 - x^2 + 19x + 6$

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

c. $f(x) = x^4 - x^3 + 5x^2 - 2x - 6$

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

3a. $f(x) = x^3 - 2x^2 - 11x + 12$

$\pm 1, \pm 2, \pm 3, \pm 4, \pm 6, \pm 12$

$$\begin{array}{r} 1 \overline{) 1 \quad -2 \quad -11 \quad 12} \\ \underline{1 \quad -1 \quad -12} \\ 1 \quad -1 \quad -12 \quad 0 \end{array}$$

$(x-1)(x^2 - x - 12)$

$(x-1)(x-4)(x+3) = 0 \quad x = 1, 4, -3$

b. $f(x) = x^3 - 5x^2 + 17x - 13$

$\pm 1, \pm 13$

$$\begin{array}{r} 1 \overline{) 1 \quad -5 \quad 17 \quad -13} \\ \underline{1 \quad -4 \quad 13} \\ 1 \quad -4 \quad 13 \quad 0 \end{array}$$

$(x-1)(x^2 - 4x + 13) = 0$

$x = \frac{4 \pm \sqrt{16 - 52}}{2} = \frac{4 \pm 6i}{2} = 2 \pm 3i, x = 1$

$$3c. f(x) = x^4 - 2x^3 - 5x^2 + 8x + 4$$

$$\pm 1, \pm 2, \pm 4$$

$$(x-2)(x^3 - 5x - 2)$$

$$\pm 1, \pm 2$$

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

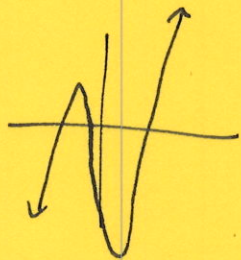
$$x = \frac{2 \pm \sqrt{4+4}}{2} = \frac{2 \pm 2\sqrt{2}}{2}$$

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

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

$$4a. f(x) = 2x^3 - x^2 - 9x - 4$$

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



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

$$x = \frac{1 \pm \sqrt{1+16}}{2} = \frac{1 \pm \sqrt{17}}{2}, x = -\frac{1}{2}$$

$$b. f(x) = x^4 - 2x^3 + x^2 + 12x + 8$$

$$x = -1 \text{ (repeated)}$$

$$(x+1)^2(x^2 - 4x + 8) = 0$$

$$x = \frac{4 \pm \sqrt{16-32}}{2} = \frac{4 \pm 4i}{2} = 2 \pm 2i$$

$$x = 2 \pm 2i, x = -1$$

(2)

$$1 \overline{) \begin{array}{r} 1 \quad -2 \quad -5 \quad 8 \quad 4 \\ \quad \quad 1 \quad -1 \quad -6 \quad 2 \\ \hline 1 \quad -1 \quad -6 \quad 2 \quad \underline{6} \end{array}} \quad \text{not a zero}$$

$$-1 \overline{) \begin{array}{r} 1 \quad -2 \quad -5 \quad 8 \quad 4 \\ \quad \quad -1 \quad 3 \quad 2 \quad -10 \\ \hline 1 \quad -3 \quad -2 \quad 10 \quad \underline{-6} \end{array}} \quad \text{not a zero}$$

$$2 \overline{) \begin{array}{r} 1 \quad -2 \quad -5 \quad 8 \quad 4 \\ \quad \quad 2 \quad 0 \quad -10 \quad -4 \\ \hline 1 \quad 0 \quad -5 \quad -2 \quad \underline{0} \end{array}}$$

$$2 \overline{) \begin{array}{r} 1 \quad 0 \quad -5 \quad -2 \\ \quad \quad 2 \quad 4 \quad -2 \\ \hline 1 \quad 2 \quad -1 \quad \underline{4} \end{array}} \quad \text{not a zero}$$

$$-2 \overline{) \begin{array}{r} 1 \quad 0 \quad -5 \quad -2 \\ \quad \quad -2 \quad 4 \quad 2 \\ \hline 1 \quad -2 \quad -1 \quad \underline{0} \end{array}}$$

$$-\frac{1}{2} \overline{) \begin{array}{r} 2 \quad -1 \quad -9 \quad -4 \\ \quad \quad -1 \quad 1 \quad 4 \\ \hline 2 \quad -2 \quad -8 \quad \underline{0} \end{array}}$$



$$-1 \overline{) \begin{array}{r} 1 \quad -2 \quad 1 \quad 12 \quad 8 \\ \quad \quad -1 \quad 3 \quad -4 \quad -8 \\ \hline 1 \quad -3 \quad 4 \quad 8 \quad \underline{0} \end{array}}$$

$$-1 \overline{) \begin{array}{r} 1 \quad -3 \quad 4 \quad 8 \\ \quad \quad -1 \quad 4 \quad -8 \\ \hline 1 \quad -4 \quad 8 \quad \underline{0} \end{array}}$$

4c. $f(x) = 2x^4 + 3x^3 - 11x^2 - 9x + 15$

$x = -5/2, x = 1$

$(2x+5)(x-1)(x^2-3) = 0$

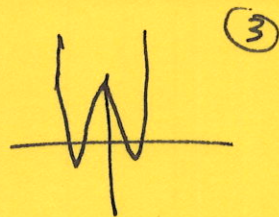
$x = -5/2, x = 1$

$x = \pm\sqrt{3}$

$$\begin{array}{r|rrrrr} 1 & 2 & 3 & -11 & -9 & 15 \\ & & 2 & 5 & -6 & -15 \\ \hline & 2 & 5 & -6 & -15 & 0 \end{array}$$

$$\begin{array}{r|rrrr} -\frac{5}{2} & 2 & 3 & -11 & -9 & 15 \\ & & -5 & 0 & 15 & \\ \hline & 2 & 0 & -6 & 0 & \end{array}$$

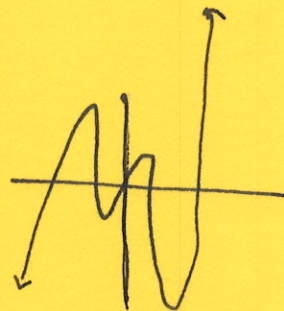
$2(1 \ 0 \ -3)$



4d. $f(x) = 4x^5 + 12x^4 - 41x^3 - 99x^2 + 10x + 24$

$x = -4, x = 2, x = -1/2, x = 1/2, x = 3$

$(x+4)(x-2)(2x+1)(2x+1)(x-3) = 0$

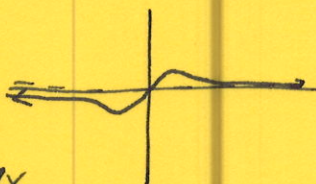


5a. $f(x) = \frac{x}{x^2+4}$

horizontal asymptote $y=0$
no vertical asymptotes

b. $f(x) = \frac{12x^3}{3x^2+1}$

no vertical asymptotes



oblique asymptote

$y = 4x$

$$\begin{array}{r} 4x \\ 3x^2+1 \overline{) 12x^3} \\ \underline{-12x^3 + 4x} \\ -4x \end{array}$$

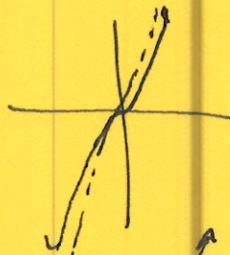
$y = 4x - \frac{4x}{3x^2+1}$

c. $f(x) = \frac{2x^3}{x^2-1}$

$$\begin{array}{r} 2x \\ x^2-1 \overline{) 2x^3} \\ \underline{-2x^3 + 2x} \\ 2x \end{array}$$

oblique asymptote $y = 2x$

vertical asymptotes at $x=1, x=-1$

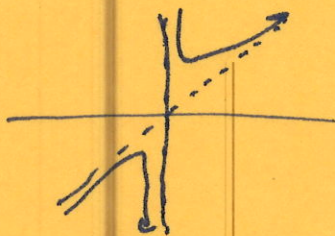


$y = 2x + \frac{2x}{x^2-1}$



5d. $f(x) = \frac{x^2+1}{x}$ $y = x + \frac{1}{x}$

oblique asymptote $y=x$
vertical asymptote

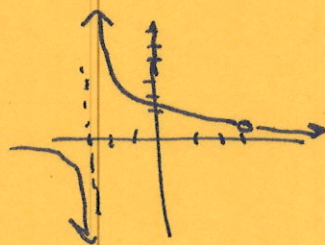


e. $f(x) = \frac{x-3}{x^2-9} = \frac{x-3}{(x-3)(x+3)} = \frac{1}{x+3}$

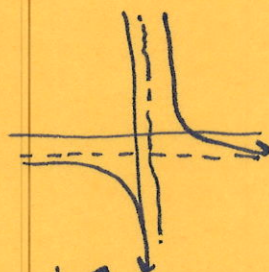
vertical asymptote $x=-3$

hole at $x=3$

horizontal asymptote at $y=0$



f. $f(x) = \frac{-3x+7}{5x-2}$ horizontal asymptote $y = -\frac{3}{5}$
vertical asymptote $x = \frac{2}{5}$

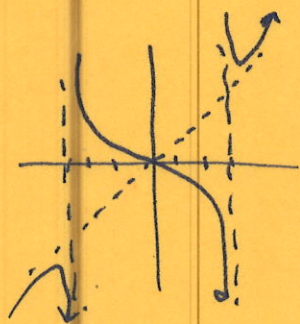


g. $f(x) = \frac{x^3-1}{x^2-9}$

$$\begin{array}{r} x^2-9 \overline{) x^3 -1} \\ -x^3 \\ \hline 9x-1 \\ y = x + \frac{9x-1}{x^2-9} \end{array}$$

oblique asymptote
 $y=x$

vertical asymptotes
 $x=3, x=-3$



6a. $y=kx$

$\frac{65}{5} = \frac{k5}{5}$ $k=13$ $y=13x$ $y=13(12) = 156$

b. $y = \frac{k}{x}$

$6 = \frac{k}{3}$ $k=18$ $y = \frac{18}{x}$ $y = \frac{18}{9} = 2$

c. $y = kxz$

$25 = k(2)(5) \Rightarrow \frac{5}{2} = k$ $y = \frac{5 \times 2}{2} = \frac{5(8)(12)}{2} = 240$

d. $y = \frac{kab}{\sqrt{c}}$

$12 = \frac{k(3)(2)}{\sqrt{25}} \Rightarrow k=10$ $y = \frac{10ab}{\sqrt{c}} = \frac{10(5)(\cancel{5})}{\sqrt{9}} = 50$

7. $T = \frac{k}{d}$

$4.4 = \frac{k}{1000}$ $k = 4400$ $T = \frac{4400}{d}$ $T = \frac{4400}{5000} = .88^\circ\text{C}$

8. $F = kAs^2$

$$150 = k(20)(30)^2$$

$$k = \frac{1}{120}$$

$$F = \frac{As^2}{120}$$

$$F = \frac{60^2(12)}{120} = 360$$

yes, put up shutters

9. $y = \frac{6}{x}$

yes it does

