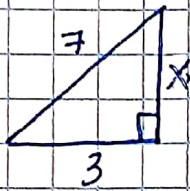


Ch 4.

1)



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

$$x = \sqrt{40}$$

$$x = 2\sqrt{10}$$

$$\sin \theta = \frac{2\sqrt{10}}{7}$$

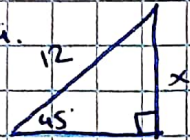
$$\tan \theta = \frac{2\sqrt{10}}{3}$$

$$\csc \theta = \frac{7\sqrt{10}}{20}$$

$$\sec \theta = \frac{7}{3}$$

$$\cot \theta = \frac{3\sqrt{10}}{20}$$

2.) a.

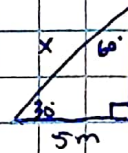


$$12 = x\sqrt{2}$$

$$\frac{12\sqrt{2}}{2} = x$$

$$6\sqrt{2} = x$$

b.

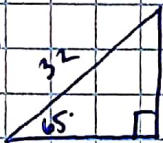


$$5m = a\sqrt{3}$$

$$\frac{5\sqrt{3}}{3} = a$$

$$\frac{10\sqrt{3}}{3} m = x$$

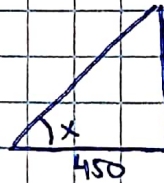
3)



$$\sin 65^\circ = \frac{x}{32}$$

$$29.0025 \text{ ft} = x$$

4)



$$\tan x = \frac{2000}{450}$$

$$x = \tan^{-1}\left(\frac{2000}{450}\right)$$

$$x = 77.320^\circ$$

5)

a.  $990 \left(\frac{\pi}{180}\right) = \frac{11\pi}{2}$

b.  $-220 \left(\frac{\pi}{180}\right) = -\frac{11\pi}{9}$

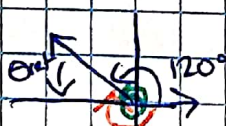
c.  $55 \left(\frac{\pi}{180}\right) = \frac{11\pi}{36}$

6) a.  $-\frac{3\pi}{4} = -135^\circ$

b.  $\frac{7\pi}{12} \left(\frac{180^\circ}{\pi}\right) = 105^\circ$

c.  $\frac{4\pi}{21} \left(\frac{180^\circ}{\pi}\right) = \left(\frac{240}{7}\right)^\circ$

7. a.

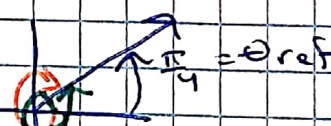


$$\theta_{\text{ref}} = 60^\circ$$

$$\ominus = -240^\circ$$

$$\oplus = 480^\circ$$

b.



$$\ominus = -\frac{7\pi}{4}$$

$$\oplus = \frac{9\pi}{4}$$

8.  $s = r\theta$

$$\theta = 115 \left(\frac{\pi}{180}\right) = \frac{23\pi}{36}$$

a)  $s = 4 \text{ cm} \left(\frac{23\pi}{36}\right)$

$$s = \frac{23}{9}\pi \text{ cm} \approx 8.029 \text{ cm}$$

b.

$$A = \frac{1}{2} r^2 \theta$$

$$A = \frac{1}{2} (4 \text{ cm})^2 \left(\frac{23\pi}{36}\right)$$

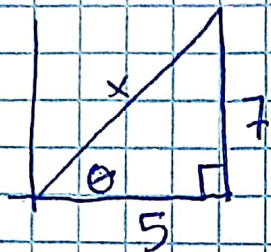
$$A = 16.755 \text{ cm}^2$$



9. a.  $20(110)\pi$   
 $220\pi \text{ rad/min}$

b.  $\frac{220\pi}{\text{min}} (15 \text{ in}) \left( \frac{60 \text{ min}}{1 \text{ hr}} \right) \left( \frac{1 \text{ ft}}{12 \text{ in}} \right) \left( \frac{1 \text{ mi}}{5280 \text{ ft}} \right)$   
 $\frac{198000\pi \text{ mi}}{63360 \text{ hr}} \approx 9.817 \text{ mi/hr}$

10.

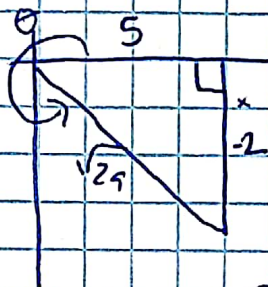


$x^2 = 7^2 + 5^2$   
 $x = \sqrt{74}$

$\sin \theta = \frac{7\sqrt{74}}{74}$   
 $\cos \theta = \frac{5\sqrt{74}}{74}$   
 $\tan \theta = \frac{7}{5}$

$\csc \theta = \frac{\sqrt{74}}{7}$   
 $\sec \theta = \frac{\sqrt{74}}{5}$   
 $\cot \theta = \frac{5}{7}$

11.



$x^2 + 5^2 = (\sqrt{29})^2$   
 $x = 2$

$\sin \theta = \frac{-2\sqrt{29}}{29}$   
 $\cos \theta = \frac{5\sqrt{29}}{29}$   
 $\tan \theta = -\frac{2}{5}$

$\csc \theta = \frac{-\sqrt{29}}{2}$   
 $\sec \theta = \frac{\sqrt{29}}{5}$   
 $\cot \theta = -\frac{5}{2}$

12. a.  $\cos\left(\frac{13\pi}{4}\right) = \frac{-\sqrt{2}}{2}$   
 c.  $\tan\left(\frac{29\pi}{6}\right) = -\frac{\sqrt{3}}{3}$

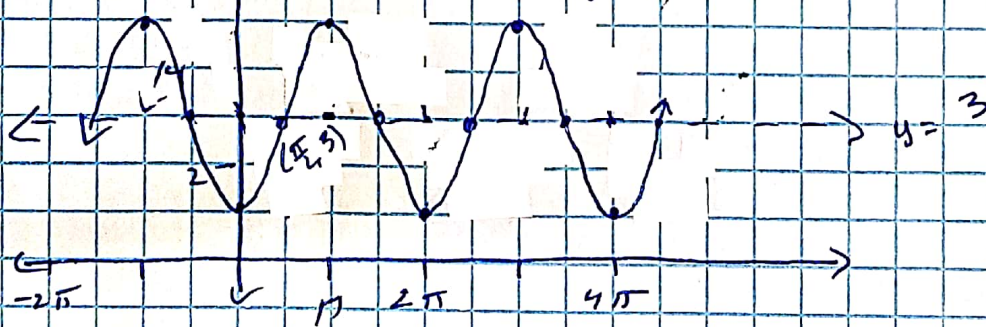
b.  $\sin(-390^\circ) = -\frac{1}{2}$

13.  $y = 2\sin\left(x - \frac{\pi}{2}\right) + 3$

a. per:  $2\pi$

b. freq:  $\frac{1}{2\pi}$

c. right  $\frac{\pi}{2}$ , d.v.s. up 3



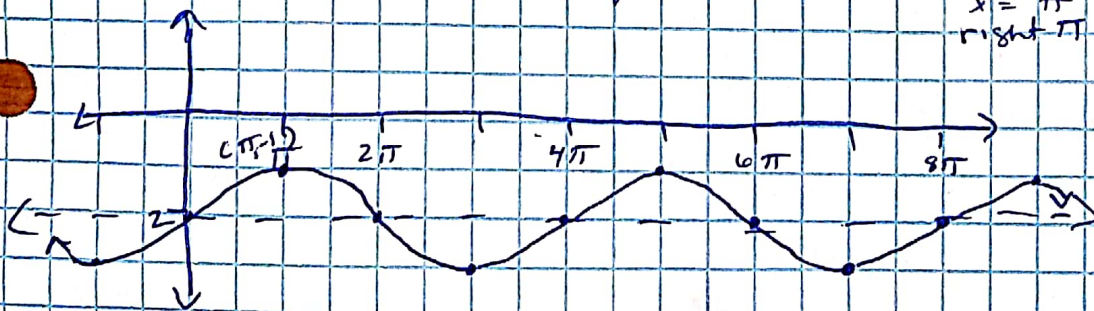
14.  $y = \cos\left(\frac{1}{2}x - \frac{\pi}{2}\right) - 2$

a. per:  $\frac{2\pi}{\frac{1}{2}} = 4\pi$

b. freq:  $\frac{1}{4\pi}$

c.  $\frac{1}{2}x - \frac{\pi}{2} = 0$   
 $\frac{1}{2}x = \frac{\pi}{2}$   
 $x = \pi$   
 right  $\pi$

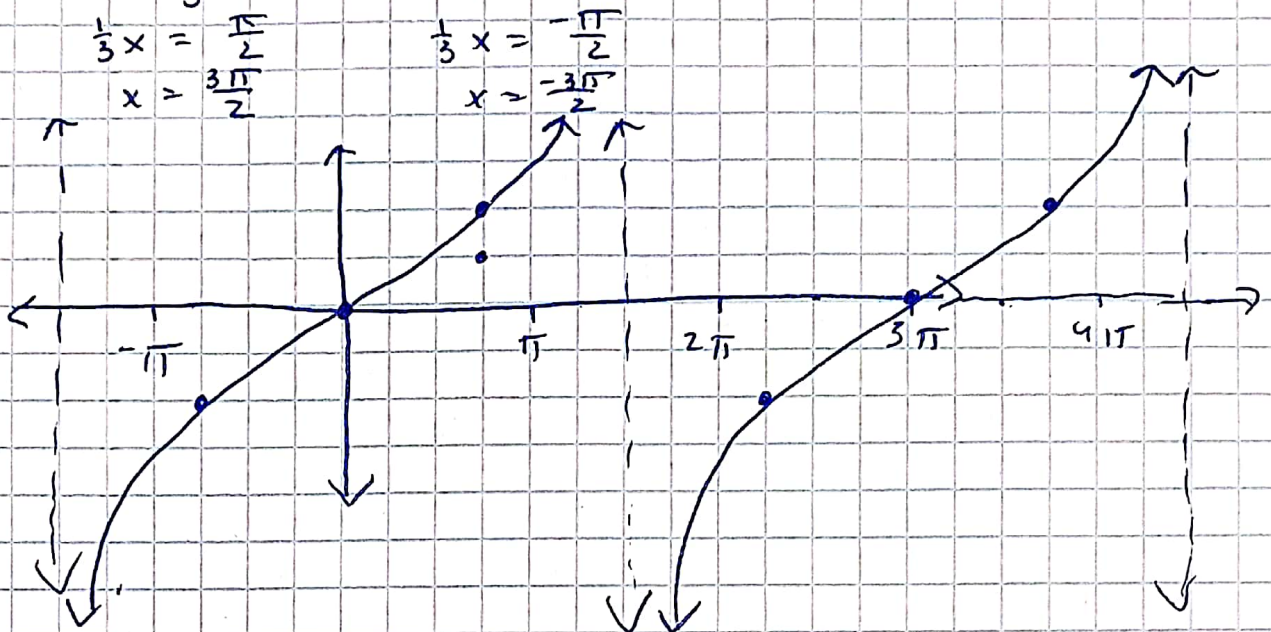
d. down 2



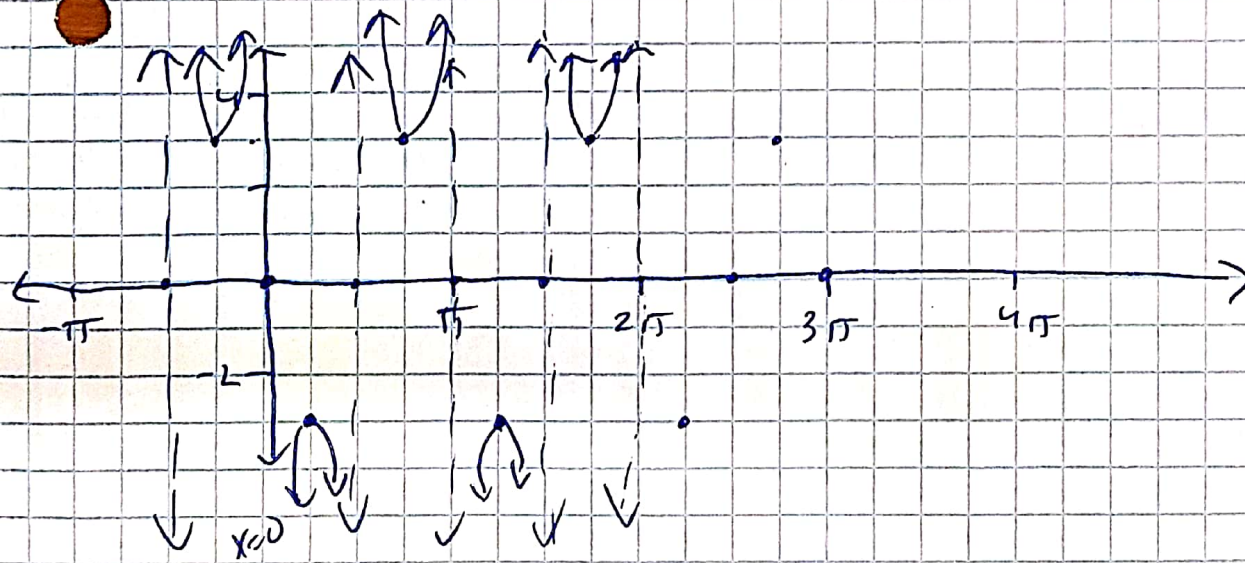


15.  $y = 2 \tan\left(\frac{1}{3}x\right) - 1$

a. per =  $\frac{\pi}{\frac{1}{3}} = 3\pi$     b.  $\frac{1}{3\pi}$     c. none    d. down 1



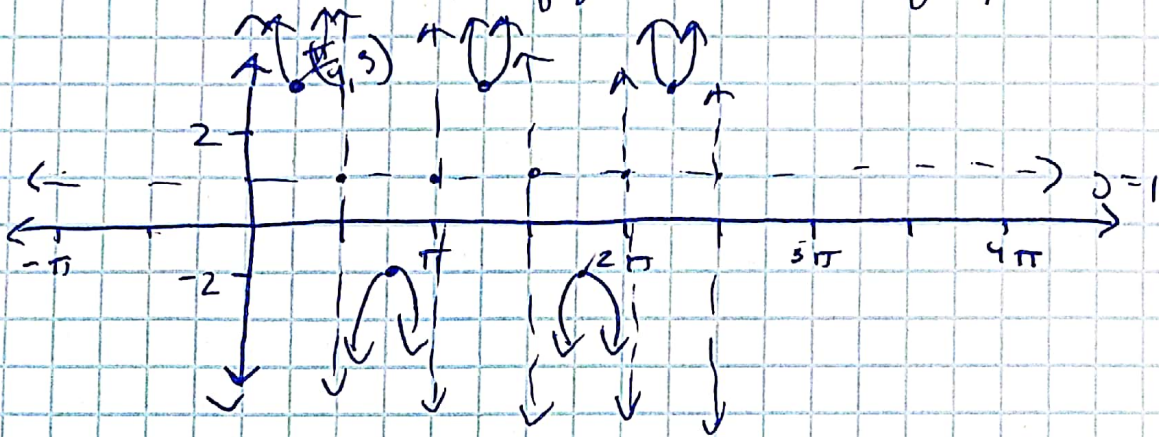
16. a. per =  $\frac{2\pi}{2} = \pi$     b.  $\frac{1}{\pi}$     c. none    d. none





17.  $y = 2 \sec\left(x + \frac{\pi}{4}\right) + 1$

- a.  $per = \frac{2\pi}{2} = \pi$       b.  $freq. = \frac{1}{\pi}$       c. left  $\frac{\pi}{4}$       d. up 1

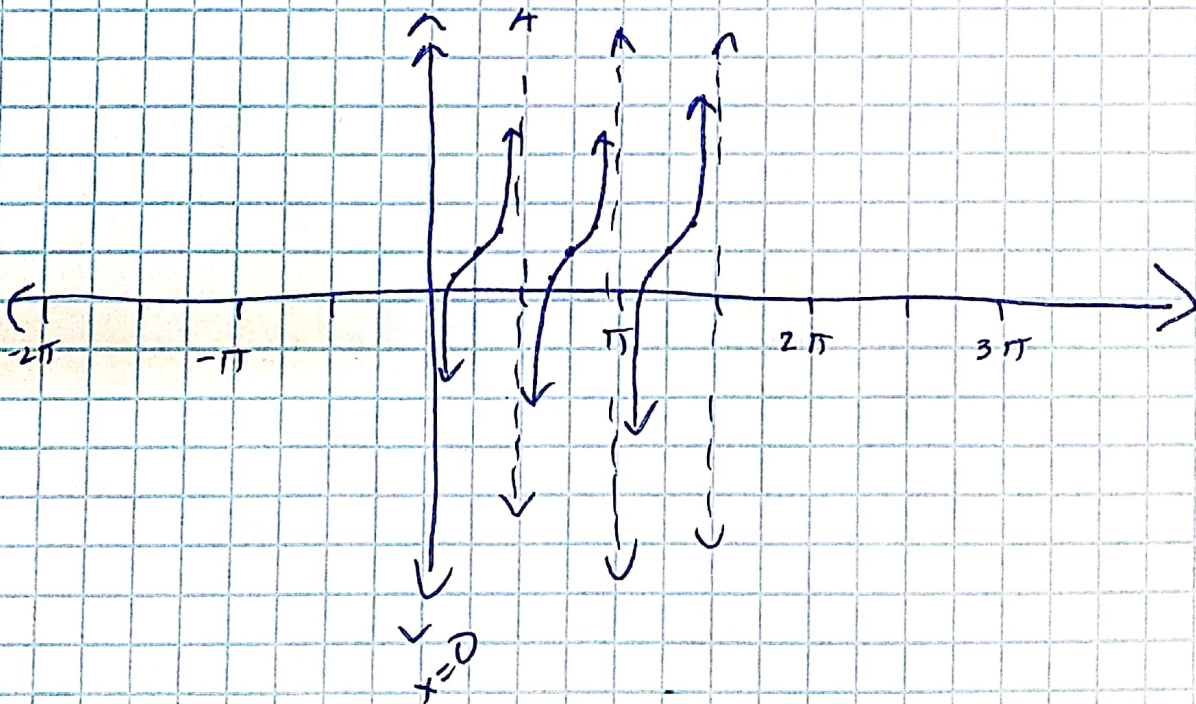


18.  $y = \frac{1}{2} \cot(2x) + 1$

- a.  $per = \frac{\pi}{2}$       b.  $freq. = \frac{2}{\pi}$       c. none      d. up 1

e.  $2x = 0$   
 $x = 0$

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





Ch 3 review:

1. a)  $\log_2 32 = 5$       b.  $\log_{19} 19 = 1$       c.  $\log_7 \frac{1}{2041} = x$

d.  $14^{\log_{14} 2.3} = 2.3$       e.  $\ln(-2) = \text{Undefined}$       f.  $e^{\ln 30} = 30$   
 $7^x = 7^{-4}$   
 $x = -4$

2. a.  $\log_3 \sqrt[4]{243} = x$       b.  $3 \ln e^4 - 2 \ln e^2$       c.  $\log_6 4 = x$

$3^x = 3^{\frac{5}{4}}$        $3(4) - 2(2)$        $x = .774$   
 $x = \frac{5}{4}$        $8$

3. a.  $\log 4x^3y^5$       b.  $\ln \left( \frac{2x-3}{3\sqrt{x}} \right)$

$\log 4 + 3 \log x + 5 \log y$        $\ln(2x-3) - \ln 3 - \frac{1}{4} \ln x$

4. a.  $\frac{1}{3} \log_4 x - 5 \log_4 (x+2)$       b.  $5 \ln(y+1) + 6 \ln y$

$\log_4 \frac{\sqrt[3]{x}}{(x+2)^5}$        $\ln(y+1)^5 y^6$

5. a.  $4^{x+2} = 16^{x-3}$       b.  $\left(\frac{2}{3}\right)^{x-5} = \left(\frac{1}{9}\right)^{\frac{3x}{4}}$       c.  $2 \frac{\ln x}{2} = \frac{18}{2}$

$4^{x+2} = 4^{2(x-3)}$        $\left(\frac{2}{3}\right)^{x-5} = \left(\frac{2}{3}\right)^{-2\left(\frac{3x}{4}\right)}$        $\ln x = 9$   
 $x+2 = 2x-6$        $2(x-5) = \left(-\frac{3x}{2}\right) 2$        $x = e^9$   
 $8 = x$        $2x-10 = -3x$        $2 = x$   
 $-10 = -5x$

d.  $7 - 3 \log_{10} 10x = 13$       e.  $\log_2 5 = \log_2 10 - \log_2 (x-4)$

$-3 \log_{10} 10x = 6$   
 $\log_{10} 10x = -2$   
 $10^{-2} = 10x$   
 $\frac{.01}{10} = \frac{10x}{10}$   
 $.001 = x$

$\log_2 5 = \log_2 \frac{10}{x-4}$   
 $5 = \frac{10}{x-4}$   
 $5(x-4) = 10$   
 $x-4 = 2$   
 $x = 6$



$$f. e^{2x+1} = 8$$

$$2x+1 = \ln 8$$

$$x = \frac{\ln 8 - 1}{2}$$

$$x = .540$$

$$g. 3^{2x-1} = 2^{4-x}$$

$$\ln 3^{2x-1} = \ln 2^{4-x}$$

$$(2x-1) \ln 3 = (4-x) \ln 2$$

$$2x \ln 3 - \ln 3 = 4 \ln 2 - x \ln 2$$

$$2x \ln 3 + x \ln 2 = 4 \ln 2 + \ln 3$$

$$\frac{x(2 \ln 3 + \ln 2)}{2 \ln 3 + \ln 2} = \frac{4 \ln 2 + \ln 3}{2 \ln 3 + \ln 2}$$

$$x = 1.339$$

$$h. \log(6x+2) - \log(x+1) = \log(2x-1)$$

$$\log\left(\frac{6x+2}{x+1}\right) = \log(2x-1)$$

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

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

$$2x^2 - 5x - 3 = 0$$

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

$$\cancel{x = -\frac{1}{2}} \quad x = 3$$

$$i. \ln(3x-4) = 1 + \ln(2x+3)$$

$$\ln(3x-4) - \ln(2x+3) = 1$$

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

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

$$e'(2x+3) = 3x-4$$

$$2e'x + 3e' = 3x-4$$

$$2e'x - 3x = -4 - 3e'$$

$$\frac{x(2e'-3)}{2e'-3} = \frac{-4-3e'}{2e'-3}$$

$$x = \frac{-4-3e'}{2e'-3}$$

$$x = -4.589$$

- no solution  $\hat{=}$

6.

a. In 2012 there were 2400 posts

$$b. 150,000 = 2400(2.1)^t$$

$$62.5 = 2.1^t$$

$$\log_{2.1} 62.5 = t$$

$$5.573 = t$$

about midway through the 5<sup>th</sup> year

$$c. f(8) = 2400(2.1)^8$$

$$f(8) = 907748.625$$

907,748 posts

$$7. a. y = 19560 e^{-0.031t}$$

$$y = 13908.312$$

13908 people

$$b. 10,000 = 19560 e^{-0.031t}$$

$$\frac{10,000}{19560} = e^{-0.031t}$$

$$\ln \frac{10,000}{19560} = -0.031t$$

$$\frac{-0.031}{-0.031} = \frac{-0.031}{-0.031}$$

$$21.642 = t$$

$$8. a. f(18) = 1500 \left(1 + \frac{0.0375}{4}\right)^{4(18)}$$

$$f(18) = \$2936.80$$

$$b. f(18) = 1500 \left(1 + \frac{0.0375}{12}\right)^{18(12)}$$

$$f(18) = \$2942.95$$



# Ch 2

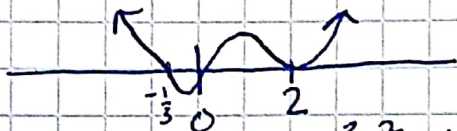
1. a)  $(2i+7) - (3i-5)$   
 $-i + 12$

b)  $3i(10i) + i^2(2i-8)$   
 $30i^2 + 2i^3 - 8i^2$   
 $-30 - 2i + 8$   
 $-22 - 2i$

2. a)  $\frac{2}{3i-4} \left( \frac{3i+4}{3i+4} \right)$   
 $\frac{6i+8}{9i^2-16}$   
 $\frac{6i+8}{-25}$

b)  $(2i-4)(4i-9)$   
 $8i^2 - 16i - 18i + 36$   
 $28 - 34i$

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



4.  $f(x) = 3x^4 - x^3 + x^2 + x - 1$   
 ⊕ even  $\lim_{x \rightarrow +\infty} f(x) = \infty$   
 PRZ = 4  
 TP's = 3

5.  $2x-5 \overline{) 6x^3 + 17x^2 - 104x + 60}$   
 $-(6x^3 - 15x^2)$   
 $32x^2 - 104x$   
 $-(32x^2 - 80x)$   
 $-24x + 60$   
 $-24x + 60$   
 $0$

6.  $x+1 \overline{) 4x^3 - 6x^2 + 6x + 2}$   
 $-(4x^3 + 4x^2)$   
 $-6x^3 + 10x^2$   
 $-(-6x^3 - 6x^2)$   
 $6x^2 + 8x$   
 $-(6x^2 + 6x)$   
 $2x + 10$   
 $-(2x + 2)$   
 $-12$   
 $4x^3 - 6x^2 + 6x + 2 - \frac{12}{x+1}$

$(2x-5)(3x^2 + 16x - 12)$   
 $(2x-5)(3x-2)(x+6)$

7.  $x^2 - 5x + 6 \overline{) x^3 - x^2 - 14x + 4}$   
 $-(x^3 - 5x^2 + 6x)$   
 $4x^2 - 20x + 4$   
 $-(4x^2 - 20x + 24)$   
 $-20$   
 $x+4 - \frac{20}{x^2-5x+6}$

8.  $3 \overline{) 2 \ -4 \ -3 \ -6 \ -5 \ -8}$   
 $6 \ 6 \ 9 \ 9 \ 12$   
 $2 \ 2 \ 3 \ 3 \ 4 \ 4$   
 $r = 4$

that 3 is not a factor,  
 (3, 4) is a pt on graph



$$9.3) \begin{array}{r} 4 \quad -9 \quad -15 \quad 30 \\ 12 \quad 9 \quad -30 \\ \hline 4 \quad 3 \quad -10 \quad 0 \end{array}$$

$$f(x) = (x-3)(4x^2+3x-10)$$

$$f(x) = (x-3)(4x-5)(x+2)$$

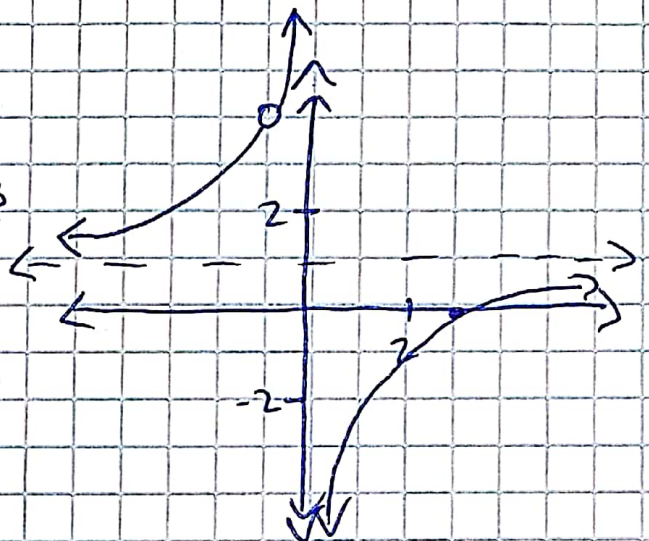
$$11) g(x) = \frac{(x-2)(x+3)}{(x+2)}$$

HA:  $2 > 1 \therefore$  no horizontal asymptote

VA:  $x = -2$

$$12) a. h(x) = \frac{(x-3)(x+1)}{x(x+1)}$$

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



VA:  $x = 0$

HA:  $y = 1$

hole:  $f(-1) = \frac{-1-3}{-1} = 4$   
 $(-1, 4)$

$x: x-3=0$   
 $x=3$   
 $(3, 0)$

$$b. f(x) = \frac{x^2-x-12}{2x^2-8}$$

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

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

VA:  $x = 2 \quad x = -2$

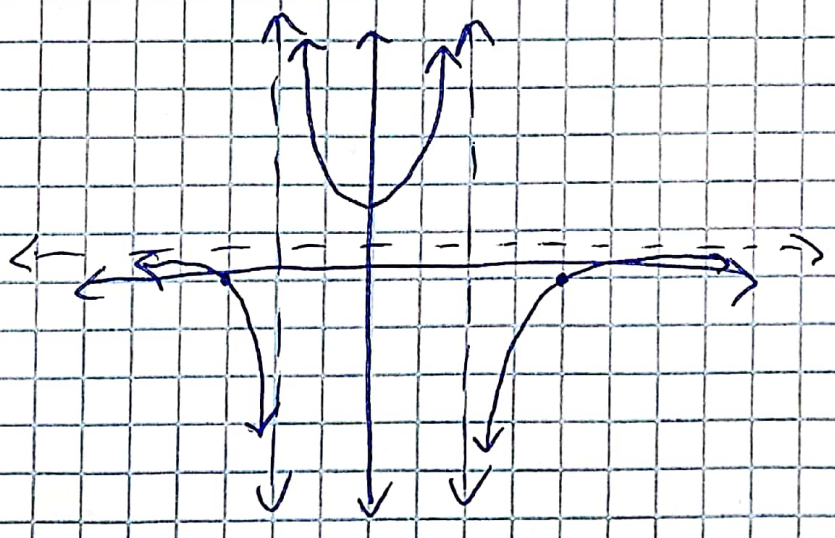
HA:  $y = \frac{1}{2}$

hdx:  $\emptyset$

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

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

y int:  $f(0) = \frac{-12}{-8}$   
 $(0, \frac{3}{2})$



$$10. f(x) = 2x^4 - 4x^3 - x^2 - 10x - 15$$

PRZ = 4

$$\pm (1, 3, 5, 15, \frac{1}{2}, \frac{3}{2}, \frac{5}{2}, \frac{15}{2})$$

$$\begin{array}{r} -1 \mid 2 \quad -4 \quad -1 \quad -10 \quad -15 \\ \quad -2 \quad 6 \quad -5 \quad 15 \\ \hline 3 \mid 2 \quad -6 \quad 5 \quad -15 \quad 0 \\ \quad 6 \quad 0 \quad 15 \\ \hline 2 \quad 0 \quad 5 \quad 0 \end{array}$$

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



$$\begin{aligned} 13) \quad f(x) &= (x+3)(x+2i)(x-2i) \\ &= (x+3)(x^2+4) \\ f(x) &= x^3 + 3x^2 + 4x + 12 \end{aligned}$$

$$14) \quad \left( \frac{-28}{x^2-1} + \frac{4x}{x-1} = \frac{5x-2}{x+1} \right) \quad x^2=1$$

$$-28 + 4x(x+1) = (5x-2)(x-1)$$

$$-28 + 4x^2 + 4x = 5x^2 - 7x + 2$$

$$0 = x^2 - 11x + 30$$

$$0 = (x-6)(x-5)$$

$$x=6 \quad x=5$$



# Ch 1 review answers

1)  $g(x) = \sqrt{4x-1}$

D:  $[\frac{1}{4}, \infty)$   
R:  $[0, \infty)$

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

D:  $(-\infty, -1) \cup (-1, 1) \cup (1, \infty)$   
R:  $(-\infty, 0] \cup (3, \infty)$

3) NO, not a f(x)

4)  $f(3a) = \sqrt{(3a)^2 - 4}$   
 $= \sqrt{9a^2 - 4}$

5) D:  $(-\infty, 3]$   
R:  $(-\infty, 2]$

6)  $xy = -6$   
 $-xy = -6$  NO  
 $x-y = -6$  NO  
 $(-x)(y) = -6$   
 $xy = -6$   
odd origin symmetry

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

NO symmetry / not odd/even

8)  $f(x) = \frac{x-2}{(x-2)(x+2)} = \frac{1}{x+2}$   
removable discontinuity

1.9	1.99	1.999	2	2.001	2.01	2.1
.256	.251	.25	0	.249	.249	.243

9)  $f(x) = \frac{1}{x^2-1}$   
 $f(1) = \frac{1}{0}$  undef

.9	.99	.999	1	1.001	1.01	1.1
-526	-506	-500	0	500	510	576

infinite

10)  $\frac{f(-3) - f(-1)}{-3 - (-1)} = \frac{-24 - 0}{-2} = 12$

11)  $\lim_{x \rightarrow -\infty} f(x) = \infty$

$\lim_{x \rightarrow \infty} f(x) = -\infty$

Dec:  $(-\infty, -1.232) \cup (2.151, \infty)$

Inc:  $(-1.232, 2.151)$

relative min  $(-1.232, -7.93)$   
relative max  $(2.151, 4.570)$

12)  $\lim_{x \rightarrow -\infty} f(x) = -\infty$

$\lim_{x \rightarrow \infty} f(x) = \infty$

rel. min  $(.549, .369)$

rel max  $(-1.215, 3.113)$

dec:  $(-2.151, .549)$  inc:  $(-\infty, -1.215) \cup (.549, \infty)$

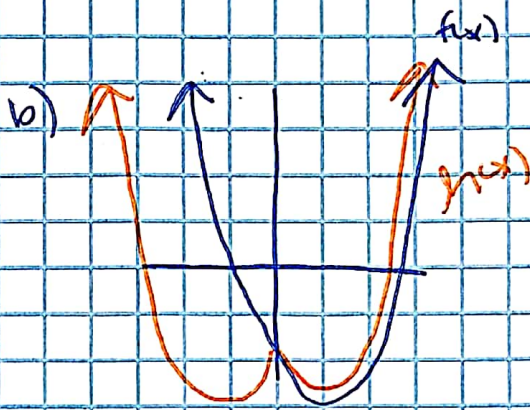
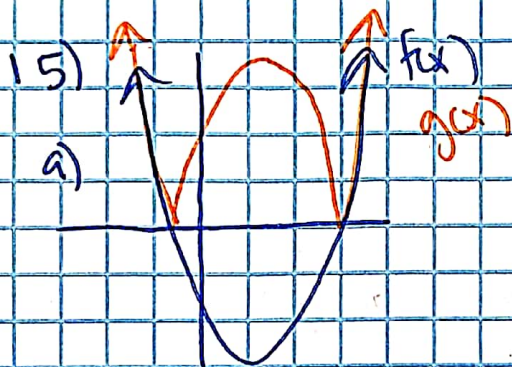


13)  $f(x) = |x|$

dom:  $(-\infty, \infty)$   
 rang:  $[0, \infty)$

x-int:  $(0, 0)$   
 y-int:  $(0, 0)$   
 dec:  $(-\infty, 0)$   
 even (w)  
 symmetry w/ y-axis  
 inc:  $(0, \infty)$

14)  $f(x) = 3\sqrt{-4x}$



16) a.  $(f-g)(x) =$   
 $2x^2 + 1 - (3x - 4)$   
 $2x^2 - 3x + 5$

b.  $(f \circ g)(x) = 2(3x - 4)^2 + 1$   
 $= 2(9x^2 - 24x + 16) + 1$   
 $= 18x^2 - 48x + 33$

c.  $(g \circ f)(x) = 3(2x^2 + 1) - 4$   
 $= 6x^2 - 1$

d.  $f(g(3)) = 18(3)^2 - 48(3) + 33$   
 $= 51$

17. No, it is not one-to-one

18.  $x = \frac{7}{3-y}$

$7 = x(3-y)$

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

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

$-\frac{7}{x} + 3 = f^{-1}(x)$

19.  $f(g(x)) = \frac{2}{3}(\frac{3}{2}(x-2)) + 2$

$= x$

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

$= x$

Inverses

