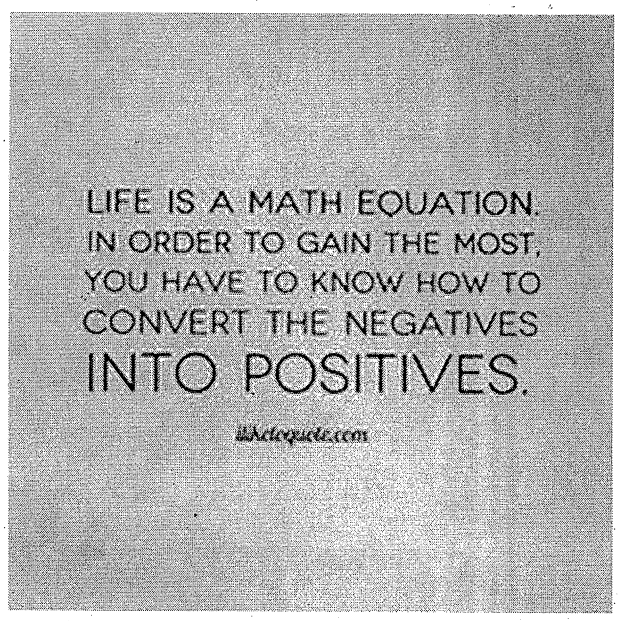
Pre–Calculus Extra Practice



Fall and Spring Projects

Worksheets

Both Honors and Regulars

Ms. Sherman

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Pre–Calculus Honors Spring Projects

Almond Joy, Hershey's , M&M's, Snickers

Key

Worksheets

Trigonometric Information Sheet

Sherm's Happy Homework

Additional Chapter 5 Problems

Attitude **Please note ** indicates that you should use your calculator**

1. Factor completely: $3x^2y^5 - 7xy^5 - 6y^5$

2. Solve for x: $\frac{3}{4}(3-7x)^2 = 18(7x-3)$

3. Simplify the expression: $\frac{2+7i}{2i} + \frac{5i}{1-i}$

4. Using Descarte's Rule of Signs, determine the number of positive and negative roots:
$f(x) = x^5 + x^4 - 3x^3 - 5x + 3$

5. Graph and label all intercepts:
$g(x) = -4(x-7)^2 + 25$

6. Graph and label all intercepts:
$g(x) = \frac{-x}{3} - 2$

7. Graph and label all intercepts:
$g(x) = 2 - \sqrt{x+9}$

8. Graph and label all intercepts and state the domain: $g(x) = -1 + \log_2(x+4)$

9. Graph and label all intercepts:
$g(x) = x^7 - 8x^6 - 20x^5$

10. Graph and label all intercepts:
$g(x) = -|2x+4| + 6$

11. Using interval notation, state the domain of the rational function:
$f(x) = \frac{x^2-4}{x^2+x-56}$

12. Using interval notation, state the range of the exponential function:
$k(x) = -4 + 2e^{x-3}$

13. Using interval notation, state the range of the quadratic function:
$w(x) = -8x^2 + 16x + 5$

14. Find the General Form of the equation that is perpendicular to the line $\frac{5x}{4} = -\frac{2}{3}(y-5)$ and passes through the point $(-1,12)$.

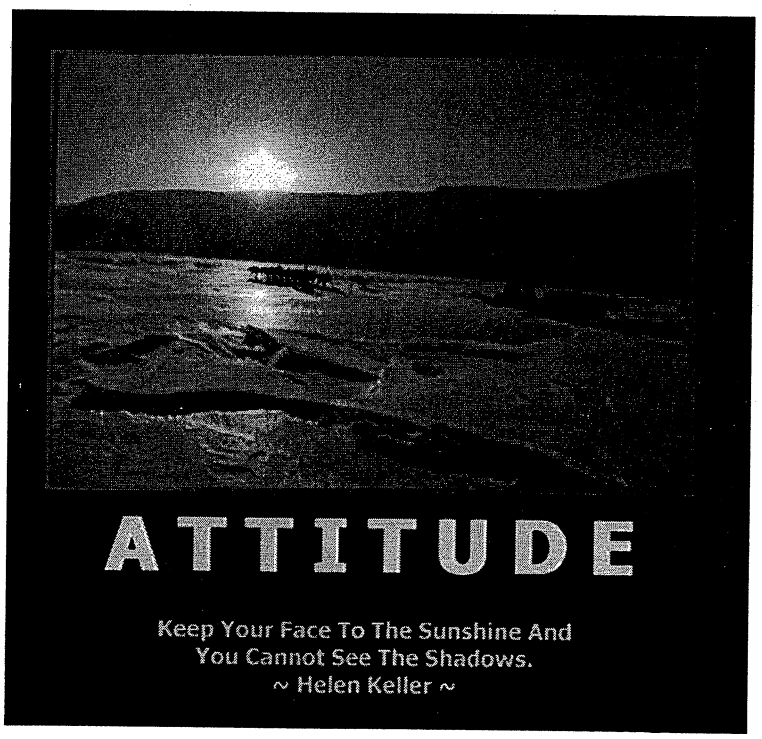
15. Given
$g(x) = 3 + 2x^2$ *and* $h(x) = 3x - 1$
evaluate $g(h(x))$

27. ** Find the polynomial of degree 3 that has the given zeros: $\frac{1}{2}$; -5; $\frac{2}{3}$

28. Given $f(x) = x^3 + x^2 - 7x + 65$ evaluate $f(2-3i)$

29. Solve for x: $\left(4\sqrt{2}\right)^{3x-1} = \frac{1}{2}$

30. Graph, label all intercepts and state the range of the exponential function: $l(x) = 9 - 3^{1-x}$



16. Graph and label all intercepts:

$$j(x)=\begin{cases}\sqrt[3]{x}-1; & x>0\\ -5x+1; & x\le 0\end{cases}$$

17. Given $j(x)=\begin{cases}\sqrt[3]{x}-1; & x>0\\ -5x+1; & x\le 0\end{cases}$

a. Evaluate $j(4)$

b. Evaluate $j(-2)$

18. ** Graph the polynomial function $b(x)=4x^4-123x^2+121x-30$

a. State all x- and y- intercepts

b. State the relative maximum and relative minimum points

c. Using interval notation, state where the function is increasing and decreasing.

19. Determine whether the graph is even, odd or neither- show your work for credit: $h(x)=\dfrac{4^{x^2}}{x}$

20. ** Find the average rate of change of the function $f(x)=x^2-3x-3$ from $x_1=10.7$ *to* $x_2=-9.8$.

21. Graph the function $w(x)=-x^2+7x-12$ and using interval notation, determine where the interval(s) for which $w(x)<0$

22. Given $f(x)=4-3x$, $g(x)=16-9x^2$

a. Evaluate $f(x)-g(x)$

b. Evaluate $\dfrac{f(x)}{g(x)}$

c. State the domain of $\dfrac{f(x)}{g(x)}$

23. Graph the function: $j(x)=[\![x]\!]+4$

24. Write the GENERAL form of the equation of the parabola that has vertex $(6,-7)$ and whose graph passes through the point $(3,-2)$

25. State the center and radius of the circle: $x^2+y^2+10x-10=0$

26. Sketch the graph and label all intercepts: $r(x)=2x(2x-3)(x+4)^3$

1. Factor completely:
$5x^4y^4+7x^3y^4-6x^2y^4$

2. Solve for x: $\frac{-1}{3}(5-2x)^2=2(2x-5)$

3. Simplify the expression: $\frac{2+3i}{i}-\frac{4i}{1-2i}$

4. Using Descarte's Rule of Signs, determine the number of positive and negative roots:
$f(x)=-2x^5-x^4+3x^3-5x+3$

5. Graph and label all intercepts:
$g(x)=9(x+2)^2-25$

6. Graph and label all intercepts:
$g(x)=-8x-2$

7. Graph and label all intercepts:
$g(x)=1-\sqrt{x-9}$

8. Graph and label all intercepts and state the domain: $g(x)=3-\log_2(x+1)$

9. Graph and label all intercepts:
$g(x)=x^3-5x^2-24x$

10. Graph and label all intercepts:
$g(x)=-2|x+3|+2$

11. Using interval notation, state the domain of the rational function:
$f(x)=\frac{x^2-5}{x^2+3x}$

12. Using interval notation, state the range of the exponential function:
$k(x)=-4+3e^{x-3}$

13. Using interval notation, state the range of the quadratic function:
$w(x)=-2x^2+12x+5$

14. Find the Standard Form of the equation that is perpendicular to the line $3x=\frac{2}{5}(y-1)$ and passes through the point $(-11,2)$.

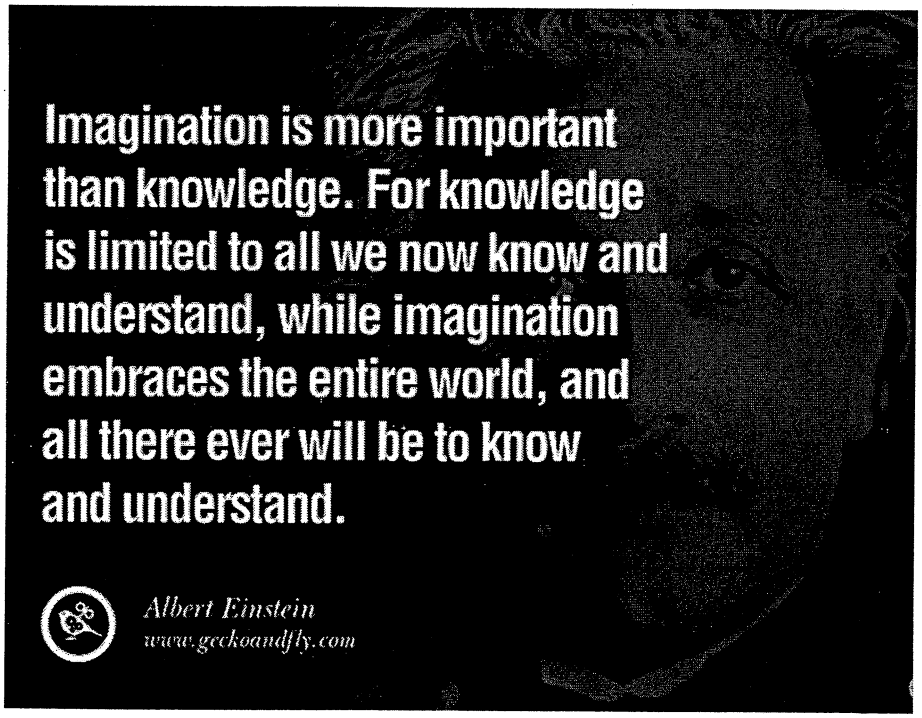
15. Given
$g(x)=1-2x^2$ *and* $h(x)=x-6$
evaluate $g(h(x))$

27. ** Find the polynomial of degree 3 that has the given zeros: $\frac{2}{7}$; 5; $\frac{5}{3}$

28. Given $f(x) = x^3 - 7x^2 + 13x - 3$ evaluate $f\left(2-\sqrt{3}\right)$

29. Solve for x: $\left(\frac{\sqrt{2}}{4}\right)^{3x-1} = \frac{1}{2}$

30. Graph, label all intercepts and state the range of the exponential function: $l(x) = -3 + 3^{1-x}$



16. Graph and label all intercepts:

$$j(x)=\begin{cases}\frac{1}{2}x-5; & x>0\\ -x^3+1; & x\le 0\end{cases}$$

17. Given $j(x)=\begin{cases}\frac{1}{2}x-5; & x>0\\ -x^3+1; & x\le 0\end{cases}$

a. Evaluate $j(4)$

b. Evaluate $j(-2)$

18. ** Graph the polynomial function $b(x)=2x^4+7x^3-4x^2-27x-18$

a. State all x- and y- intercepts

b. State the relative maximum and relative minimum points

c. Using interval notation, state where the function is increasing and decreasing.

19. Determine whether the graph is even, odd or neither- show your work for credit: $h(x)=4^{-x^2}$

20. ** Find the average rate of change of the function $f(x)=x^2-x-1$ from $x_1=4.5$ *to* $x_2=3.1$.

21. Graph the function $w(x)=9-x^2$ and using interval notation, determine where the interval(s) for which $w(x)<0$

22. Given $f(x)=4x-5$, $g(x)=25-16x^2$

a. Evaluate $f(x)-g(x)$

b. Evaluate $\frac{f(x)}{g(x)}$

c. State the domain of $\frac{f(x)}{g(x)}$

23. Graph the function: $j(x)=[\![2x]\!]$

24. Write the standard form of the equation of the parabola that has vertex $(2,-4)$ and whose graph passes through the point $(9,0)$

25. State the center and radius of the circle: $x^2+y^2-6x+8y-10=0$

26. Sketch the graph and label all intercepts: $r(x)=-x^2(x-3)(x+4)^4$

Attitude Answer Key page 1/5

#1 $3x^2y^5 - 7xy^5 - 6y^5$

$y^5(3x^2 - 7x - 6)$

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

#2 $\frac{1}{4}(3-7x)^2 = 6(7x-3)$

$(3-7x)^2 = 24(7x-3)$

$(7x-3)^2 - 24(7x-3) = 0$

$(7x-3)[(7x-3) - 24] = 0$

$(7x-3)(7x-27) = 0$ $\boxed{x = \frac{3}{7},\ x = \frac{27}{7}}$

#3 $\frac{2+7i}{2i} + \frac{5i}{1-i}$

$\frac{2+7i}{2i} \cdot \frac{i}{i} = \frac{2i-7}{2i^2} = \frac{7-2i}{2}$

$\frac{5i}{1-i} \cdot \frac{1+i}{1+i} = \frac{5i-5}{2} = \frac{-5+5i}{2}$

$\frac{7-2i}{2} + \frac{-5+5i}{2} = \boxed{1 + \frac{3}{2}i}$

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

2

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

1

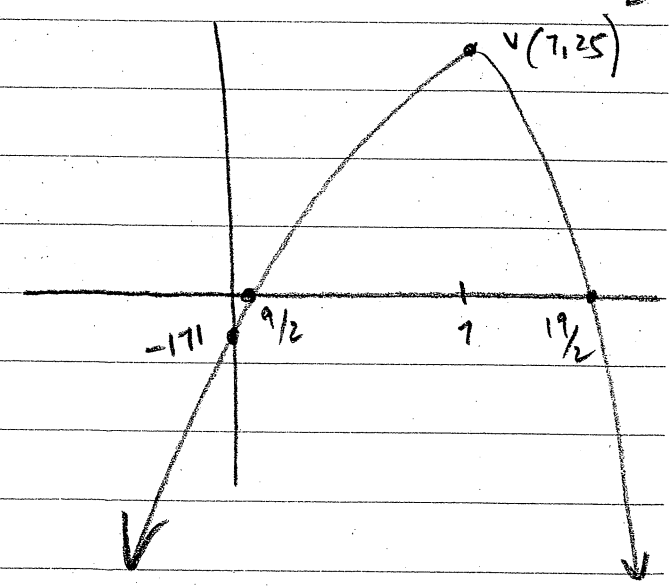
+	-	C
~~2~~	~~3~~	~~0~~
2	1	2
~~0~~	~~5~~	~~0~~
0	1	4
~~0~~	~~3~~	~~2~~

5. $g(x) = -4(x-7)^2 + 25$ Down $V(7, 25)$

$g(0) = -4(49) + 25 = -171$ $(0, -171)$

$0 = -4(x-7)^2 + 25$

$\frac{25}{4} = (x-7)^2$ $x = 7 \pm \frac{5}{2}$ $7 + \frac{5}{2} = \frac{19}{2}$ $7 - \frac{5}{2} = \frac{9}{2}$



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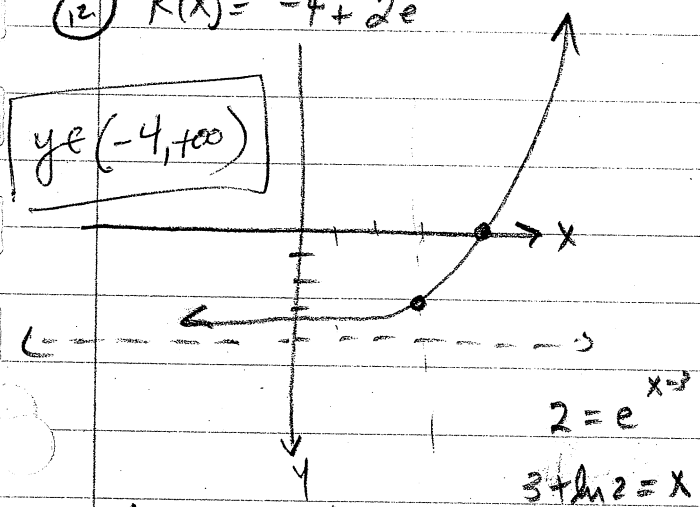
(11) $f(x) = \dfrac{(x+2)(x-2)}{(x+8)(x-7)}$ $\quad x \neq -8, 7$

$\boxed{x \in (-\infty, -8) \cup (-8, 7) \cup (7, +\infty)}$

(12) $K(x) = -4 + 2e^{x-3}$

$\boxed{y \in (-4, +\infty)}$



$2 = e^{x-3}$

$3 + \ln 2 = x$

$\left(0, -4 + \frac{2}{e^3}\right)$ $\quad (3 + \ln 2, 0)$

(13) $w(x) = -8(x^2 - 2x + 1) + 5 + 8$

$w(x) = -8(x-1)^2 + 13$ Down

$V(1, 13)$

$\boxed{y \in (-\infty, 13]}$

(14) $15x = -8(y-5)$

$15x + 8y = 40$

$m = \dfrac{-15}{8}$ $\perp$ $m = \dfrac{8}{15} = \dfrac{y-12}{x+1}$

$8x + 8 = 15y - 180 \Rightarrow \boxed{8x - 15y + 188 = 0}$

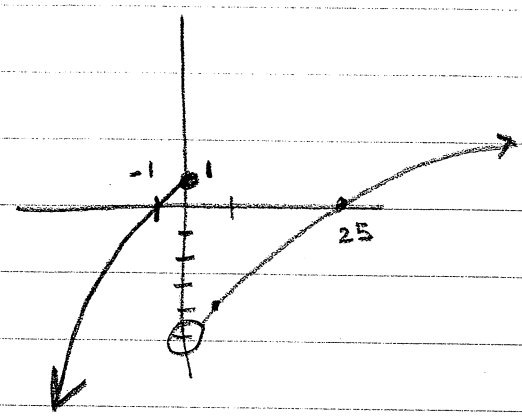
(15) $g(3x-1) = 3 + 2(3x-1)^2$

$= 3 + 2(9x^2 - 6x + 1)$

$= 3 + 18x^2 - 12x + 2$

$\boxed{g(h(x)) = 18x^2 - 12x + 5}$

(16)



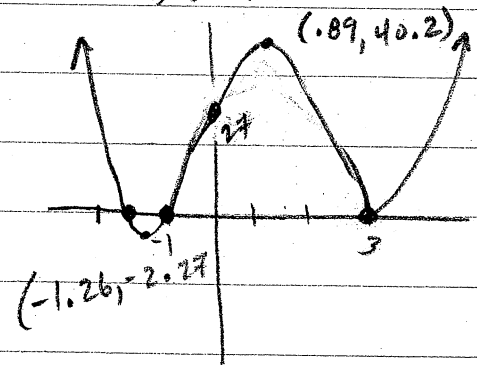
(17) a) $f(4) = \sqrt{4} - 5 = 2 - 5 = 3$

$f(4) = 3$

b) $f(-2) = -(-2)^2 + 1 = -4 + 1 = -3$

$f(-2) = -3$

(18) $b(x) = (x-3)^2(x+1)(2x+3)$ Degree 4



Dec: $(-\infty, -1.26) \cup (.89, 3)$

Inc: $(-1.26, .89) \cup (3, +\infty)$

MIN Pt: $(-1.26, -2.27)$ $(3, 0)$ MAX $(.89, 40.2)$

Intercepts: $(3,0)$; $(-1,0)$; $\left(-\frac{3}{2}, 0\right)$; $(0, 27)$

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(27.) $p(x) = (2x-1)(x+5)(3x-2)$

$$\boxed{p(x) = 6x^3 + 23x^2 - 33x + 10}$$

(28) $2-3i$

1	1	-7	65
↓	$2-3i$	$-3-15i$	-65
1	$3-3i$	$-10-15i$	0

$(2-3i)(3-3i) = 6 - 15i - 9 =$

$-9i$
$-6i$
-3

$(2-3i)(-10-15i) = -20 - 30i - 45$
$30i$

$$\boxed{f(2-3i) = 0}$$

(29.) $\left(2^2 \cdot 2^{1/2}\right)^{3x-1} = 2^{-1}$

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

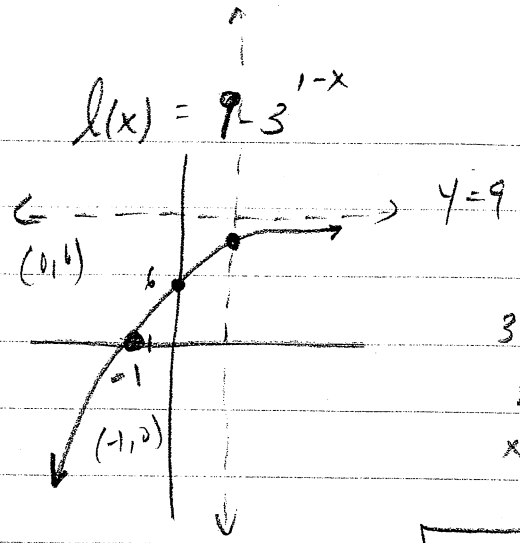
$5(3x-1) = -2$

$15x - 5 = -2$

$15x = 3$

$$\boxed{x = \frac{1}{5}}$$

(30.) $f(x) = 9 - 3^{1-x}$



$3^2 = 3^{1-x}$

$2 = 1 - x$

$x = -1$

Range

$$\boxed{y \in (-\infty, 9)}$$

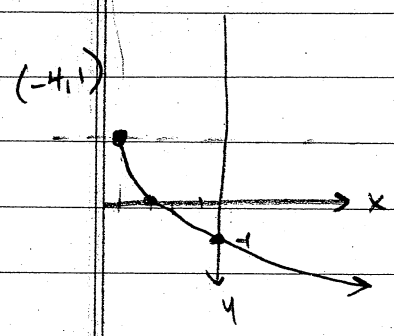
$$\boxed{\begin{matrix}(0,6)\\(-1,0)\end{matrix}}$$

Dreams page 2/5

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

DOMAIN $x+4 \geq 0$

$x \geq -4$



$g(0) = 1 - \sqrt{4} = 1 - 2 = -1$

$(0,-1)$

$0 = 1 - \sqrt{x+4}$

$\sqrt{x+4} = 1$

$x+4 = 1$

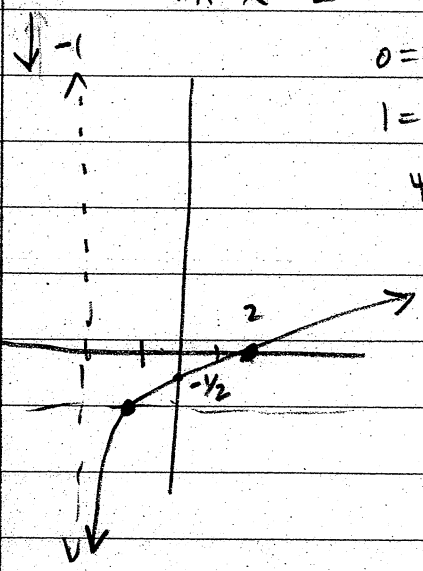
$x = -3$

8. $g(x) = -1 + \log_4(x+2)$

DOMAIN $x+2 > 0$ $\quad (0, \frac{-1}{2})$

$x > -2$ $\quad (2,0)$

VA: $x = -2$



$0 = -1 + \log_4(x+2)$

$1 = \log_4(x+2)$

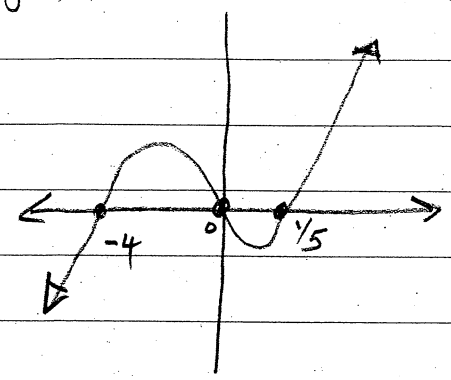
$4^1 = x+2$

$2 = x$

#9 $g(x) = 5x^3 + 19x^2 - 4x$

$= x(5x^2 + 19x - 4)$

$g(x) = x(5x-1)(x+4)$



$(-4,0)$

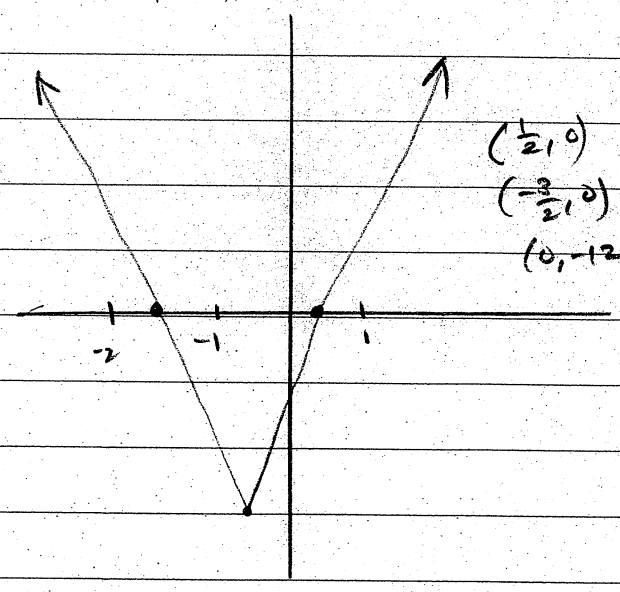
$(0,0)$

$(\frac{1}{5},0)$

#10 $g(x) = 12|2x+1| - 24$

$V(\frac{-1}{2}, -24)$ $\quad$ up

$(0,-12)$



$(\frac{1}{2},0)$

$(-\frac{3}{2},0)$

$(0,-12)$

$2 = |2x+1|$

$2x+1 = 2$

$2x = 1$

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

$2x+1 = -2$

$2x = -3$

$x = \frac{-3}{2}$

Dreams 4/5

#19 $h(x) = \frac{4^{x^2}}{x}$

$h(-x) = \frac{4^{x^2}}{-x}$

$h(-x) = -h(x)$

$\boxed{\text{ODD}}$

#20 $f(x) = x^2 - 3x - 3$

$f(10.7) = 79.39$

$f(-9.8) = 122.44$

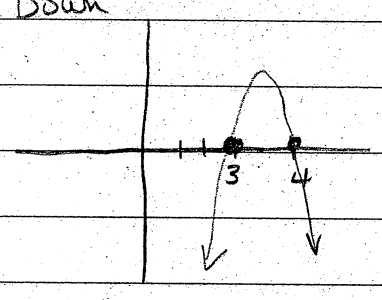
$\frac{\Delta y}{\Delta x} = \frac{122.44 - 79.39}{-9.8 - 10.7} = -2.1$

21 $w(x) = -x^2 + 7x - 12$

$w(x) = -(x^2 - 7x + 12)$

$w(x) = -(x-3)(x-4)$

Down



$\boxed{w(x) < 0 \quad (-\infty, 3) \cup (4, +\infty)}$

22 $f(x) = 4 - 3x \qquad g(x) = 16 - 9x^2$

$f(x) - g(x) = 4 - 3x - 16 + 9x^2$

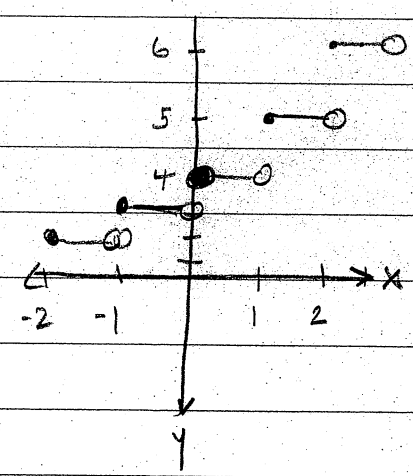
a) $\rightarrow f(x) - g(x) = 9x^2 - 3x - 12$

$\frac{f(x)}{g(x)} = \frac{4-3x}{16-9x^2} = \frac{1}{4+3x}$

b) $\rightarrow \frac{f(x)}{g(x)} = \frac{1}{4+3x}$

c) $\rightarrow$ domain $x \neq -\frac{4}{3}, \frac{4}{3}$

23 $g(x) = [\![x]\!] + 4$



24 $y = a(x-6)^2 - 7$

$-2 = a(3-6)^2 - 7$

$5 = 9a$

$\frac{5}{9} = a$

$\boxed{y = \frac{5}{9}(x-6)^2 - 7}$

① $5x^4y^4 + 7x^3y^4 - 6x^2y^4$

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

$x^2y^4(5x-3)(x+2)$

② $\frac{-1}{3}(5-2x)^2 - 2(2x-5) = 0$

$(5-2x)^2 + 6(2x-5) = 0$

$(2x-5)^2 + 6(2x-5) = 0$

$(2x-5)[(2x-5)+6] = 0$

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

$\boxed{x = \frac{5}{2}\ ;\ x = \frac{-1}{2}}$

③ $\frac{2+3i}{i} - \frac{4i}{1-2i}$

$\frac{2i+3i^2}{i^2} - \frac{4i(1+2i)}{1+4}$

$\frac{2i-3}{-1} + \frac{-4i-8i^2}{5}$

$3 - 2i - \frac{4i}{5} + \frac{8}{5}$

$\boxed{\frac{23}{5} \quad \frac{-14i}{5}}$

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

+	−	0
3	2	0
3	0	2
~~1~~	~~4~~	~~0~~
1	0	4
1	2	2

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

⑤ $g(x) = 9(x+2)^2 - 25$

up parabola $V(-2,-25)$

$g(0) = 9(4) - 25 = 36 - 25 = 11$

$(0,11)$

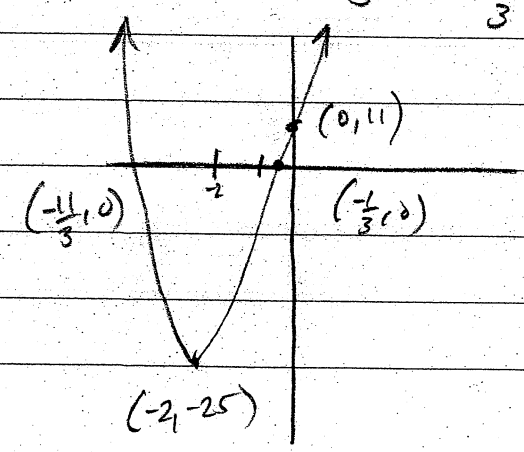
$0 = 9(x+2)^2 - 25$

$\frac{25}{9} = (x+2)^2$

$\pm\frac{5}{3} = x+2$

$x = -2 + \frac{5}{3} = \frac{-1}{3}$

$x = -2 - \frac{5}{3} = \frac{-11}{3}$



Imagination p 3/5

13. $w(x) = -2(x^2-6x+9)+5+18$

$w(x) = -2(x-3)^2 + 23$

Down $V(3,23)$

$\boxed{\text{Range } y \in (-\infty, 23]}$

(14) $3x = \frac{2}{5}(y-1)$

$15x = 2y-2$

$2y-2 = 15x$

$2y = 15x+2$

$y = \frac{15}{2}x + 1$

$m = \frac{15}{2}$ so $\perp$ $m = -\frac{2}{15}$

$-\frac{2}{15} = \frac{y-2}{x+11}$

$15y - 30 = -2x - 22$

$\boxed{2x+15y=8}$

(15) $g(x) = 1-2x^2$

$h(x) = x-6$

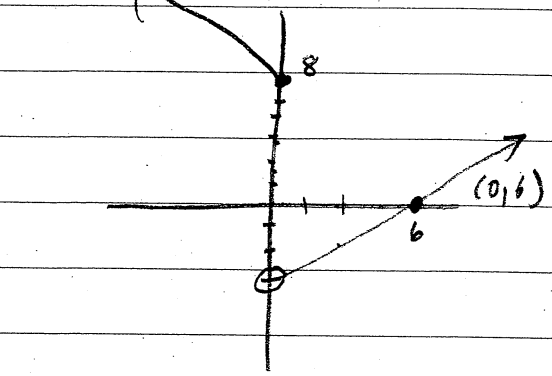
$g(x-6) = 1-2(x-6)^2$

$= 1-2(x^2-12x+36)$

$= 1-2x^2+24x-72$

$\boxed{g(f(x)) = -2x^2+24x-71}$

(16) $j(x) = \begin{cases} \frac{1}{2}x-3 & x>0 \\ -x^3+8 & x \le 0 \end{cases}$



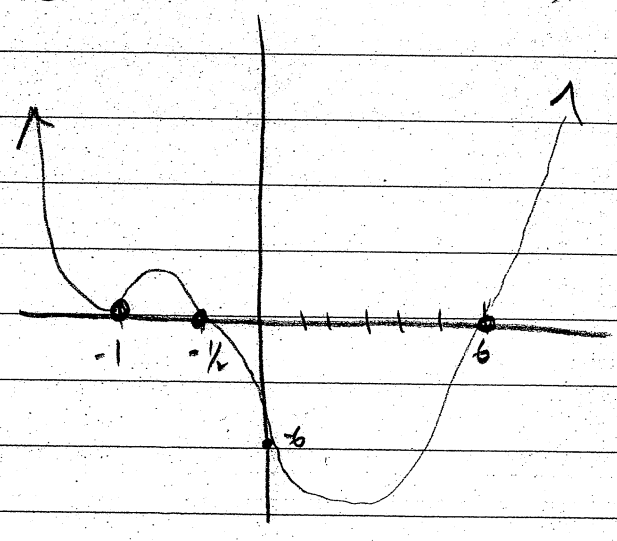
(17) $j(4) = \frac{1}{2}(4)-3 = -1$

a) $\boxed{j(4)=-1}$

$j(-2) = -(-2)^3+8 = 16$

$\boxed{j(-2)=16}$

(18) $b(x) = (x-6)(x+1)^2(2x+1)$



Imagination

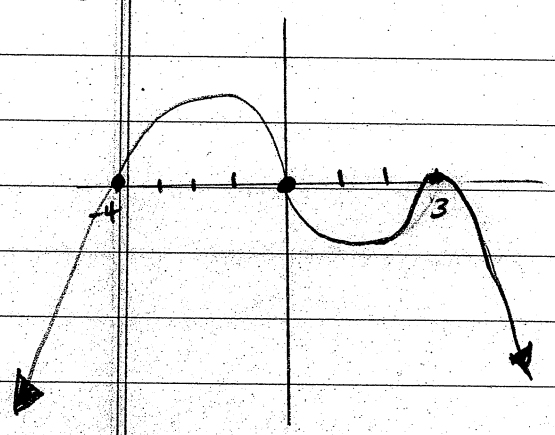
p. 5/5

(25.) $x^2-4x+\boxed{4}+y^2+12y+\boxed{36}=4+40$

$(x-2)^2+(y+6)^2=44$

$\boxed{C(2,-6) \quad r=2\sqrt{11}}$

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



Intercepts $(-4,0)$ $(0,0)$ $(3,0)$

(27.) $p(x)=(7x-2)(x-5)(3x-5)$

$\boxed{p(x)=21x^3-146x^2+215x-50}$

(28) $\boxed{2-\sqrt{3}}$

1	-7	13	-3
↓	$2-\sqrt{3}$	$-7+3\sqrt{3}$	3
1	$-5-\sqrt{3}$	$6+3\sqrt{3}$	0

$\boxed{f(2-\sqrt{3})=0}$

$(2-\sqrt{3})(-5-\sqrt{3})$

$-10-2\sqrt{3}+5\sqrt{3}+3$

$(2-\sqrt{3})(6+3\sqrt{3})$

$12-6\sqrt{3}+6\sqrt{3}-9$

(29) $\left(\frac{2^{1/2}}{2^2}\right)^{3x-1}=2^{-1}$

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

$-\frac{3}{2}(3x-1)=-1$

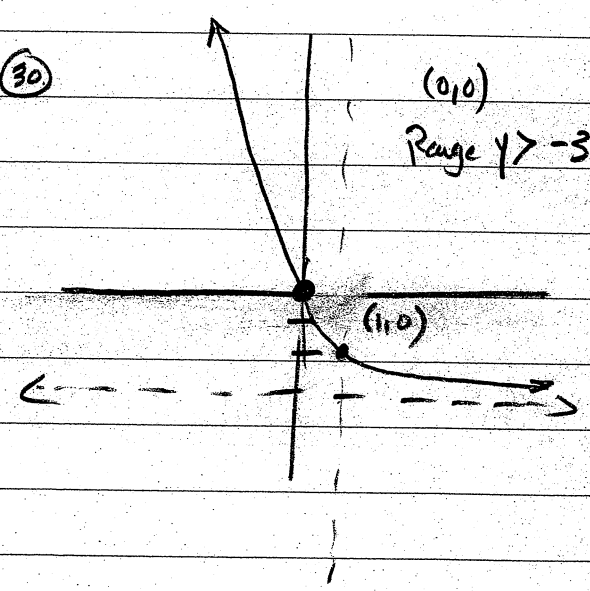
$-3(3x-1)=-2$

$-9x+3=-2$

$-9x=-5$

$\boxed{x=\frac{5}{9}}$

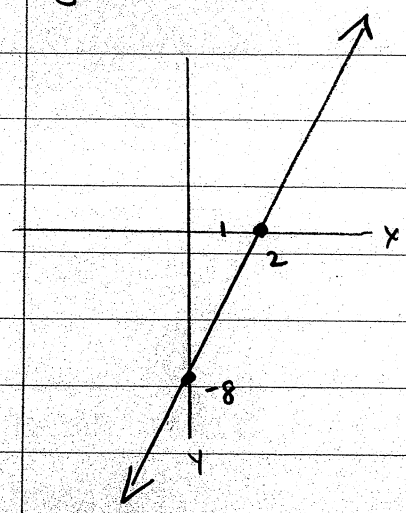
(30)



6. $g(x) = 4x - 8$

SLOPE 4

$(0, -8)$ $(2, 0)$



⑧ $g(x) = 2 - \log_4(x+8)$

$(-7, 2)$

DOMAIN: $x + 8 > 0$

VA: $x = -8$ $\boxed{x > -8}$

$y = 0$ $0 = 2 - \log_4(x+8)$

$\log_4(x+8) = 2$

$(8, 0)$

$16 = x + 8$

$8 = x$

$\log_4 8 = ?$

$4^? = 8$

$2^2 = 2^3$

$x = 0$ $g(0) = 2 - \log_4(8)$

$2 - \frac{3}{2} = \frac{1}{2}$

$(0, \frac{1}{2})$

7. $g(x) = 2 - \sqrt{x+9}$

END pt.

$(-9, 2)$

DOMAIN

$x + 9 \geq 0$

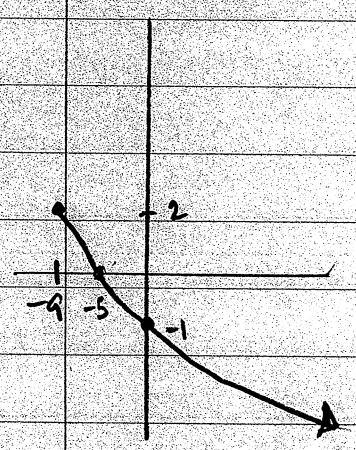
$x \geq -9$

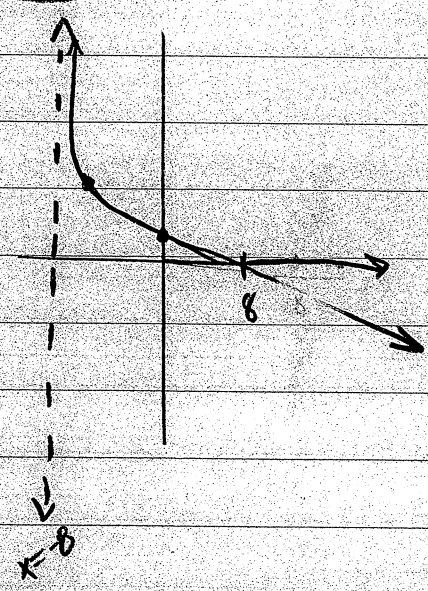
$(0, -1)$

$2 = \sqrt{x+9}$

$4 = x + 9$

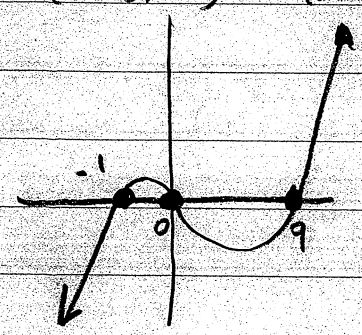
$-5 = x$





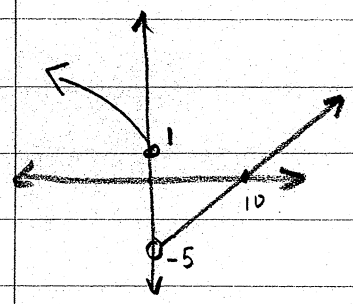
END PT.	$(-9, 2)$
Y-int	$(0, -1)$
X-int	$(-5, 0)$

#9 $g(x) = x(x^2 - 8x - 9) = x(x-9)(x+1)$



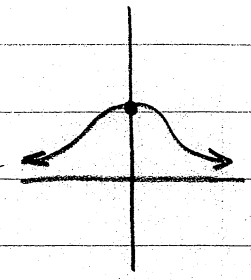
Answer Key Life Lessons Page 4/5

16.



(19) $h(x) = 4^{-x^2}$

$\boxed{\text{EVEN}}$



17. a) $J(4) = \frac{4}{2} - 5 = 2 - 5 = -3$

a) $J(4) = -3$

b) $J(-2) = -(8) + 1 = 9$

$J(-2) = 9$

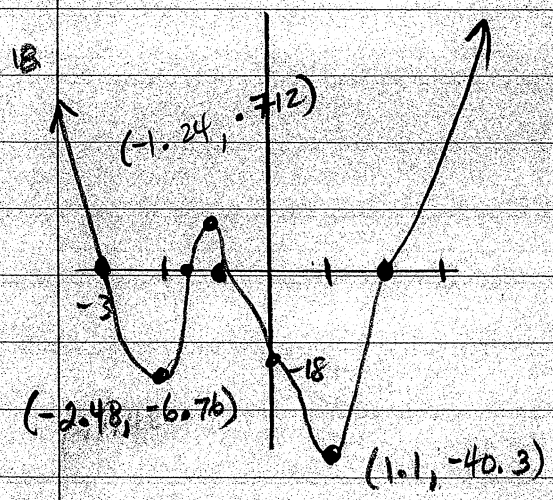
(20) $f(x) = x^2 - x - 1$

$x_1 = 4.5$ $\quad f(4.5) = 14.75$

$x_2 = 3.1$ $\quad f(3.1) = 5.51$

Avg Δ: $\frac{14.75 - 5.51}{4.5 - 3.1} = \boxed{6.6}$

18



Intercepts: $(0,-18)$; $(2,0)$, $(-1,0)$, $(-\frac{3}{2},0)$ $(-3,0)$

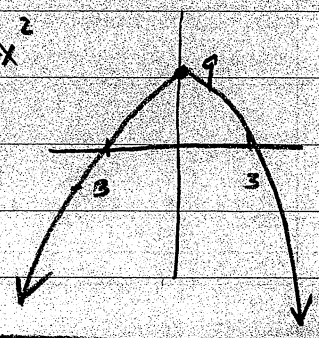
max pt: $(-1.24, .712)$

MIN pt $(-2.48, -6.76)$; $(1.1, -40.3)$

INC: $(-2.48, -1.24)$, $(1.1, +\infty)$

Dec $(-\infty, -2.48)$, $(-1.24, 1.1)$

(21) $w(x) = 9 - x^2$



$\boxed{w(x) < 0 \mid (-\infty, -3) \cup (3, +\infty)}$

(22) $f(x) - g(x) = 4x - 5 - (25 - 16x^2)$

(a) $\boxed{f(x) - g(x) = 16x^2 + 4x - 30}$

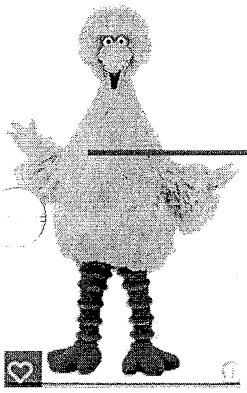
(b) $\frac{f(x)}{g(x)} = \frac{-1}{4x+5}$

c) $x \neq \pm\frac{5}{4}$

Regulars Spring Projects

- Big Bird (3 pages)
- Cookie Monster (3 pages)
- The Count (3 pages)
- Oscar (3 pages)

- Answer Key (15 pages)



9. Solve for x: $\left(\frac{1}{4\sqrt{2}}\right)^{3x-2} = 16^x$

10. Solve for x: $2^{2x} - 4\left(2^x\right) = 32$

11. Solve for x over the interval $0 \le x < 2\pi$: $\sqrt{3}\cos 3x + \sqrt{3}\sin 3x = 0$

12. Graph one full period $J(x) = 4 + 2\sin\left(\frac{-x}{3}\right)$ and label the maximum and minimum points

13. Graph one full period $J(x) = -1 + \tan(2x)$ and label the relative maximum and relative minimum points and all asymptotes

14. Simplify the expression: $\cot\left(\arccos\left(-\frac{3}{5}\right)\right)$

15. The terminal side of θ lies on the given line $3x + 4y = 0$ in the fourth quadrant. Find the $\cot\theta$ by finding a point on the line.

16. Find the complement and supplement of the angle 1.03^r Leave your answer in terms of π

17. Using your calculator Solve for θ such that $\theta \in [0, 2\pi)$: $\sin\theta = .573$

SPRING PROJECT Pre-Calculus | 2016

1. State the domain, graph the rational function and label any intercept, all asymptotes and any point of discontinuity (if any): $R(x)=\dfrac{x^2-x-6}{4x^2-16}$

2. Graph the rational function and label any intercept, all asymptotes and any point of discontinuity (if any): $R(x)=\dfrac{1-x^2}{x+2}$

3. Graph the rational function and label any intercept, all asymptotes and any point of discontinuity (if any): $R(x)=\dfrac{x-1}{2x^2-x-3}$

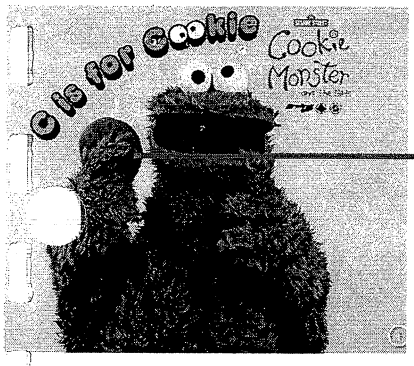
4. Using interval notation, solve the inequality: $x(2x-5)^2 \geq 2x(5-2x)$

5. Using interval notation, solve the rational inequality: $\dfrac{-3}{x-4} \leq \dfrac{2}{x-5}$

6. State the domain, graph and label all intercepts and asymptotes: $T(x)=1+\log_4(2-x)$

7. Graph and label all intercepts and asymptotes: $T(x)=-4+2^{x-1}$

8. Solve for x: $\ln(x-4)-\ln(2x-3)=-1$



18. Using your calculator, convert $314.232°$ into degrees minutes seconds

19. Using your calculator, find the arc length and the area of the sector whose radius is 8cm and central angle is 70° . Round your answer to three decimal places.

20. Using your calculator, find the maximum and minimum points and intercepts over the interval $[0, 2\pi)$ for the trigonometric function: $P(x) = 6\sqrt{3}\cos x + 6\sqrt{3}\sin x$

9. Solve for x: $\left(\frac{1}{\sqrt{3}}\right)^{3x-2} = 27$

10. Solve for x: $3^{2x} - 10\left(3^{x}\right) = -9$

11. Solve for x over the interval $0 \le x < 2\pi$: $\cos 2x - \sqrt{3}\sin 2x = 0$

12. Graph one full period $J(x) = 4 - 2\sin 3x$ and label the maximum and minimum points

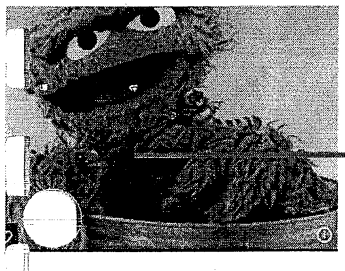
13. Graph one full period $J(x) = 3 + 2\sec(-2x)$ and label the relative maximum and relative minimum points and all asymptotes

14. Simplify the expression: $\sin(\arctan(-4))$

15. The terminal side of θ lies on the given line $3x - 4y = 0$ in the third quadrant. Find the $\cot\theta$ by finding a point on the line.

16. Find the complement and supplement of the angle $.23^{r}$ Leave your answer in terms of π

17. Using your calculator Solve for θ such that $\theta \in [0, 2\pi)$: $\sec\theta = -2.873$



SPRING PROJECT Pre-Calculus | 2016

1. State the domain, graph the rational function, label any intercept and all asymptotes and check if the functions crosses the horizontal asymptote: $R(x)=\dfrac{2x^2-x-6}{x^2-16}$

2. Graph the rational function and label any intercept, all asymptotes and any point of discontinuity (if any): $R(x)=\dfrac{x+2}{9-x^2}$

3. Graph the rational function and label any intercept, all asymptotes and any point of discontinuity (if any): $R(x)=\dfrac{x^2-x-2}{x+2}$

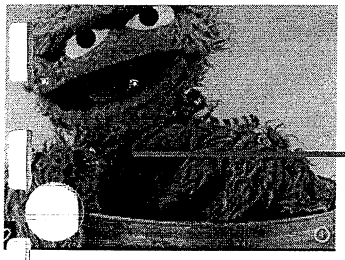
4. Using interval notation, solve the inequality: $x(2x-5)\geq 6x^2(5-2x)$

5. Using interval notation, solve the rational inequality: $\dfrac{5}{x-2}\leq\dfrac{-4}{x-7}$

6. State the domain and graph and label all intercepts and asymptotes: $T(x)=4+\log_2(-x)$

7. Graph and label all intercepts and asymptotes: $T(x)=-4+2^{1-x}$

8. Solve for x: $\ln(x+1)-\ln(2x-7)=-1$

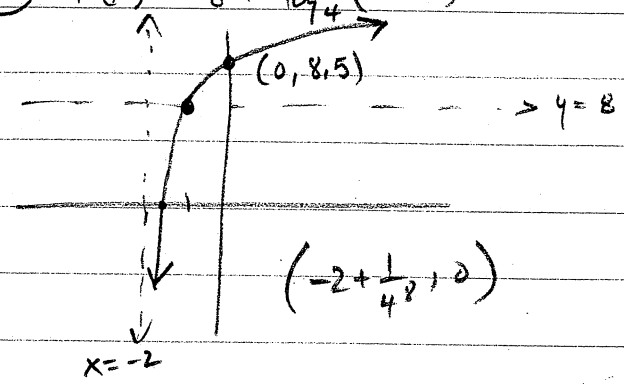


18. Using your calculator, convert $24.256°$ into degrees minutes seconds

19. Using your calculator, find the arc length and the area of the sector whose radius is 7cm and central angle is 50° . Round your answer to three decimal places.

20. Using your calculator, find the maximum and minimum points and intercepts over the interval $[0, 2\pi)$ for the trigonometric function: $P(x) = 6\sqrt{3}\cos x - 6\sin x$

#6 $T(x) = 8 + \log_4(x+2)$



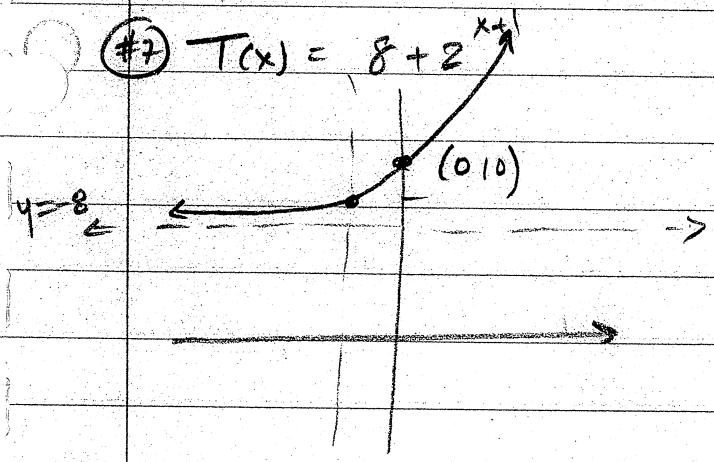
$T(0) = 8 + \log_4(2) = 8.5$

$0 = 8 + \log_4(x+2)$

$-8 = \log_4(x+2)$ $\quad 4^{-8} = x+2$

$x = -2 + \frac{1}{4^8}$

#7 $T(x) = 8 + 2^{x+1}$



#8 $\ln\left(\frac{x-4}{2x+9}\right) = -2$

$\frac{1}{e^2} = e^{-2} = \frac{x-4}{2x+9}$

$e^2x - 4e^2 = 2x + 9$

$e^2x - 2x = 4e^2 + 9$

$\boxed{x = \frac{4e^2+9}{e^2-2}}$

#9 $\left(\frac{1}{4\sqrt{2}}\right)^{3x-2} = 16^x$

$\left(2^2 \cdot 2^{1/2}\right)^{2-3x} = 2^{4x}$

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

$5 - \frac{15}{2}x = 4x$

$10 - 15x = 8x$

$10 = 23x$

$x = \frac{10}{23}$

#10 $2^{2x} - 4(2^x) - 32 = 0$

$A^2 - 4A - 32 = 0$

$(A-8)(A+4) = 0$

$A = 8 \qquad A = -4$

$2^x = 8 \qquad 2^x = -4$

$x = 3 \qquad \times$

#11 $\sqrt{3}\cos 3x + \sqrt{3}\sin 3x = 0$

$\sqrt{3}\sin 3x = -\sqrt{3}\cos 3x$

$\sin 3x = -\cos 3x$

$\frac{\sin 3x}{\cos 3x} = -1$

$\tan 3x = -1$

3 gets of answers

$\tan ☺ = -1$

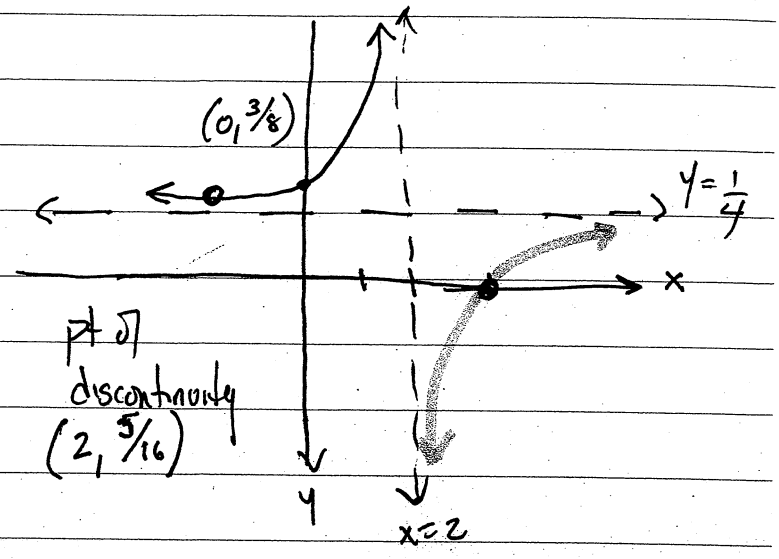
$☺ = \underbrace{\frac{3\pi}{4}, \frac{7\pi}{4}}_{\#1}, \underbrace{\frac{11\pi}{4}, \frac{15\pi}{4}}_{\#2}, \frac{19\pi}{4}, \frac{23\pi}{4}$

$x \in \left\{\frac{\pi}{4}, \frac{7\pi}{12}, \frac{11\pi}{12}, \frac{5\pi}{4}, \frac{19\pi}{12}, \frac{23\pi}{12}\right\}$

#1 $R(x) = \dfrac{(x-3)\cancel{(x+2)}}{4\cancel{(x+2)}(x-2)}$

D: $x \neq 2, -2$ $(3,0)$ $(0, 3/8)$

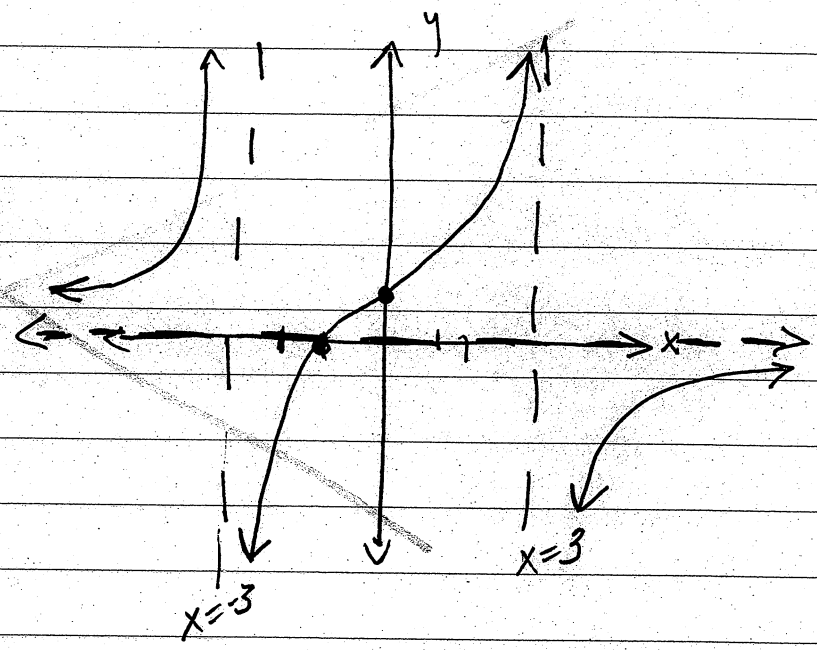
$R(x) = \dfrac{x-3}{4(x-2)}$



VA: $x = 2$

HA: $y = \frac{1}{4}$

#2 $R(x) = \dfrac{x+2}{(x+3)(x-3)}$



D: $x \neq 3, -3$

VA: $x = 3$, $x = -3$

HA: $y = 0$

$(-2, 0)$ $(0, 2/9)$

#3 $R(x) = \dfrac{(x-2)(x+1)}{x+2}$

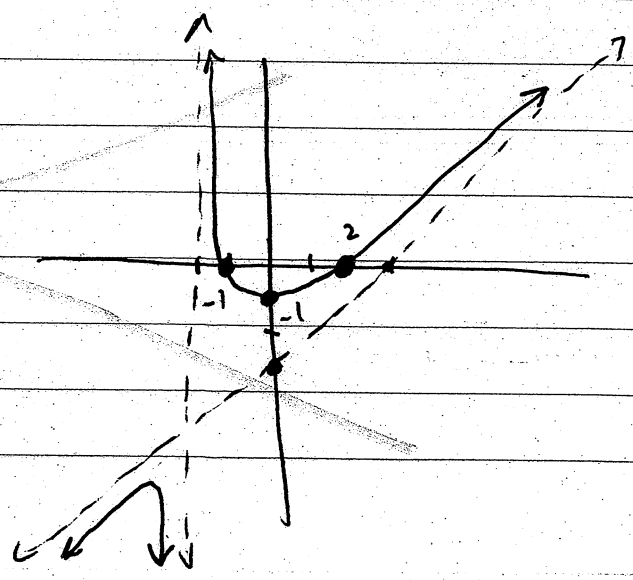
D: $x \neq -2$

VA: $x = -2$

$$\begin{array}{r|rrr} -2 & 1 & -1 & -2 \\ & \downarrow & -2 & 6 \\ \hline & 1 & -3 & 4 \end{array}$$

$(0, -1)$

$(2, 0)$ $(-1, 0)$ SA: $y = x - 3$



#3 $R(x) = \dfrac{2x^2 - x - 3}{x+1} = \dfrac{(2x-3)(x+1)}{x+1}$

D: $x \neq +1$

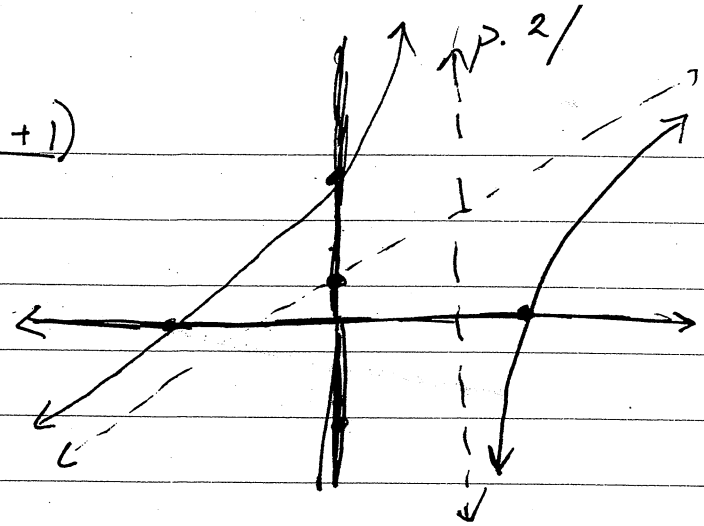
VA: $x = +1$

$(0, +3)$

$(3/2, 0)$ $(-1, 0)$

SA: $y = 2x + 1$

	2	-1	-3
1	↓	2	1
	2	1	-2

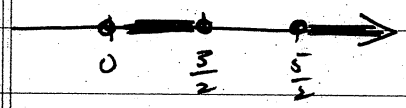


#4 $x(2x-5)^2 - 2x(5-2x) \geq 0$

$x(2x-5)^2 + 2x(2x-5) \geq 0$

$x(2x-5)\left[(2x-5) + 2\right] \geq 0$

$x(2x-5)(2x-3) \geq 0$



$[0, 3/2] \cup [5/2, +\infty)$

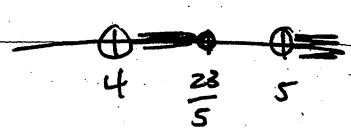
#5 $\dfrac{-3}{x-4} - \dfrac{2}{x-5} \leq 0$

$\dfrac{-3(x-5) - 2(x-4)}{(x-4)(x-5)} \leq 0$

$\dfrac{-3x + 15 - 2x + 8}{(x-4)(x-5)} \leq 0$

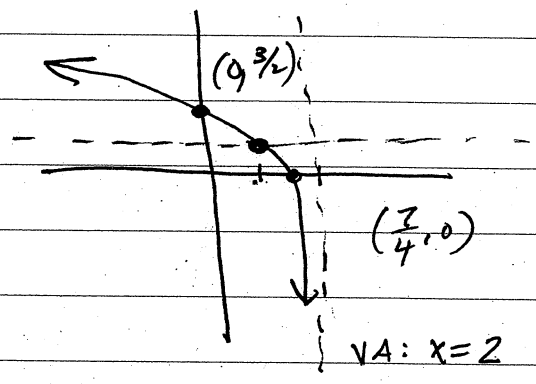
$\dfrac{-5x + 23}{(x-4)(x-5)} \leq 0$

$\dfrac{5x - 23}{(x-4)(x-5)} \geq 0$



$\left(4, \frac{23}{5}\right] \cup (5, +\infty)$

#6 $T(x) = 1 + \log_4(2-x)$



$T(0) = 1 + \log_4(2) = 3/2$

$0 = 1 + \log_4(2-x)$

$-1 = \log_4(2-x)$

$4^{-1} = 2 - x$

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

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

#12 $f(x) = 4 - 2\cos\left(\frac{x}{3}\right)$

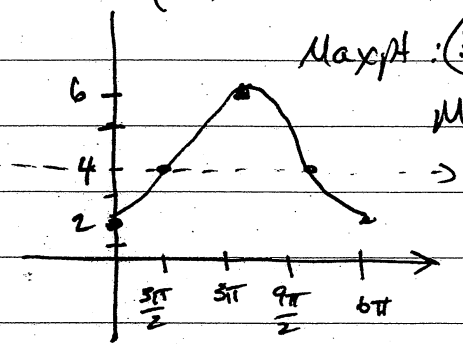
P: 6π

A: 2

↑ 4

Max pt: $(3\pi, 6)$

MIN pt $(0,2)$, $(6\pi, 2)$

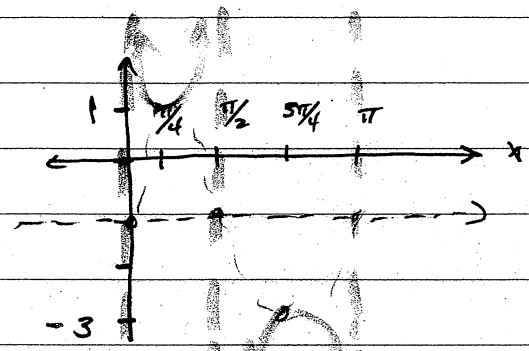


#13 $f(x) = -1 + 2\csc(2x)$

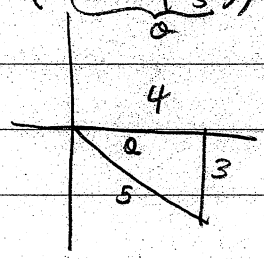
VA $x=0$, $x=\frac{\pi}{2}$, $x=\pi$

Rel MIN pt $\left(\frac{\pi}{4}, 1\right)$

Rel max pt $\left(\frac{3\pi}{4}, -3\right)$



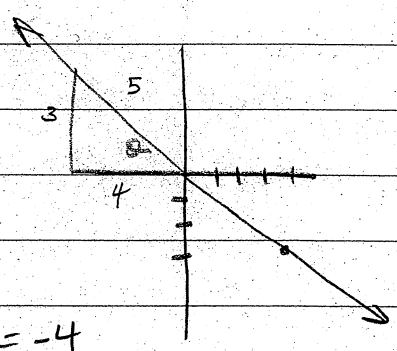
#14 $\cos\left(\underbrace{\arcsin\left(\frac{-3}{5}\right)}_{\theta}\right) = \frac{4}{5}$



15 $3x + 4y = 0$

$4y = -3x$

$y = \frac{-3}{4}x$



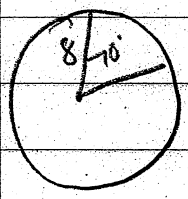
$\cot\theta = \frac{-4}{3}$

16 Comp $\frac{\pi}{2} - .12^r$

Supp $\pi - .12^r$

17 $\cos\theta = -.873$ $\theta = 2.632$, $\theta = 3.651$

18 $314.232° = 314° 13' 55.2''$

19 

$A = 8(70°)\left(\frac{\pi}{180}\right) \approx 9.77384$

$A = \frac{1}{2}(64)70\left(\frac{\pi}{180}\right) \approx 39.954$

20 $P(x) = 6\sqrt{3}(\cos x + \sin x)$

zeros @ $(2.36, 0)$, $(5.5, 0)$

MIN pt $(3.93, -14.7)$

Max pt $(.785, 14.7)$

$(0, 6\sqrt{3}) \approx (0, 10.3923)$

(4) $3x^2(2x-5)-6x(5-2x)\geq 0$

$3x^2(2x-5)+6x(2x-5)\geq 0$

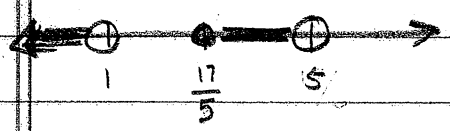
$3x(2x-5)[x+2]\geq 0$

$[-2,0]\cup[\frac{5}{2},+\infty)$

(5) $\frac{2}{x-5}+\frac{3}{x-1}\leq 0$

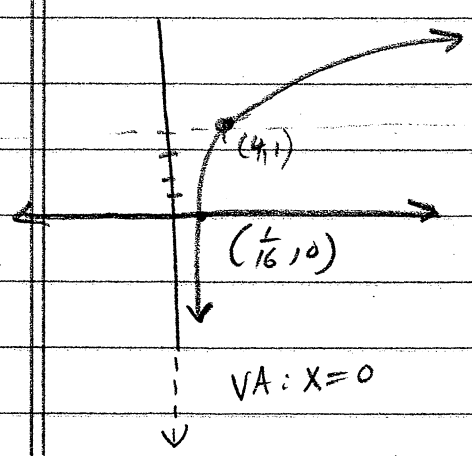
$\frac{2x-2+3x-15}{(x-5)(x-1)}\leq 0$

$\frac{5x-17}{(x-5)(x-1)}\leq 0$



$(-\infty,1)\cup[\frac{17}{5},5)$

(6) $T(x)=4+\log_2 x$

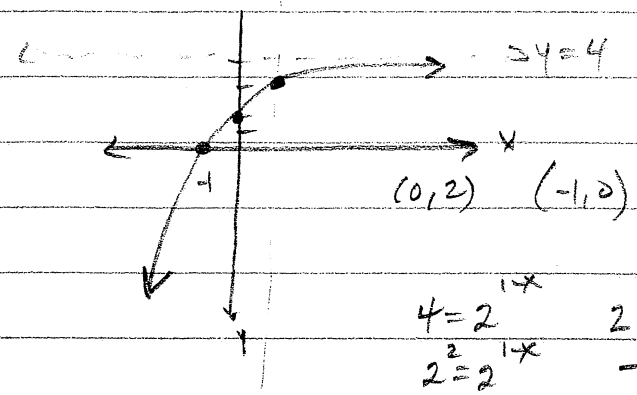


$-4=\log_2 x$

$2^{-4}=x$

$x=\frac{1}{16}$

(7) $T(x)=4-2^{1-x}=4-(\frac{1}{2})^{x-1}$



$4=2^{1-x}$ $\quad 2=1-x$

$2^2=2^{1-x}$ $\quad -1=x$

(8) $\ln(x+2)-\ln(3x-7)=2$

$\frac{x+2}{3x-7}=\frac{e^2}{1}$

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

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

$x=\frac{7e^2+2}{3e^2-1}$

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

$-\frac{1}{2}(3x-2)=3$

$3x-2=-6$

$3x=-4$

$x=\frac{-4}{3}$

(10) $P^2-10P+9=0$

$(P-9)(P-1)=0$

$P=9 \quad P=1$

$3^x=9 \quad 3^x=1$

$x=2 \quad x=0$

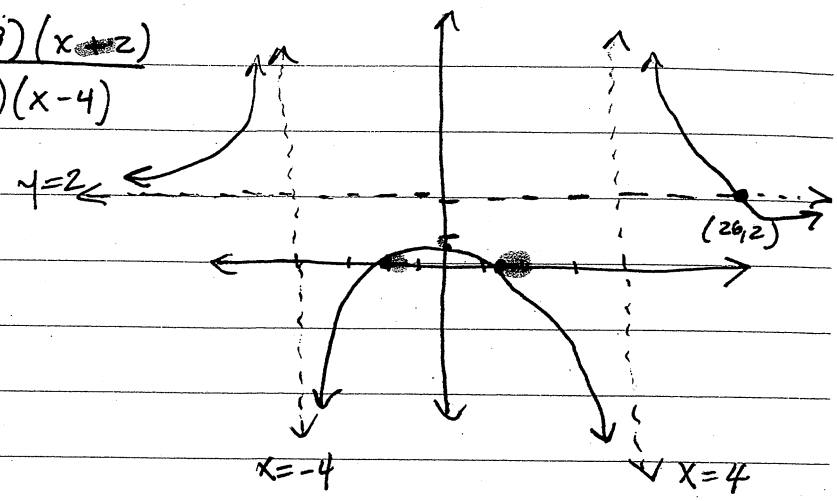
<OSCAR>

#1 $R(x) = \dfrac{2x^2 - x - 6}{x^2 - 16} = \dfrac{(2x+3)(x-2)}{(x+4)(x-4)}$

VA: $x = 4$, $x = -4$

HA: $y = 2$

$(-3/2, 0)$ $(2, 0)$ $(0, 3/8)$



Does $R(x)$ cross $y=2$

$$\frac{2}{1} = \frac{2x^2 - x - 6}{x^2 - 16}$$

$$2x^2 - 32 = 2x^2 - x - 6$$

$$-32 = -x - 6$$

$$32 = x + 6$$

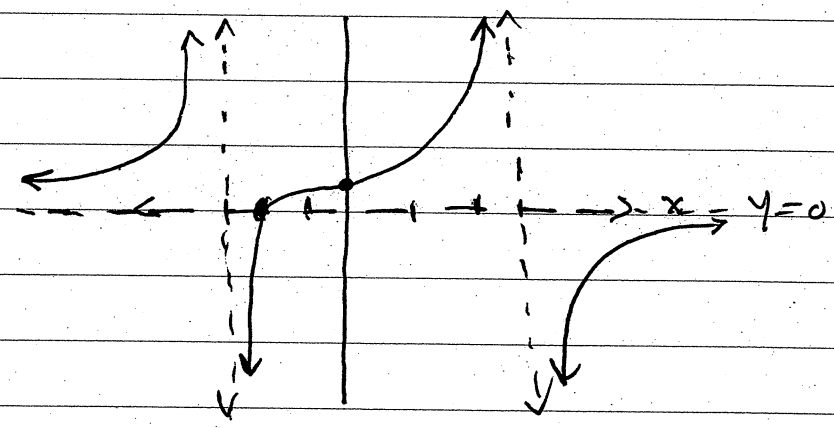
$$26 = x$$

#2 $R(x) = \dfrac{x+2}{(3-x)(3+x)}$

VA: $x = 3$, $x = -3$

HA: $y = 0$

$(-2, 0)$ $(0, 2/9)$



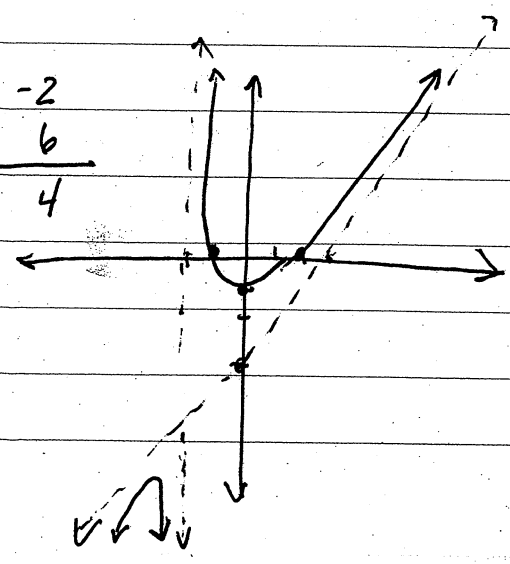
#3 $R(x) = \dfrac{(x-2)(x+1)}{x+2}$

$$\begin{array}{r|rrr} -2 & 1 & -1 & -2 \\ & \downarrow & -2 & 6 \\ \hline & 1 & -3 & 4 \end{array}$$

VA: $x = -2$ $(2, 0)$

NO HA $(-1, 0)$

SA $y = x - 3$ $(0, -1)$



#10 $A = 3^x \quad A^2 = 3^{2x}$

$A^2 - 8A - 9 = 0$

$(A-9)(A+1) = 0$

$A = 9 \quad A = -1$

$3^x = 9 \quad 3^x = -1$

$\varnothing$

$x = 2$

#11 $\sqrt{3}\cos 2x = \sin 2x$

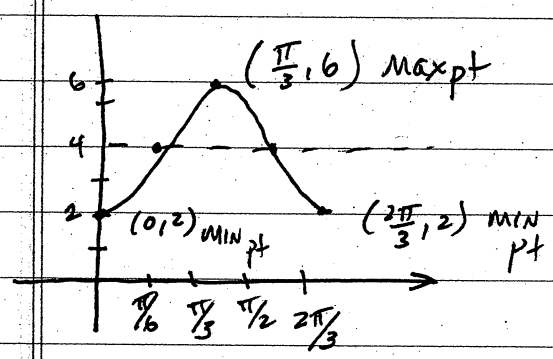
$\sqrt{3} = \tan 2x$

$\tan ☺ = \sqrt{3}$

$☺ = \underbrace{\frac{\pi}{3}, \frac{4\pi}{3}}_{\#1}, \underbrace{\frac{7\pi}{3}, \frac{10\pi}{3}}_{\#2}$

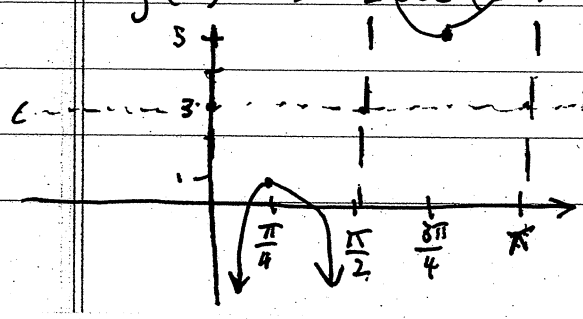
$x \in \left\{\frac{\pi}{6}, \frac{2\pi}{3}, \frac{7\pi}{6}, \frac{5\pi}{3}\right\}$

#12 $f(x) = 4 - 2\cos 3x$



#13 $f(x) = 3 + 2\csc(-2x)$

$f(x) = 3 - 2\csc(2x)$



VA:
$x = 0$
$x = \frac{\pi}{2}$
$x = \pi$

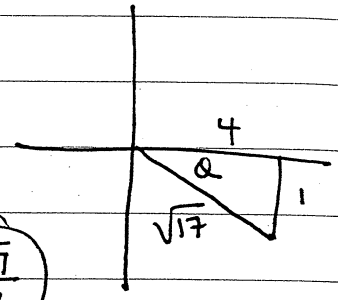
Rel MIN $(\frac{3\pi}{4}, 5)$

Rel max $(\frac{\pi}{4}, 1)$

#14 $\sin\left(\text{arc}\cot\left(\frac{-4}{1}\right)\right)$

$\sin\left(\underbrace{\text{arctan}\left(\frac{-1}{4}\right)}_{\theta}\right)$

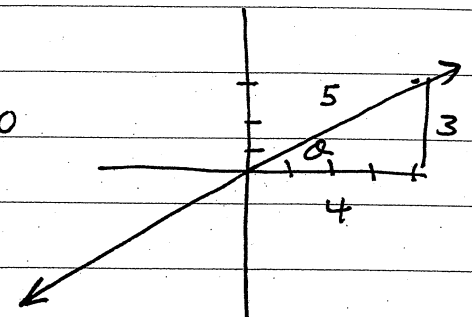
$= \frac{-1}{\sqrt{17}} \text{ or } \frac{-\sqrt{17}}{17}$



#15 $3x - 4y = 0$

$-4y = -3x$

$y = \frac{3}{4}x$



$\boxed{\cot\theta = +\frac{4}{3}}$

#16 Compl. $\frac{\pi}{2} - .13$

Supp. $\pi - .13$

#17 $\cot\theta = -2.873$

$\theta = 2.80664$

$\theta = 5.94823$

Honors Fall Projects

- Dog (4 pages)
- Lion (5 pages)
- Panda (4 pages)
- Sunshine (4 pages)

- Answer Key (17 pages)

9. **Graph** and label the **end point** and all **intercepts**: $h(x) = -2 + \sqrt{8-8x}$

10. **Graph** and label all **intercepts** and **asymptotes**: $w(x) = 36 - 36^{-x}$

11. **Graph** and label all **intercepts** and **asymptotes**: $e(x) = 4 + \ln x^2$

12. **Graph** and label all **intercepts** and **asymptotes**: $e(x) = 4 + \log_2(-4x)$

13. **Graph** and label all **intercepts** and **asymptotes**: $p(x) = 4 - 2\left(\frac{1}{e}\right)^{-x^2}$

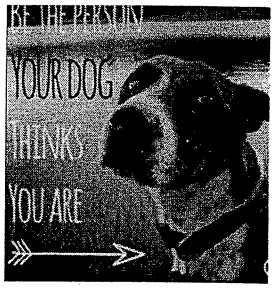
14. Simplify the expression and write your answer in standard form: $\frac{i^{22} - 5i^{35}}{1+i}$

15. Given $j(x) = 4 + 2e^{x-1}$ evaluate $j^{-1}(9)$

16. Divide: $(6x^3 - 13x^2 + 11x - 4) \div (x^2 - 3)$

17. Solve for x: $12(x^2 - 25)^3 + 48(25 - x^2) = 0$

18. Using interval notation, solve for x: $\frac{2x^2 - 3x - 9}{3x^2 - 8x - 3} \geq 0$



27. Find a polynomial of degree 6 that has the given zeros: $x = \frac{2}{3}, 4, 3i, 1+2i$

MEDICINE The numbers y of freestanding ambulatory care surgery centers in the United States from 2000 through 2007 can be modeled by

$$y = 2875 + \frac{2635.11}{1 + 14.215e^{-0.8038t}}, \quad 0 \le t \le 7$$

where t represents the year, with $t = 0$ corresponding to 2000. (Source: Verispan)

(a) Use a graphing utility to graph the model.

(b) Use the *trace* feature of the graphing utility to estimate the year in which the number of surgery centers exceeded 3600.

28. ..

29. How long would it take to double your money at an annual interest rate of 3.4% if your money was compounded monthly?

30. Using interval notation, solve for x: $-2 \le \frac{4-3x}{3} < 3$

9. **Graph** and label all **intercepts**: $h(x) = -2 + \sqrt[3]{8-x}$

10. **Graph** and label all **intercepts** and **asymptotes**: $w(x) = 2 - 8^{x^2}$

11. **Graph** and label all **intercepts** and **asymptotes**: $e(x) = 2 + \ln(x-3)$

12. **Graph** and label all **intercepts** and **asymptotes**: $e(x) = 2 + \log_{\frac{1}{4}}(x+4)$

13. **Graph** and label all **intercepts** and **asymptotes**: $p(x) = 2 - 6e^{-x^2}$

14. Simplify the expression and write your answer in standard form: $\dfrac{i^{21} - 5i^{34}}{1-i}$

15. Given $j(x) = 3e^{x-2}$ evaluate $j^{-1}(9)$

16. Divide: $(6x^3 - 19x^2 + 16x - 4) \div (x^2 - 2)$

17. Solve for x: $12(x^2-9)^3 + 3(9-x^2) = 0$

18. Using interval notation, solve for x: $\dfrac{4x^2 - 8x - 5}{4x^2 - 1} \le 0$

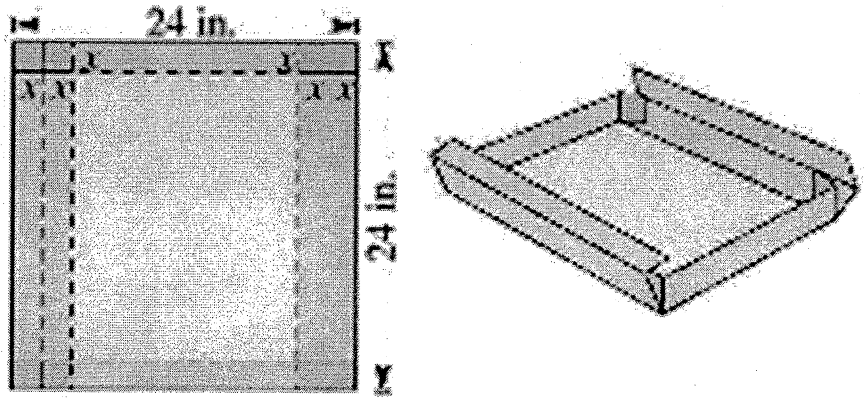
27. Find a polynomial of degree 6 that has the given zeros: $x = 2, 1, 4i, 1 - i$

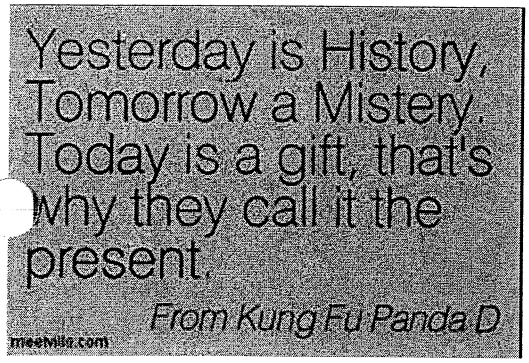
28. Write a function $V(x)$ that represents the volume of the box

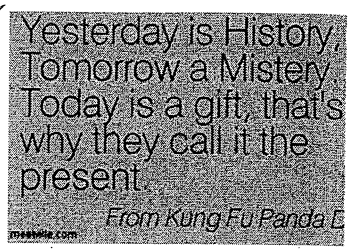
a. Determine the domain of the function $V(x)$

b. Sketch a graph of the function and estimate the value of x for which $V(x)$ is a maximum.

MAXIMUM VOLUME An open box with locking tabs is to be made from a square piece of material 24 inches on a side. This is to be done by cutting equal squares from the corners and folding along the dashed lines shown in the figure.







1. Using interval notation, state the **domain** of the function: $f(x)=\dfrac{x^2-1}{x-4x^3}$

2. Using interval notation, state the **domain** of the function: $j(x)=\log_2\left(2x^3+5x^2-2x-5\right)$

3. Using interval notation, state the **domain** of the function: $l(x)=\begin{cases} e^{\frac{2}{3}x}; & x>0 \\ 4-\sqrt[3]{x}; & x\le 0 \end{cases}$

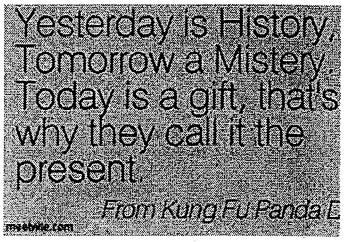
4. Using interval notation, state the **range** of the function: $m(x)=6x^2-12x+5$

5. Using interval notation, state the **domain** of the function: $n(x)=5e^{\sqrt{x}}$

6. Using interval notation, state the **range** of the function: $p(x)=-1+4e^{x-1}$

7. **Graph** and label all **intercepts**, **asymptotes**, and any **point(s) of discontinuity**: $v(x)=\dfrac{x^2+9}{x+9}$

8. **Graph** and label all **intercepts**, **asymptotes**, and any **point(s) of discontinuity**: $v(x)=\dfrac{9x^2}{x^2+4x}$



19. Write a rational function $f(x)$ that has the specified characteristics. (There are many correct answers) Vertical asymptotes: $x=8$ Horizontal asymptote: $y=-1$ and zero: $x=2,6$

20. Using interval notation, solve for x: $25x^4 \le x^2(3x-1)^2$

21. State the upper and lower bound of the real zeros of $f(x)=x^3-4x^2-5$

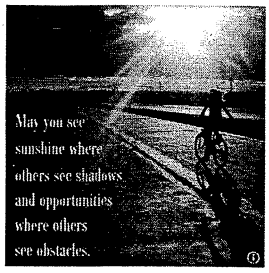
22. Using Descarte's Rule of Signs, determine the possible number of positive and negative zeros of the function $k(x)=x^5+3x^4+6x^3+x^2-5x+1$

23. Solve for x: $2(4^x)-19(2^x)+24=0$

24. Solve for x in terms of e: $\ln x-\ln(2x-4)=6$

25. If $\begin{matrix}\ln 7=D\\ \ln 2=G\end{matrix}$ express $\log_8 7$ in terms of D and G.

26. Simplify the expression $64^{\log_{16}\left(\sqrt{3-x}\right)}$



1. Using interval notation, state the **domain** of the function: $f(x)=\dfrac{x-4}{\sqrt[3]{x}}$

2. Using interval notation, state the **domain** of the function: $j(x)=\log_2\left(x^3-5x^2-3x+15\right)$

3. Using interval notation, state the **domain** of the function: $l(x)=\begin{cases}\sqrt[3]{-x}; & x>0\\ 3x^2; & x\le 0\end{cases}$

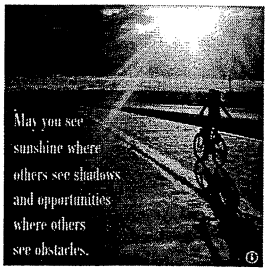
4. Using interval notation, state the **range** of the function: $m(x)=-3x^2-12x+1$

5. Using interval notation, state the **domain** of the function: $n(x)=-1+5e^{-5x}$

6. Using interval notation, state the **range** of the function: $p(x)=4\left|e^{-x-1}\right|$

7. **Graph** and label all **intercepts**, **asymptotes**, and any **point(s) of discontinuity**: $v(x)=\dfrac{x^2+x}{3x^2-2x}$

8. **Graph** and label all **intercepts**, **asymptotes**, and any **point(s) of discontinuity**: $v(x)=\dfrac{x^2+4}{-9x^2}$



19. Write a rational function $f(x)$ that has the specified characteristics. (There are many correct answers) Vertical asymptotes: $x=0$ *and* $x=1$ Horizontal asymptote: $y=2$ and zero: $x=2$

20. Using interval notation, solve for x: $x^4 \le 81$

21. State the upper and lower bound of the real zeros of $f(x)=x^3-3x-6$

22. Using Descarte's Rule of Signs, determine the possible number of positive and negative zeros of the function $k(x)=x^5+3x^4-6x^3-x^2-5x-1$

23. Solve for x: $3(9^x)+9=28(3^x)$

24. Solve for x in terms of e: $\ln x+\ln(2x-3)=4$

25. If $\begin{matrix}\ln 7=D\\ \ln 2=G\end{matrix}$ express $\ln\left(\frac{\sqrt{56}}{4}\right)$ in terms of D and G.

26. Simplify the expression $8^{\log_2(\sqrt{3x})}$

Pre-Calc

Honors DOG Page 1

#1 $f(x) = \frac{x(x+1)}{\sqrt[3]{x-4}}$

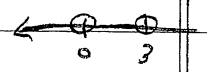
Domain $x \neq 4$

$x \in (-\infty, 4) \cup (4, +\infty)$

#2 $y(x) = \log_2(5x^2(3-x))$

$5x^2(3-x) > 0$

$5x^2(x-3) < 0$



$\boxed{x \in (-\infty, 0) \cup (0, 3)}$

#3 D: $x \in (-\infty, +\infty)$

#4 $m(x) = 3x^2 - 18x - 7$

$m(x) = 3(x^2 - 6x + 9) - 7 - 27$

$m(x) = 3(x-3)^2 - 34$

UP $V(3, -34)$

Range $y \in [-34, +\infty)$

#5 $n(x) = -3 + 5e^{-x}$

Domain $x \in (-\infty, +\infty)$

#6 $p(x) = 2 - e^{5-x}$

Range $y \in (-\infty, 2)$

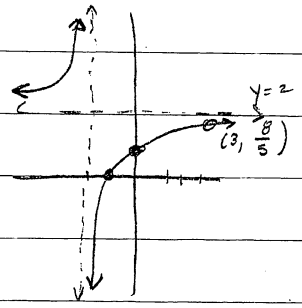
#7 $v(x) = \frac{2(x^2 - 2x - 3)}{(x-3)(x+2)}$

$v(x) = \frac{2\cancel{(x-3)}(x+1)}{\cancel{(x-3)}(x+2)} = \frac{2(x+1)}{x+2}$

Domain $x \neq 3, -2$

VA: $x = -2$ Hole $(3, \frac{8}{5})$

HA: $y = 2$



#8 $v(x) = \frac{9-x}{x^2+4}$

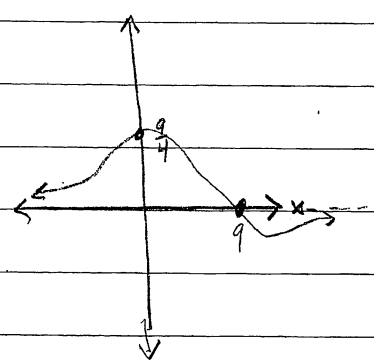
Domain $x \in \mathbb{R}$

No VA

HA: $y = 0$

$(9, 0)$

$(0, \frac{9}{4})$

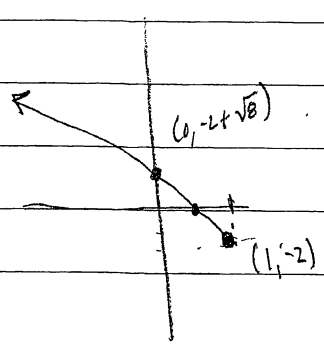


#9 $h(x) = -2 + \sqrt{8 - 8x}$

$4 = 8 - 8x$ $(\frac{1}{2}, 0)$

$8x = 4$

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



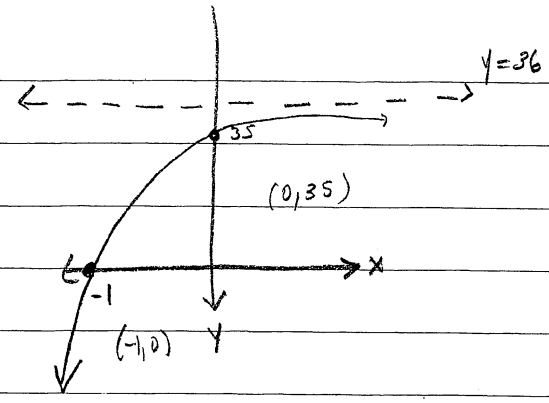
Domain

$8 - 8x \geq 0$

$8x \leq 8$

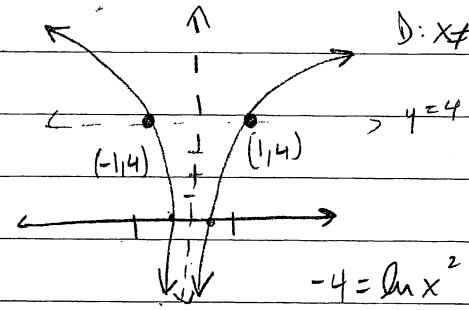
$x \leq 1$

#10 $w(x) = 36 - 36^{-x}$



#11 $e(x) = 4 + \ln x^2$ "EVEN"

D: $x \neq 0$



$-4 = \ln x^2$

$e^{-4} = x^2$

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

$x = \pm \frac{1}{e^2}$

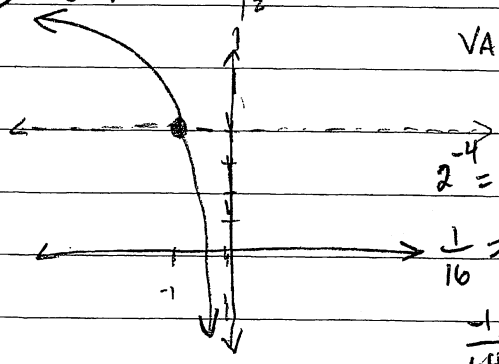
$\boxed{(\pm \frac{1}{e^2}, 0)}$

#12 $e(x) = 4 + \log_2(-4x)$

$-4x > 0$

$x < 0$

VA $x = 0$



$2^{-4} = -4x$

$\frac{1}{16} = -4x$

$\frac{-1}{64} = x$

(21)

$$\begin{array}{r|rrrr} 1 & 1 & 0 & -3 & -2 \\ & \downarrow & 1 & 1 & \\ \hline & 1 & 1 & -2 & \end{array}$$

$$\begin{array}{r|rrrr} 2 & 1 & 0 & -3 & -2 \\ & \downarrow & 2 & 4 & 2 \\ \hline & 1 & 2 & 1 & 0 \end{array}$$

$\boxed{UB = 2}$

$$\begin{array}{r|rrrr} -1 & 1 & 0 & -3 & -2 \\ & \downarrow & -1 & 1 & \\ \hline & 1 & -1 & -2 & \end{array}$$

$\boxed{LB = -2}$

$$\begin{array}{r|rrrr} -2 & 1 & 0 & -3 & -2 \\ & \downarrow & -2 & 4 & -2 \\ \hline & 1 & -2 & 1 & -4 \end{array}$$

(#22) $K(x) = x^5 - 6x^3 + x^2 - 5x - 1$

3 SIGN

$K(-x) = -x^5 + 6x^3 + x^2 + 5x - 1$

2 SIGN

+	-	0
3	2	0
3	0	2
~~1~~	~~4~~	~~0~~
1	0	4
1	2	2

(#23) $A = 2^x$; $A^2 = 2^{2x}$

$27A^2 - 6A - 1 = 0$

$(9A + 1)(3A - 1) = 0$

$\cancel{A = \frac{-1}{9}}$ $\quad A = \frac{1}{3}$

$2^x = 1/3$

$\boxed{x = -\log_2 3}$

(#24) $\ln 3x(2x-2) = 2$

$6x^2 - 6x = e^2$

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

$x = \frac{6 \pm \sqrt{36 - 4(6)(-e^2)}}{12}$

$x = \frac{6 \pm \sqrt{36 + 24e^2}}{12}$

$x = \frac{6 \pm 2\sqrt{9 + 6e^2}}{12}$

$\boxed{x = \frac{3 + \sqrt{9 + 6e^2}}{6}}$

(25) $\frac{\log 49}{\frac{1}{2}\log 2} = \frac{\frac{\ln 49}{\cancel{\ln 10}}}{\frac{\ln 2}{\cancel{\ln 10}}} = \frac{4 \ln 7}{\ln 2}$

$\boxed{\frac{4D}{9}}$

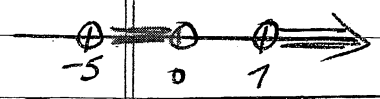
PAGE 1/4 LION

#1 $x \neq 4$ $\boxed{x \in (-\infty, 4) \cup (4, +\infty)}$

#2 $x^3 - 2x^2 - 35x > 0$

$x(x^2 - 2x - 35) > 0$

$x(x-7)(x+5) > 0$



$\boxed{x \in (-5, 0) \cup (7, +\infty)}$

#3 $x \in (-\infty, +\infty)$

#4 $m(x) = 3(x^2 - 4x + 4) - 5 - 12$

up $3(x-2)^2 - 17 = m(x)$

$V(2, -17)$

$\boxed{y \in [-17, +\infty)}$

#5 $y \in (-3, +\infty)$

#6 $y \in (-\infty, 2)$

#7 $v(x) = \dfrac{x(1-2x)}{x(x+1)}$ $x \neq 0, -1$

VA: $x = -1$

HA $y = -2$

$v(x) = \dfrac{1-2x}{x+1}$ HOLE $(0,1)$

zero $(\frac{1}{2}, 0)$

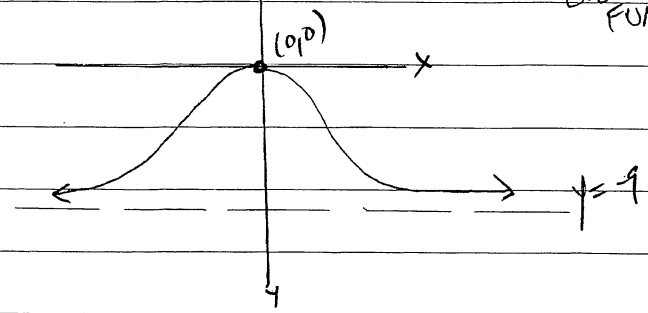
#8 $v(x) = \dfrac{-9x^2}{x^2+4}$

D: $x \in \mathbb{R}$ no VA

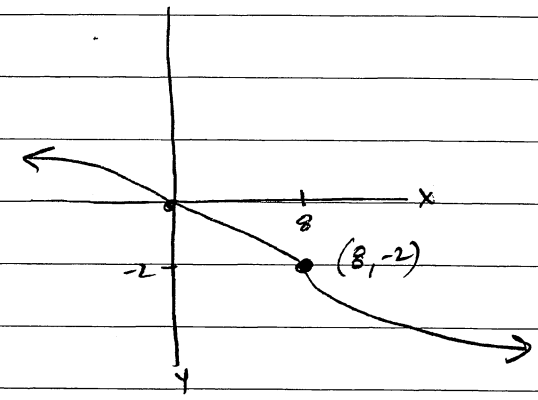
$(0,0)$

HA $y = -9$

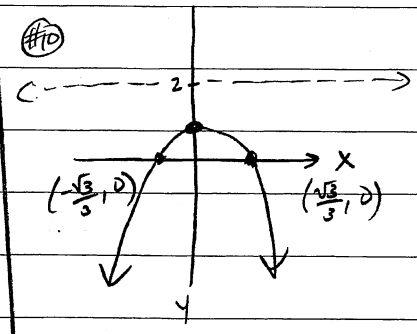
EVEN FUNCTION



#9 $h(x) = -2 + \sqrt[3]{8-x}$



#10

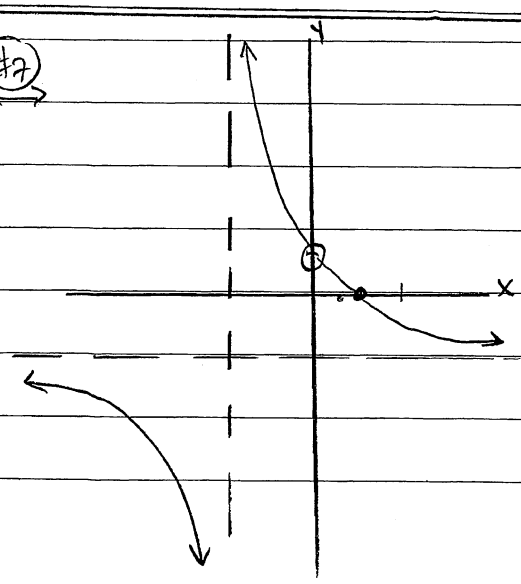


$2 = 2^{3x^2}$

$\frac{1}{3} = x^2$

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

#7



LION / PAGE 3

#17 $3(x^2-9)\left[4(x^2-9)^2-1\right]=0$

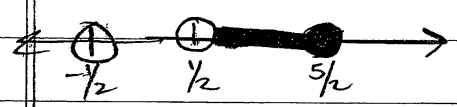
$3(x+3)(x-3)\left[2(x^2-9)-1\right]\left[2(x^2-9)+1\right]=0$

$3(x+3)(x-3)(2x^2-19)(2x^2-17)=0$

$$\boxed{x=-3,\ 3,\ \pm\frac{\sqrt{38}}{2},\ \pm\frac{\sqrt{34}}{2}}$$

#18 $\dfrac{(2x-5)\cancel{(2x+1)}}{\cancel{(2x+1)}(2x-1)}\le 0$

$x\neq -1/2$ $\qquad \dfrac{2x-5}{2x-1}\le 0$



$$\boxed{\left(\tfrac{1}{2},\ \tfrac{5}{2}\right]}$$

#19 $f(x)=\dfrac{-3(x-2)^2}{(x-9)(x+1)}$

#20 $x^4-81\ge 0$

$(x^2+9)(x+3)(x-3)\ge 0$

$\boxed{(-\infty,-3]\cup[3,+\infty)}$

#21 $f(x)=x^3+0x^2-4x-5$

UB 3

1	0	-4	-5
↓	3	9	15
1	3	5	10

-1

1	0	-4	-5
↓	-1	1	
1	-1	-3	

LB -2

1	0	-4	-5
↓	-2	4	0
1	-2	0	-5

#22 $K(x)=x^5-3x^4-6x^3+x^2-5x-1$

3 SIGN Δ

$K(-x)=\ -\ \ -\ \ +\ \ +\ \ +\ \ -$

2 SIGN Δ.

+	−	0
3	2	0
3	0	2
1	4	0
1	0	4
1	2	2

#23 let $A=3^x$ $\quad A^2=3^{2x}$

$27A^2-6A-1=0$

$(9A+1)(3A-1)$

$A=-\dfrac{1}{9}$ $\quad A=\dfrac{1}{3}$

$$\boxed{x=-1}$$

PANDA PAGE 1/4

#1 $x - 4x^3 \neq 0$

$x(1-4x^2) \neq 0$

$x \neq 0,\ x \neq \frac{1}{2},\ x \neq -\frac{1}{2}$

$\boxed{x \in (-\infty, -\frac{1}{2}) \cup (-\frac{1}{2}, 0) \cup (0, \frac{1}{2}) \cup (\frac{1}{2}, +\infty)}$

#2 $2x^3 + 5x^2 - 2x - 5 > 0$

$x^2(2x+5) - (2x+5) > 0$

$(x+1)(x-1)(2x+5) > 0$

$\boxed{x \in (-\frac{5}{2}, -1) \cup (1, +\infty)}$

#3 $\boxed{x \in (-\infty, +\infty)}$

#4 $m(x) = 6(x^2 - 2x + 1) - 6 + 5$

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

UP $V(1, -1)$

$\boxed{y \in [-1, +\infty)}$

#5 $\boxed{x \in [0, +\infty)}$

#6 $\boxed{y \in (-1, +\infty)}$

#7 $\frac{x^2+9}{x+9} = v(x)$

D: $x \neq -9$

VA: $x = 9$

$$\begin{array}{r|rrr} -9 & 1 & 0 & 9 \\ & \downarrow & -9 & 81 \\ \hline & 1 & -9 & \end{array}$$

SA: $y = x - 9$

#8 $v(x) = \frac{9x^2}{x(x+4)}$

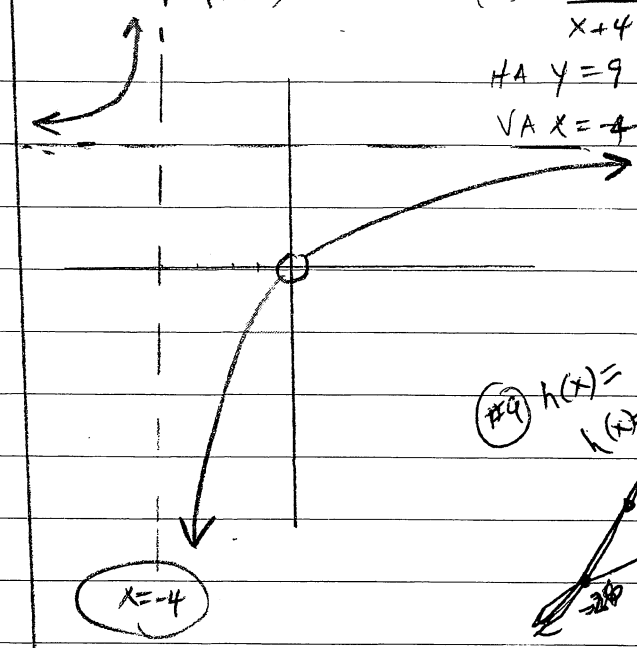
DOMAIN $x \neq 0, -4$

$v(x) = \frac{9x}{x+4}$

HOLE $(0, 0)$

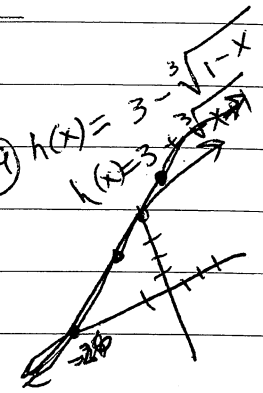
HA $y = 9$

VA $x = -4$



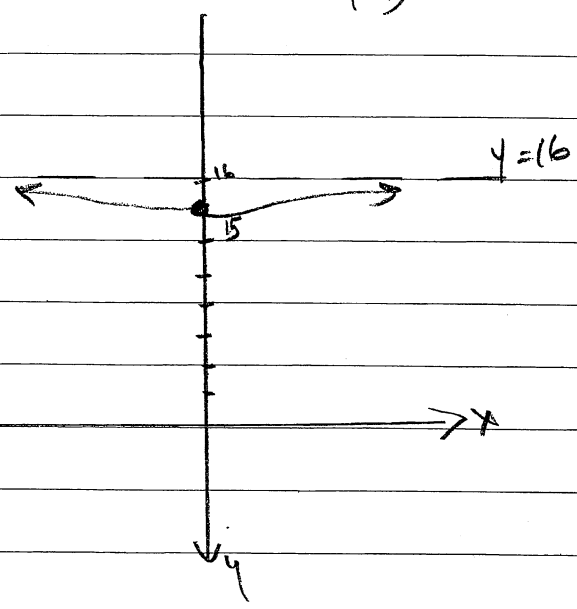
#9 $h(x) = 3 - \sqrt[3]{1-x}$

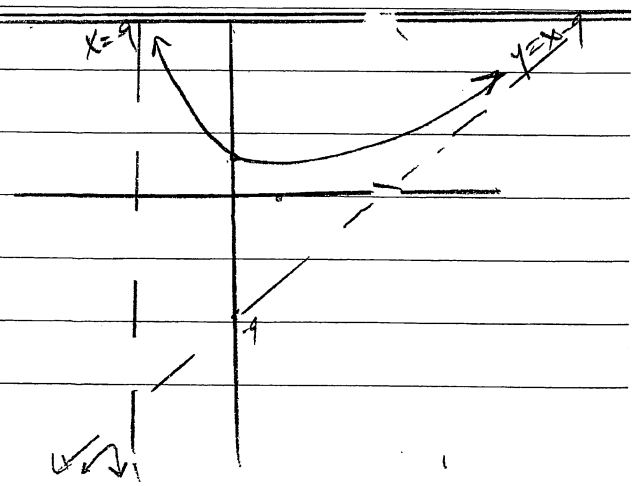
$h(x) = 3 + \sqrt[3]{x}$



#10 $w(x) = 16 - 4^{-x^2} = 16 - \left(\frac{1}{4}\right)^{x^2}$

EVEN!





PAGE 3/4 PANDA

17. $50(x^2-49)^3 + 8(49-x^2) = 0$

$25(x^2-49)^3 - 4(x^2-49) = 0$

$(x^2-49)\left[25(x^2-49)^2 - 4\right] = 0$

$(x+7)(x-7)\left(5(x^2-49)+2\right)\left(5(x^2-49)-2\right) = 0$

$(x+7)(x-7)(5x^2-243)(5x^2-247) = 0$

$x=-7$ $\quad x=7$ $\quad x = \pm\sqrt{\frac{243}{5}}$ $\quad x = \frac{\pm\sqrt{247}}{\sqrt{5}}$

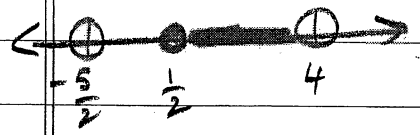
$x = \frac{\pm 9\sqrt{15}}{5}$ $\quad x = \frac{\pm\sqrt{1235}}{5}$

$x \approx \pm 6.97$ $\quad x \approx \pm 7.029$

18. $\frac{(2x-1)\cancel{(2x+5)}}{\cancel{(2x+5)}(x-4)} \le 0$

$x \neq \frac{-5}{2}$

$\frac{2x-1}{x-4} \le 0$



$\boxed{\left[\frac{1}{2}, 4\right)}$

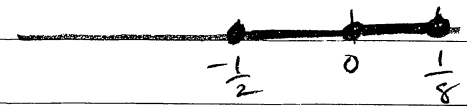
19. $f(x) = \frac{-(x-2)(x-6)}{(x-8)^2}$

20. $25x^4 - x^2(3x-1)^2 \le 0$

$x^2\left(25x^2 - (3x-1)^2\right) \le 0$

$x^2\left(5x - (3x-1)\right)\left(5x + (3x-1)\right) \le 0$

$x^2(2x+1)(8x-1) \le 0$



$\boxed{\left[-\frac{1}{2}, \frac{1}{8}\right]}$

21.

4	1	-4	0	-5
	↓	4	0	
	1	0	0	

5	1	-4	0	-5
	↓	5	5	25
	1	1	5	20

$\boxed{UB = 5}$ $\quad \boxed{LB = -1}$

-1	1	-4	0	-5
	↓	-1	5	-5
	1	-5	5	-10

22.

+	−	0
2	3	0
2	1	2
0	5	0
0	1	4
0	3	2

$K(-x) = - + - + + +$

SUNSHINE PAGE 1/4

#1 D: $x \in (-\infty, 0) \cup (0, +\infty)$

#2 $x^3 - 5x^2 - 3x + 15 > 0$

$x^2(x-5) - 3(x-5) > 0$

$(x-5)(x^2-3) > 0$

$-\sqrt{3}$ $\sqrt{3}$ 5

$\boxed{x \in (-\sqrt{3}, \sqrt{3}) \cup (5, +\infty)}$

#3 $x \in (-\infty, +\infty)$

#4 $M(x) = -3(x^2 + 4x + 4) + 1 + 12$

$M(x) = -3(x+2)^2 + 13$

$V(-2, 13)$ DOWN

$\boxed{y \in (-\infty, 13]}$

#5 $n(x) = 1 + 3e^{-5x}$

$\boxed{x \in (-\infty, +\infty)}$

#6 $\boxed{y \in (0, +\infty)}$

#7 $V(x) = \dfrac{x(x+1)}{x(3x-2)} = \dfrac{x+1}{3x-2}$

D: $x \neq 0, 2/3$ $\quad (0, -\frac{1}{2})$

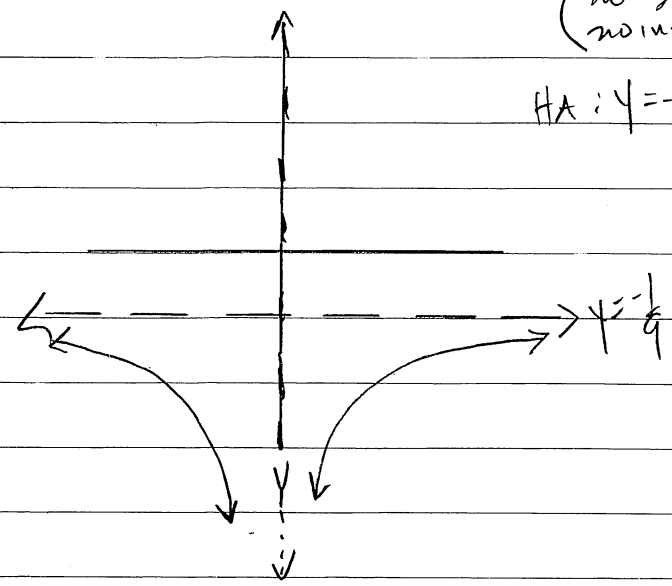
VA: $x = \frac{2}{3}$ $\quad$ Hole @

HA: $y = 1/3$ $\quad (-1, 0)$

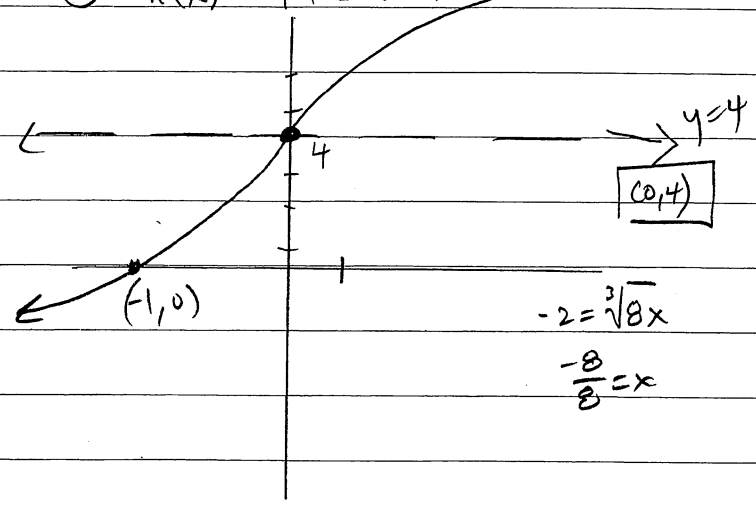
(8) $v(x) = \dfrac{x^2+4}{-9x^2}$

VA: $x = 0$ (no zeros, no intercepts)

HA: $y = -\frac{1}{9}$

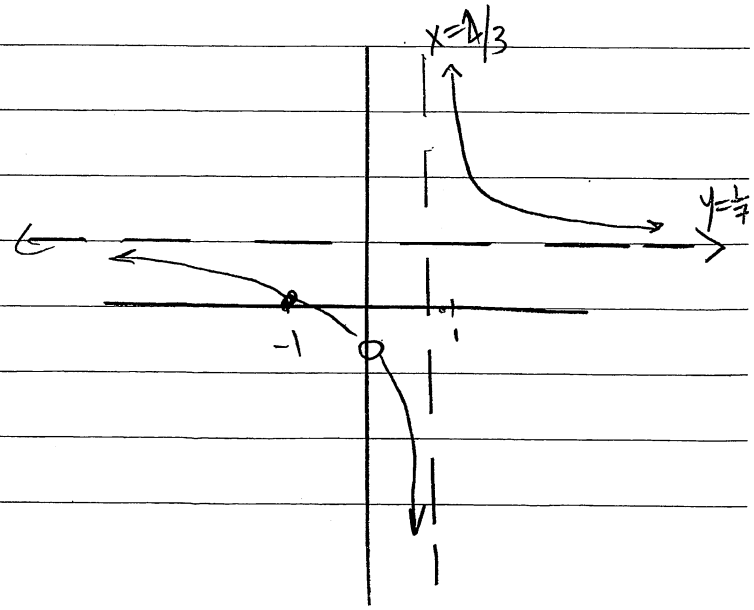


(9) $h(x) = 4 + 2\sqrt[3]{8x}$



$-2 = \sqrt[3]{8x}$

$\frac{-8}{8} = x$



Sunshine p3

(14) $\dfrac{6e^{25} - 2e^{26}}{2e}$

$\dfrac{3e^{24} - e^{25}}{2} = \boxed{3 - \frac{1}{2}e}$

(15) $f(x) = 3 + e^{x-2}$

$y = 3 + e^{x-2}$

$x = 3 + e^{y-2}$

$x - 3 = e^{y-2}$

$\ln(x-3) = y - 2$

$f^{-1}(x) = \ln(x-3) + 2$

$\boxed{f^{-1}(9) = \ln(6) + 2}$

(16)

$$\begin{array}{r} 6x - 19 \\ x^2 - 1 \overline{\big) 6x^3 - 19x^2 + 16x - 4} \\ -(6x^3 \qquad - 6x) \\ \hline -19x^2 + 22x - 4 \\ -(-19x^2 \qquad + 19) \\ \hline 22x - 23 \end{array}$$

$\boxed{6x - 19 + \dfrac{22x - 23}{x^2 - 1}}$

(17) $5(x^2-16)^3 + 20(16 - x^2) = 0$

$5(x^2-16)\left[(x^2-16)^2 - 4\right] = 0$

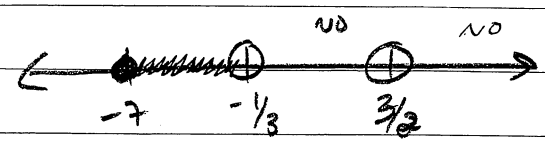
$5(x+4)(x-4)(x^2-16+2)(x^2-16-2) = 0$

$5(x+4)(x-4)(x^2-14)(x^2-18) = 0$

$\boxed{x = 4, -4, \pm\sqrt{14}, \pm 3\sqrt{2}}$

(18) $\dfrac{\cancel{(2x-3)}(x+7)}{(3x+1)\cancel{(2x-3)}} \le 0$

$x \ne 3/2$ $\qquad \dfrac{x+7}{3x+1} \le 0$



$\boxed{[-7, 1/3)}$

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

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

Sunshine p 5

(25)

$\ln\sqrt{56} + \ln 4$

$\frac{1}{2}\ln 56 + \ln 4$

$\frac{1}{2}(\ln 8 + \ln 7) + 2\ln 2$

$\frac{1}{2}(3\ln 2 + \ln 7) + 2\ln 2$

$\frac{3}{2}\ln 2 + \frac{1}{2}\ln 7 + 2\ln 2$

$\boxed{\frac{7}{2}G + \frac{1}{2}D}$

(26) $2^{3\log_2(3x)^{1/2}}$

$(3x)^{3/2}$

$\boxed{3x\sqrt{3x}}$

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

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

$\boxed{p(x) = x^6 - 3x^5 + 10x^3 - 11x^2 + 13x - 10}$

$r_1 = 2-i$ $\quad 4 = -\frac{b}{a}$

$r_2 = 2+i$ $\quad 5 = \frac{c}{a}$

$N = 68(10^{-.04x})$ $[5, 40]$

(28) Solve $\left(21 = 68\left(10^{-.04x}\right), x\right)$

$\boxed{x \approx 12.7572}$

(29) $2 = \left(1 + \frac{.0437}{365}\right)^{365t}$

$x \approx 15.86$ YEARS

(30) $3 \le 4 - 3x < 18$

$-1 \le -3x < 14$

$\frac{1}{3} \ge x > \frac{-14}{3}$

$\left(-\frac{14}{3}, \frac{1}{3}\right]$

1. Using interval notation state the range of the trigonometric function:

$$w(x) = 2 - 5\csc\left(2x - \frac{\pi}{2}\right)$$

2. Graph and label all intercepts, asymptotes (if any), relative maximum points and relative minimum points: $o(x) = 1 - 2\csc\left(\frac{\pi}{2} - x\right)$

3. Graph and label all intercepts, maximum points and minimum points: $w(x) = 3\cos 4x \sin 4x$

4. Graph and label all endpoints: $z(x) = \pi - \arctan(x-1)$

5. Graph and label all asymptotes and intercepts: $f(x) = 3 - \log_{\frac{1}{3}}(3-x)$

6. Solve for x: $2^{2x+1} - 2^x = 3$

7. Solve for x in terms of y: $2y = \dfrac{e^{-x} + e^x}{e^{-x} - e^x}$

14. Find the area and solve for all missing sides and angles: $\measuredangle A = 135^\circ$ and $\measuredangle B = 30^\circ$ and side $b = 20cm$ [Round to two decimal places.]

15. Evaluate the expression: $\tan\left[\frac{\pi}{4} + \sin^{-1}\left(\frac{-5}{12}\right)\right]$

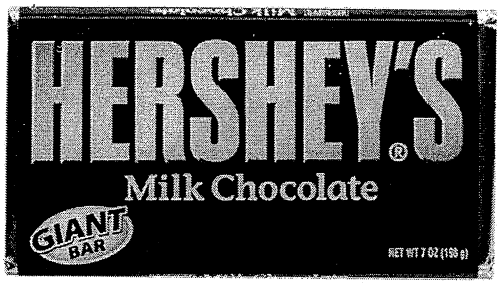
16. Evaluate the expression: $\tan\left(\frac{1}{2}\arccos\frac{-3}{5}\right)$

17. Evaluate the expression: $\dfrac{\cos\left(\frac{\pi}{12}\right)\cos\left(\frac{5\pi}{12}\right) + \sin\left(\frac{5\pi}{12}\right)\sin\left(\frac{\pi}{12}\right)}{\sin\left(\frac{7\pi}{8}\right)\cos\left(\frac{\pi}{8}\right) - \cos\left(\frac{7\pi}{8}\right)\sin\left(\frac{\pi}{8}\right)}$

18. Evaluate the expression: $\dfrac{\sin x}{1-\cot x} - \dfrac{\cos x}{\tan x - 1} - \cos x$

19. The half-life of strontium-90 is 28 days. How much of a 10g sample will remain after 10 days? [Round to two decimal places.]

20. Write an algebraic expression that is equivalent to the expression $\cos\left(\arctan\frac{2x}{5} - \arcsin\frac{1}{x}\right)$



2016

SPRING PROJECT HONORS

7. Solve for x in terms of y: $2y = \dfrac{e^{-x}+1}{e^{-x}-1}$

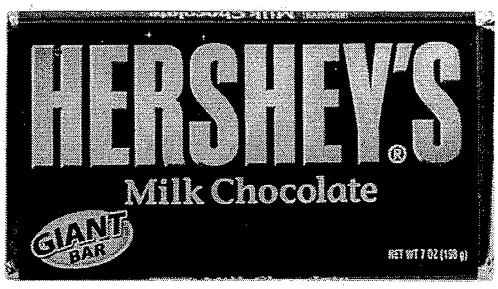
8. Solve for x: $\log_{\sqrt{3}}\left(\dfrac{1-4x}{1+4x}\right) = 4$

9. Solve for x over the interval $x \in [0, 2\pi)$ $4\sin^2 2x + 4\sin^2 2x + \cos 2x - 2\cos^2 x = 2$

10. Solve for x over the interval $x \in [0, 2\pi)$ $4\cos 2x \sin^2 x = \cos 2x$

11. Solve for **ALL** x: $3\sin 3x - \sqrt{3}\cos 3x = 0$

12. Simplify the expression: $\dfrac{\left(\tan^2 x + 1\right)\left(\cos^2 x - 1\right)}{\cos\left(x - \dfrac{\pi}{2}\right)}$



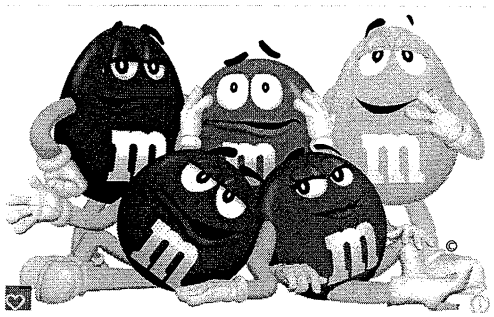
2016

SPRING PROJECT HONORS

18. Given $\sin u = \frac{-2}{5}$ and $\frac{-3\pi}{2} \le u \le 2\pi$ find $\cos u$, $\cos 2u$, $\cos \frac{1}{2}u$

19. The half-life of strontium-90 is 14 days. How much of a 25g sample will remain after 10 days? [Round to two decimal places.]

20. Write an algebraic expression that is equivalent to the expression $\cos\left(\operatorname{arc\,cot}\frac{2x}{5} + \arcsin\frac{1}{x}\right)$



SPRING PROJECT HONORS

2016

7. Solve for x in terms of y: $2y = e^{x} - e^{-x}$

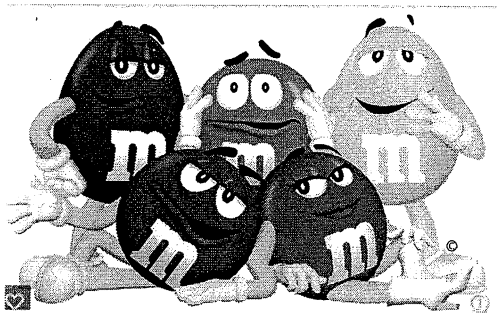
8. Solve for x: $\ln(2x+7) - \ln(3x-1) = 2$

9. Solve for x over the interval $x \in [0, 2\pi)$ $4\sin^2 2x + \cos 2x - 2\cos^2 x = 2$

10. Solve for x over the interval $x \in [0, 2\pi)$ $\tan 2x \sec^2 x = 4\tan 2x$

11. Solve for **ALL** x: $\sqrt{5}\sin 3x - \sqrt{5}\cos 3x = 0$

12. Simplify the expression: $\dfrac{(\tan^2 x + 1)(1 - \cos^2 x)}{\cos\left(\dfrac{\pi}{2} - x\right)}$



SPRING PROJECT HONORS

2016

18. Given $\tan u = \frac{-2}{3}$ and $\frac{-3\pi}{2} \le u \le 2\pi$ find $\sin u$, $\sin 2u$, $\sin \frac{1}{2}u$

19. The half-life of strontium-90 is 30 days. How much of a 8g sample will remain after 17 days?

20. Write an algebraic expression that is equivalent to the expression $\cos\left(\operatorname{arc\,sec}\frac{7x}{5} + \arctan\frac{4}{x}\right)$

8. Solve for x: $\ln(2x+1)+\ln(3x-1)=2$

9. Solve for x over the interval $x \in [0, 2\pi)$ $10\sin^2 x - 12\sin x = 7$

10. Solve for x over the interval $x \in [0, 2\pi)$ $4\tan 2x \cos^2 x = \tan 2x$

11. Solve for **ALL** x: $\sqrt{5}\sin^2 x - \sqrt{5}\cos^2 x = 0$

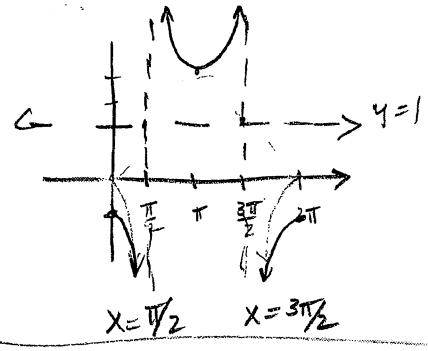
12. Simplify the expression: $\dfrac{\tan x \sin^2 x}{1+\cos x} - \tan x$

13. Simplify the expression: $\dfrac{\sin 2x}{\sin x} - \dfrac{\cos 2x}{\cos x}$

#1 $w(x) \in (-\infty, -3] \cup [7, +\infty)$

#2 $o(x) = 1 - 2\csc\left(\frac{\pi}{2} - x\right)$

$o(x) = 1 - 2\sec x$

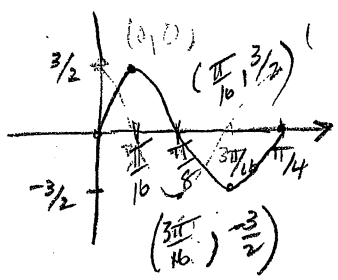


Rel MIN $(\pi, 3)$

Rel MAX $(0, 1)$; $(2\pi, 1)$

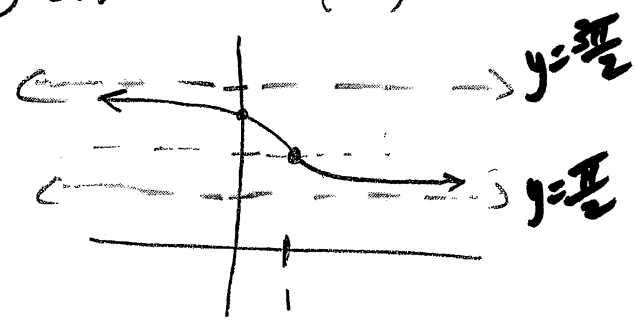
#3 $w(x) = \frac{3}{2}\, 2\cos 4x \sin 4x$

$w(x) = \frac{3}{2}\sin 8x$



$\boxed{(0,0)\ \left(\frac{\pi}{8}, 0\right)\ \left(\frac{\pi}{4}, 0\right)}$

4 $z(x) = \pi - \arctan(x-1)$



$z(0) = \pi - \arctan(-1)$

5 $f(x) = 3 + \log_3(3-x)$

DOMAIN $3 - x > 0$

$x - 3 < 0$

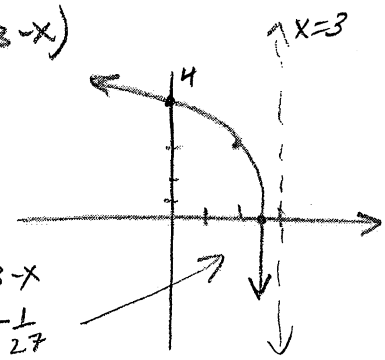
$x < 3$

VA: $x = 3$

$(0, 4)$

$3^{-3} = 3 - x$

$x = 3 - \frac{1}{27}$



6 $2(2^{2x}) - 2^x - 3 = 0$

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

$p = \frac{3}{2}$ $\quad p = -1$

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

$x = \log_2(1.5)$

7 $\left[2ye^{-x} - 2ye^{x} = e^{-x} + e^{x}\right] e^{x}$

$2y - 2ye^{2x} = 1 + e^{2x}$

$2y - 1 = e^{2x}(2y + 1)$

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

$2x = \ln\left(\frac{2y-1}{2y+1}\right)$

$\boxed{x = \frac{1}{2}\ln\left(\frac{2y-1}{2y+1}\right)}$

8 $\frac{4}{1} = \frac{1-4x}{1+4x}$

$1 - 4x = 4 + 16x$

$-3 = 20x$

$\frac{-3}{20} = x$

9 $4\sin^2 2x + \cancel{2\cos^2 x} - 1 \quad \cancel{-2\cos^2 x} = 2$

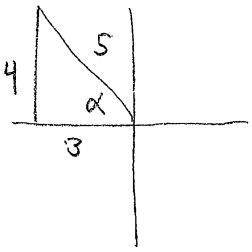
$\sin^2 2x = \frac{3}{4}$

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

$2x = \frac{\pi}{3}, \frac{2\pi}{3}, \frac{4\pi}{3}, \frac{5\pi}{3}, \frac{7\pi}{3}, \frac{8\pi}{3}, \frac{10\pi}{3}, \frac{11\pi}{3},$

$\boxed{x = \frac{\pi}{6}, \frac{\pi}{3}, \frac{2\pi}{3}, \frac{5\pi}{6}, \frac{7\pi}{6}, \frac{4\pi}{3}, \frac{5\pi}{3}, \frac{11\pi}{6}}$

16. $\tan \frac{1}{2}\alpha = \dfrac{1-\cos\alpha}{\sin\alpha}$



$= \dfrac{1+\frac{3}{5}}{\frac{4}{5}} = \dfrac{8}{4} = 2$

(17) $\dfrac{\cos\frac{\pi}{3}}{\sin\frac{6\pi}{8}} = \dfrac{\cos\frac{\pi}{3}}{\sin\frac{3\pi}{4}} = \dfrac{\frac{1}{2}}{\frac{\sqrt{2}}{2}} = \dfrac{\sqrt{2}}{2}$

(18) $\dfrac{\sin x}{1-\cot x} - \dfrac{\cos x}{\tan x - 1} - \cos x$

$\dfrac{\sin^2 x}{\sin x - \cos x} - \dfrac{\cos^2 x}{\sin x - \cos x} - \cos x$

$\dfrac{\sin^2 x - \cos^2 x}{\sin x - \cos x} - \cos x$

$\sin x + \cos x - \cos x$

$\boxed{\sin x}$

(19) $y = Ae^{kt}$

$\frac{1}{2}A = Ae^{k(28)}$

$\frac{1}{2} = e^{28k}$

$-\ln 2 = 28k$

$-\dfrac{\ln 2}{28} = k$

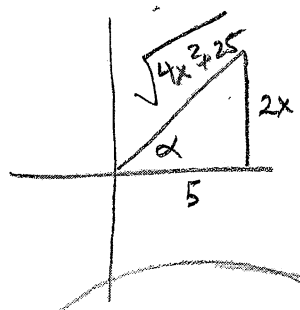
$y = 10e^{\left(\frac{-10}{28}\ln 2\right)}$

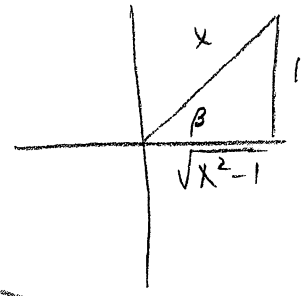
$y \approx 7.80709\ g$

(20) $\cos\left(\underbrace{\arctan\frac{2x}{5}}_{\alpha} - \underbrace{\arcsin\frac{1}{x}}_{\beta}\right)$

$\cos\alpha\cos\beta + \sin\alpha\sin\beta$

$\left(\dfrac{5}{\sqrt{4x^2+25}}\right)\left(\dfrac{\sqrt{x^2-1}}{x}\right) + \left(\dfrac{2x}{\sqrt{4x^2+25}}\right)\left(\dfrac{1}{x}\right)$





$\dfrac{5\sqrt{x^2-1} + 2x}{x\sqrt{4x^2+25}}$

Hershey's 2/4

7. $\left(2ye^{-x} - 2y = e^{-x} + 1\right) e^{x}$

$2y - 2ye^{x} + 1 + e^{x}$

$2y - 1 = 2ye^{x} + e^{x}$

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

$\boxed{\ln\left(\frac{2y-1}{2y+1}\right) = x}$

8. $\left(\sqrt{3}\right)^4 = \frac{1-4x}{1+4x} = \frac{9}{1}$

$9 + 36x = 1 - 4x$

$40x = -8$

$\boxed{x = \frac{-1}{5}}$

9. $\underbrace{4\sin^2 2x + 4\sin^2 2x} + \cos 2x - 2\cos^2 x = 2$

$8\sin^2 2x + \cos 2x - 2\cos^2 x = 2$

$8\sin^2 2x + \cancel{2\cos^2 x} - 1 - \cancel{2\cos^2 x} = 2$

$8\sin^2 2x = 3$

$\sin^2 2x = \frac{3}{8}$

$\sin 2x = \pm\frac{\sqrt{3}}{\sqrt{8}} \cdot \frac{\sqrt{2}}{\sqrt{2}}$

$\sin 2x = \pm\frac{\sqrt{6}}{4}$

$x = \frac{\arcsin\frac{\sqrt{6}}{4}}{2}, \frac{\pi - \arcsin\frac{\sqrt{6}}{4}}{2}, \frac{\pi + \arcsin\frac{\sqrt{6}}{4}}{2}$

$\frac{2\pi - \arcsin\frac{\sqrt{6}}{4}}{2}, \frac{2\pi + \arcsin\frac{\sqrt{6}}{4}}{2}$

$\frac{3\pi - \arcsin\frac{\sqrt{6}}{4}}{2}, \frac{4\pi - \arcsin\frac{\sqrt{6}}{4}}{2}$

10. $\cos 2x\left(4\sin^2 x - 1\right) = 0$

$\cos 2x = 0 \qquad \sin x = \pm\frac{1}{2}$

$2x = \frac{\pi}{2}, \frac{3\pi}{2}, \frac{5\pi}{2}, \frac{7\pi}{2} \qquad x = \frac{\pi}{6}, \frac{5\pi}{6}, \frac{7\pi}{6}, \frac{11\pi}{6}$

$x = \frac{\pi}{4}, \frac{3\pi}{4}, \frac{5\pi}{4}, \frac{7\pi}{4}$

11. $3\sin 3x = \sqrt{3}\cos 3x$

$\tan 3x = \frac{\sqrt{3}}{3}$

$\tan \textcircled{\div} = \frac{\sqrt{3}}{3}$ quad 1, 3

$3x = \textcircled{\div} = \underbrace{\frac{\pi}{6}, \frac{7\pi}{6}}_{\#1}, \underbrace{\frac{13\pi}{6}, \frac{19\pi}{6}}_{\#2}, \underbrace{\frac{25\pi}{6}, \frac{31\pi}{6}}_{\#3}$

$x = \frac{\pi}{18}, \frac{7\pi}{18}, \frac{13\pi}{18}, \frac{19\pi}{18}, \frac{25\pi}{18}, \frac{31\pi}{18}$

$\boxed{x = \frac{\pi}{18} + \frac{\pi}{3}N}$

#12 $\frac{(\tan^2 x + 1)(\cos^2 x - 1)}{\cos\left(x - \frac{\pi}{2}\right)} = \frac{(\sec^2 x)(-\sin^2 x)}{\sin x}$

$\frac{\sin^2 x}{\cos^2 x \ \sin x} = \frac{\sin x}{\cos^2 x} = \boxed{\tan x \sec x}$

#13 $\frac{\cos x - \cos y}{\sin x + \sin y} + \frac{\sin x - \sin y}{\cos x + \cos y}$

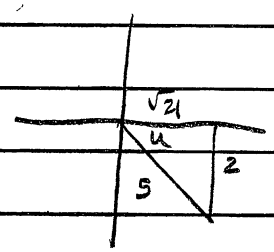
$\frac{\cos^2 x - \cos^2 y + \sin^2 x - \sin^2 y}{(\sin x + \sin y)(\cos x + \cos y)}$

$\frac{1 - (\cos^2 y + \sin^2 y)}{(\sin x + \sin y)(\cos x + \cos y)} = 0$

Hashays 4/4

(17) $\dfrac{\cos\left(\frac{7\pi}{12}-\frac{5\pi}{12}\right)}{\sin\left(\frac{17\pi}{8}-\frac{3\pi}{8}\right)} = \dfrac{\cos\left(\frac{\pi}{6}\right)}{\sin\left(\frac{14\pi}{8}\right)} = \dfrac{\cos\frac{\pi}{6}}{\sin\frac{7\pi}{4}} = \dfrac{\frac{\sqrt{3}}{2}}{-\frac{\sqrt{2}}{2}} = -\dfrac{\sqrt{6}}{2}$

(18) $\sin u = \dfrac{-2}{5}$ $\quad \dfrac{3\pi}{2} \le u \le 2\pi$ $\quad \cos u = \dfrac{\sqrt{21}}{5}$



$\cos 2u = 1 - 2\sin^2 u$

$1 - 2\left(-\frac{2}{5}\right)^2 = 1 - 2\left(\frac{4}{25}\right)$

$\frac{3\pi}{2} \le u \le 2\pi$ $\quad \cos 2u = \dfrac{17}{25}$ $\quad \frac{25}{25} - \frac{8}{25} = \frac{17}{25}$

$\frac{3\pi}{4} \le \frac{u}{2} \le \pi$

$\cos\frac{1}{2}u = -\sqrt{\dfrac{1+\cos u}{2}} = -\sqrt{\dfrac{1+\frac{\sqrt{21}}{5}}{2}} = -\sqrt{\dfrac{5+\sqrt{21}}{10}}$

(19) $\frac{1}{2}\cancel{A} = \cancel{A}e^{14k}$

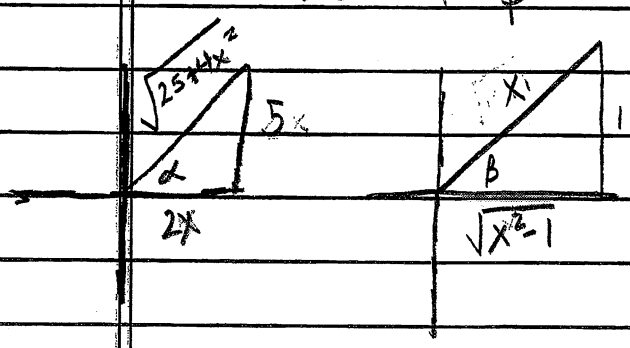
$-\ln 2 = 14k$

$\dfrac{-\ln 2}{14} = k$

$y = 25e^{\left(\frac{-\ln 2}{14}\right)(10)}$

$y \approx 15.2377$ grams

(20) $\cos\left(\underbrace{\operatorname{arccot}\frac{2x}{5}}_{\alpha} + \underbrace{\arcsin\frac{1}{x}}_{\beta}\right) = \cos(\alpha+\beta) = \cos\alpha\cos\beta - \sin\alpha\sin\beta$



$= \left(\dfrac{2x}{\sqrt{4x^2+25}}\right)\left(\dfrac{\sqrt{x^2-1}}{x}\right) - \left(\dfrac{5}{\sqrt{4x^2+25}}\right)\left(\dfrac{1}{x}\right)$

$\dfrac{2x\sqrt{x^2-1} - 5}{x\sqrt{4x^2+25}}$

(8) $\ln\left(\frac{2x+7}{3x-1}\right) = 2$

$\frac{2x+7}{3x-1} = e^2$

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

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

$x = \frac{7+e^2}{3e^2-2}$

(9) $4\sin^2 2x + \cos 2x - 2\cos^2 x = 2$

$4\sin^2 2x + \cancel{2\cos^2 x} - 1 - \cancel{2\cos^2 x} = 2$

$4\sin^2 2x = 3$

$\sin^2 2x = \frac{3}{4}$ $\quad \sin 2x = \frac{\pi}{3}, \frac{2\pi}{3}, \frac{4\pi}{3}, \frac{5\pi}{3},$

$\sin 2x = \pm\frac{\sqrt{3}}{2}$ $\quad \frac{7\pi}{3}, \frac{8\pi}{3}, \frac{10\pi}{3}, \frac{11\pi}{3}$

$x = \frac{\pi}{6}, \frac{\pi}{3}, \frac{2\pi}{3}, \frac{5\pi}{6}, \frac{7\pi}{6}, \frac{4\pi}{3}, \frac{5\pi}{3}, \frac{11\pi}{6}$

(10) $\tan 2x\left[\sec^2 x - 4\right] = 0$

$\tan 2x = 0$ $\quad \sec x = \pm 2$

$\sin 2x = 0$ $\quad \cos x = \pm\frac{1}{2}$

$2x = 0, \pi, 2\pi, 3\pi$ $\quad x = \frac{\pi}{3}, \frac{2\pi}{3}, \frac{4\pi}{3}, \frac{5\pi}{3}$

$x = 0, \frac{\pi}{2}, \pi, \frac{3\pi}{2}$

$x \in \left\{0, \frac{\pi}{2}, \pi, \frac{3\pi}{2}, \frac{\pi}{3}, \frac{2\pi}{3}, \frac{4\pi}{3}, \frac{5\pi}{3}\right\}$

(11) $\sin 3x = \cos 3x$

$\tan 3x = 1$

$3x = \frac{\pi}{4}, \frac{5\pi}{4}, \frac{9\pi}{4}, \frac{13\pi}{4}, \frac{17\pi}{4}, \frac{21\pi}{4}$

$x \in \left\{\frac{\pi}{12}, \frac{5\pi}{12}, \frac{3\pi}{4}, \frac{13\pi}{12}, \frac{17\pi}{12}, \frac{7\pi}{4}\right\}$

All $\frac{\pi}{12} + \frac{\pi N}{3}$

(#12) $\frac{(\tan^2 x + 1)(1 - \cos^2 x)}{\cos\left(\frac{\pi}{2} - x\right)}$

$\frac{(\sec^2 x)(\sin^2 x)}{\sin x} =$

$\frac{\sin x \cancel{\sin x}}{\cos x \cos x \cancel{\sin x}}$

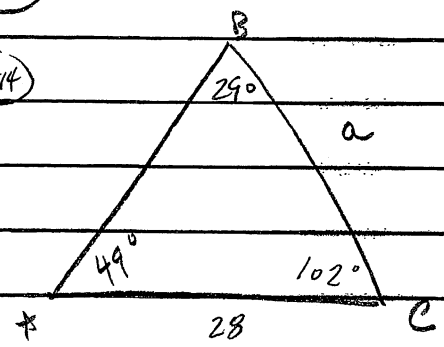
$\boxed{\tan x \sec x}$

(#13) $\sec 2x\left(2 - \sec^2 x\right)$

$\frac{1}{\cos 2x}\left(2 - \frac{1}{\cos^2 x}\right)$

$\frac{1}{\cancel{\cos 2x}}\left(\frac{2\cos^2 x - 1}{\cos^2 x}\right) = \sec^2 x$

(#14)



$\frac{a}{\sin 49°} = \frac{28}{\sin 29°}$

$a = \frac{28 \sin 49°}{\sin 29°} \approx 43.59$

$\frac{c}{\sin 102°} = \frac{28}{\sin 29°} \approx 56.49$

$A = \frac{1}{2}ab\sin C$

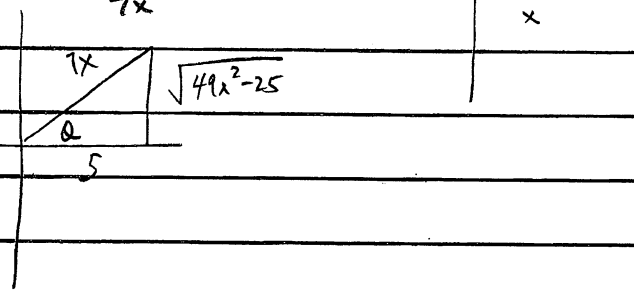
≈ 596.787

(20) $\cos\left(\underbrace{\operatorname{arcsec}\frac{7x}{5}}_{\alpha} + \underbrace{\arctan\frac{4}{x}}_{\beta}\right) = \cos\alpha\cos\beta - \sin\alpha\sin\beta$

$\left(\frac{5}{7x}\right)\left(\frac{x}{\sqrt{16+x^2}}\right) - \left(\frac{\sqrt{49x^2-25}}{7x}\right)\left(\frac{4}{\sqrt{16+x^2}}\right)$

$\sec\alpha = \frac{7x}{5}$ $\quad$ $\tan\beta = \frac{4}{x}$

$\cos\alpha = \frac{5}{7x}$



$= \frac{5x - 4\sqrt{49x^2-25}}{7x\sqrt{x^2+16}}$

#9 $10\sin^2 x - 12\sin x - 7 = 0$

$$\sin x = \frac{12 \pm \sqrt{144 + 4(10)(7)}}{20}$$

$$\sin x = \frac{12 \pm \sqrt{144+280}}{20} = \frac{12 \pm \sqrt{424}}{20}$$

$$\sin x = \frac{12 \pm 2\sqrt{106}}{20} = \frac{6 \pm \sqrt{106}}{10}$$

$$\sin x = \frac{6+\sqrt{106}}{10} \qquad \sin x = \frac{6-\sqrt{106}}{10}$$

X QUAD 3,4

$$\boxed{\begin{aligned} x &= \pi + \arcsin\left(\frac{\sqrt{106}-6}{10}\right) \\ x &= 2\pi - \arcsin\left(\frac{\sqrt{106}-6}{10}\right) \end{aligned}}$$

#10 $4\tan 2x \cos^2 x = \tan 2x$

$$\tan 2x\left(4\cos^2 x - 1\right) = 0$$

$\tan 2x = 0$ $\qquad$ $\cos x = \pm\frac{1}{2}$

$2x = 0, \pi, 2\pi, 3\pi$ $\qquad$ $\boxed{x = \frac{\pi}{3}, \frac{2\pi}{3}, \frac{4\pi}{3}, \frac{5\pi}{3}}$

$\boxed{x = 0, \frac{\pi}{2}, \pi, \frac{3\pi}{2}}$

$$\boxed{x \in \left\{0, \frac{\pi}{3}, \frac{\pi}{2}, \frac{2\pi}{3}, \pi, \frac{4\pi}{3}, \frac{3\pi}{2}, \frac{5\pi}{3}\right\}}$$

#11 $\sqrt{5}\sin^2 x = \sqrt{5}\cos^2 x$

$$\tan^2 x = 1$$

$$\tan x = \pm 1$$

$$x = \frac{\pi}{4}, \frac{3\pi}{4}, \frac{5\pi}{4}, \frac{7\pi}{4}$$

ALL $\boxed{x = \frac{\pi}{4} + \frac{\pi}{2}N}$

13 $\dfrac{2\sin x\cos x}{\sin x} - \dfrac{2\cos^2 x - 1}{\cos x}$

$$2\cos x - 2\cos x + \frac{1}{\cos x} = \boxed{\sec x}$$

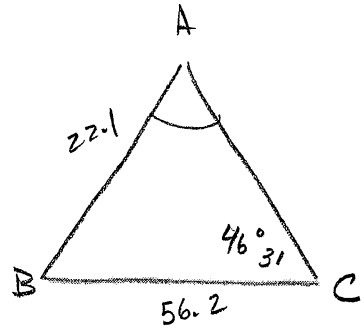
12 $\dfrac{\tan x\left(1-\cos^2 x\right)}{1+\cos x} - \tan x$

$$\tan x(1-\cos x) - \tan x$$

$$-\tan x\cos x$$

$$\boxed{-\sin x}$$

14

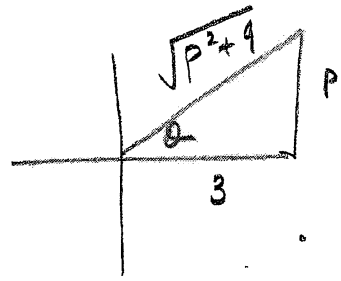


$$\frac{\sin A}{56.2} = \frac{\sin 46°31'}{22.1}$$

$$A = \sin^{-1}\left(\frac{56.2\sin 46°31'}{22.1}\right)$$

NO Δ NO AREA!

15



$$\tan\theta = \frac{p}{3}$$

Worksheet

- **Trigonometric Information Sheet (3 pages)**
- **Sherm's Happy Homework (15 pages)**
  - **#5 (3 pages)**
  - **#9 (2 pages)**
  - **#14 (3 pages)**
  - **#19 (3 pages)**
  - **#30 (2 pages)**
  - **#31 (2 pages)**
- **Additional Chapter 5 Problems (4 pages)**

Reciprocal Trigonometric Functions

$$\sin\theta\csc\theta = 1$$

$$\sin\theta = \frac{1}{\csc\theta}$$

$$\csc\theta = \frac{1}{\sin\theta}$$

$$\cos\theta\sec\theta = 1$$

$$\cos\theta = \frac{1}{\sec\theta}$$

$$\sec\theta = \frac{1}{\cos\theta}$$

$$\tan\theta\cot\theta = 1$$

$$\tan\theta = \frac{1}{\cot\theta}$$

$$\cot\theta = \frac{1}{\tan\theta}$$

Special Triangles

3-4-5; 5-12-13; 7-24-25; 8-15-17

Even vs. Odd Trigonometric Functions

$$\sin(-\theta) = -\sin(\theta)$$

$$\csc(-\theta) = -\csc(\theta)$$

$$\cos(-\theta) = \cos(\theta)$$

$$\sec(-\theta) = \sec(\theta)$$

$$\tan(-\theta) = -\tan(\theta)$$

$$\cot(-\theta) = -\cot(\theta)$$

Pythagorean Identities

$$\sin^2(\theta) + \cos^2(\theta) = 1$$

$$\tan^2(\theta) + 1 = \sec^2(\theta)$$

$$1 + \cot^2(\theta) = \csc^2(\theta)$$

Co-Functions

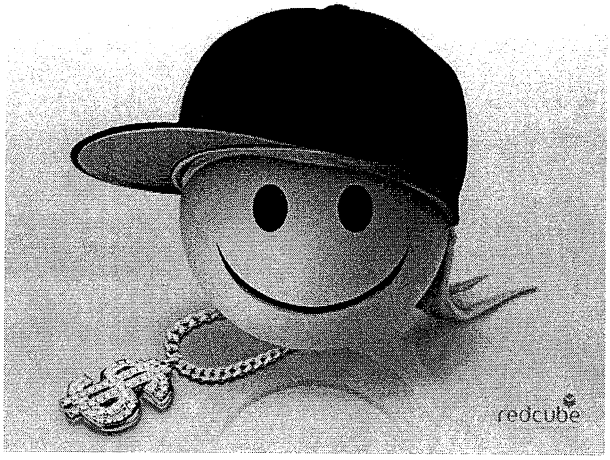
Sherm's Happy Homework #5

1. Factor completely: $x^2 + x - 10$

2. Factor completely: $2x^2 + x - 10$

3. Factor completely: $x^3y - 27x^9y^4$

4. Factor completely: $x^3 + 5x^2 - 4x - 20$



All of your work must be your SPIRAL notebook

5. Factor completely: $36x^{\frac{1}{2}} - 9x^{\frac{5}{2}}$

6. Factor completely: $12x^2 + 7x - 10$

7. Factor completely: $7x^2 - 23x + 6$

8. Factor completely: $10x^2 + 21x - 10$

9. Factor completely: $6x^2 + 7x - 3$

10. Factor completely: $35x^2 - x - 12$

17. Using interval notation, state the range of the quadratic function: $v(x) = -2(x-1)^2 + 8$

18. Find the x- and y- intercepts of the quadratic function: $v(x) = -2(x-1)^2 + 8$

19. Given $f(x) = \dfrac{1 + x - 2x^2}{x+6}$

    a. Evaluate $f(0)$

    b. Find the value of x where $f(x) = 0$

    c. Evaluate $f\left(\dfrac{1}{c}\right)$ in simplified form

11. Graph and label all asymptotes and intercepts: $l(x)=\dfrac{x+5}{x^2-x^3}$

12. Graph and label all asymptotes and intercepts: $l(x)=\dfrac{2x^2-x-3}{x^2-x}$

13. Solve for x: $2x-\sqrt{x}=10$

14. Using interval notation, solve for x: $2x^3+x^2\le 10x$

15. Using interval notation, solve for x: $\dfrac{2}{x-3}\ge\dfrac{-3}{x-1}$

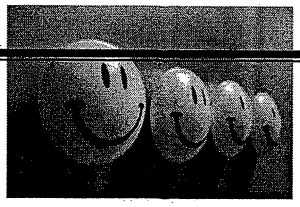
16. Graph and label all intercepts and asymptotes: $d(x)=2^{x+2}$

17. Graph and label all intercepts and asymptotes: $d(x)=4-2^{x+2}$

18. Graph and label all intercepts and asymptotes: $d(x)=2-2^{-x}$

19. Graph and label all intercepts and asymptotes: $d(x)=2^{-x^2}$

20. Graph and label all intercepts and asymptotes: $d(x)=2^{\sqrt{x}}$



12. Use the properties of logarithms to expand the expression as a sum, difference, and/or constant multiple of logarithms: $\ln\left(\frac{w^3}{e^3\sqrt{x}}\right)$

13. Condense the expression to the logarithm of a single quantity:
$-1+2\log_4 x-3\log_4 y+\frac{1}{4}\log_4 a$

14. Solve for x in terms of y: $y=\frac{e^{-x}-e^{x}}{e^{-x}+e^{x}}$

15. Solve for x: $36=\frac{216}{\left(-1+e^{-x}\right)^3}$

16. Solve for x: $4=\log_{\sqrt{6}}(x-5)$

17. Solve for x: $\log_4 x+\log_4(15x-8)=2$

18. Solve for x: $\log x=\log\sqrt{x}$

19. Solve for x: $2-\ln(3-x)^2=-2$

20. Solve for x: $3^{2x+2}+6=55\left(3^x\right)$

Sherm's Happy Homework #19 F and G period

1. Graph one full period, label all maximum and minimum points, and all intercepts:
   $h(x) = 3\sin 2x$

2. Graph one full period, label all maximum and minimum points, and all intercepts:
   $h(x) = 5 - 2\cos\frac{\pi x}{3}$

3. Graph one full period, label all maximum and minimum points, and all intercepts- (show the shift) : $h(x) = 4\sin(2x - \pi)$

4. Graph over the interval $[\frac{-\pi}{2}, \frac{3\pi}{2}]$, label all maximum and minimum points, and all intercepts:
   $h(x) = -x\sin 2x$

5. Graph over the interval $[-\pi, \pi]$, label all maximum and minimum points, and all intercepts:
   $h(x) = 2x + \sin x$

6. Solve for x over the interval $[0, 2\pi)$: $\sin x = -\frac{\sqrt{3}}{2}$

7. Solve for x over the interval $[-\pi, \pi]$: $\cos x = \frac{\sqrt{3}}{2}$

18. Review from chapter 3: Solve for x in terms of "e": $\ln(x)-\ln(4x-3)=2$

19. Review from chapter 3: Solve for x in terms of y: $y=\dfrac{3^x-3^{-x}}{3^x+3^{-x}}$

20. Review from chapter 3: Solve for x in terms of "e": $\ln(x)+\ln(4x-3)=2$

6. Solve for ALL θ: $\sin 3\theta\left(4\cos^2\theta - 3\right) = 0$

7. Solve for θ such that $\theta \in [0, 2\pi)$: $2\tan^2\theta - 5\tan\theta = 7$

8. Graph one full period and label all maximum and minimum points: $H(x) = -3 + 5\sin 4x \cos 4x$

9. Graph one full period and label all maximum and minimum points as well as any intercept:
$A(x) = \sin x \sin\frac{\pi}{2} - \cos x \cos\frac{\pi}{2}$

10. ******<u>Graph one full period and label all intercepts and maximum and minimum points</u>:
$H(x) = \sin x + \cos x$ [Use sum formula!! LOOK AT # 9]

10. Simplify the trigonometric expression: $2\sin x\cos^3 x - 2\sin^3 x\cos x$

11. Simplify the trigonometric expression: $\dfrac{\sin x\cos x}{\frac{1}{2}\cos 2x}$

12. Simplify the trigonometric expression: $\dfrac{1+\cos^2 x}{\sin^2 x} - 2\csc^2 x$

13. Simplify the trigonometric expression: $\dfrac{2\cos^3\beta - 2\sin^3\beta}{\cos\beta - \sin\beta} - 2$

14. Simplify the trigonometric expression: $\dfrac{4\sin x\cos^2 x}{16\sin^2 x\cos x}$

15. Simplify: $\cos\left(2\arctan\dfrac{3}{7}\right)$

16. Simplify: $\cos\left(\dfrac{1}{2}\arccos\left(\dfrac{-8}{17}\right)\right)$

25. Given α lies in quadrant I and β lies in quadrant III. Given $\sin\alpha = \frac{4}{5}$ and $\tan\beta = \frac{1}{4}$. Find what quadrant $\beta - \alpha$ lies in?

26. Graph one full period $h(x) = -5\sin 2x \cos 2x$ {label all maximum and minimum points}

27. Graph one full period $h(x) = 5 + 2\sin\left(x - \frac{\pi}{2}\right)$ {label all maximum and minimum points}

28. Graph one full period $h(x) = 2 + 2\sec\frac{-3x}{4}$ {label all relative maximum and relative minimum points and asymptotes}

29. Graph one full period $h(x) = \frac{2 - 2\cos x}{\sin x}$ {label all relative maximum and relative minimum points and asymptotes}

30. Given $j(x) = 2\sin 6x - 2\sqrt{3}\cos 6x$; find the amplitude, period and shift