Math 115 In Class Questions

You are responsible for these problems. Some of these problems will be asked in class and will count towards your grade. Please see me or go to the math lab if you need help. In addition to this problem set you need to work on the problems from the suggest homework set. Simply doing these problems will not properly prepare you for the tests.

Sullivan, Algebra & Trigonometry, 11th ed	
R.5 Factoring Polynomials	
1. Factor completely. $25x^2 - 4$	**1.** $(5x+2)(5x-2)$
2. Factor completely. $8x^3 + 27$	**2.** $(2x+3)(4x^2-6x+9)$
3. Factor completely. $3(4x+5)^2 \cdot 4(5x+1)^2 + (4x+5)^3 \cdot 2(5x+1)5$	**3.** $2(4x+5)^2(5x+1)(50x+31)$
R.6 Synthetic Division	
1. Use synthetic division to find the remainder when $4x^6 - 3x^4 + x^2 + 5$ is divided by $x - 1$.	**1.** 7
2. Use synthetic division to determine whether $x + 4$ is a factor of $4x^6 - 64x^4 + x^2 - 15$.	**2.** No.
3. Find the sum of *a, b,c* and *d* if $\dfrac{x^3 - 2x^2 + 3x + 5}{x+2} = ax^2 + bx + c + \dfrac{d}{x+2}$	**3.** -9
R.7 Rational Expressions	
1. Simplify. Leave your answer in factored form.	**1.** $\dfrac{(x-4)(x+3)}{(x-1)(2x+1)}$

$$\frac{\frac{2x^2-x-28}{3x^2-x-2}}{\frac{4x^2+16x+7}{3x^2+11x+6}}$$ **2.** Simplify. Leave your answer in factored form. $$\frac{x+4}{x^2-x-2}-\frac{2x+3}{x^2+2x-8}$$ **3.** Simplify $$1-\cfrac{1}{1-\cfrac{1}{1-x}}$$	**2.** $$\frac{-x^2+3x+13}{(x-2)(x+1)(x+4)}$$ **3.** $$\frac{1}{x}$$
R.8 nth Roots; Rational Exponents	
1. Simplify $$\sqrt[3]{16x^4y}-3x\sqrt[3]{2xy}+5\sqrt[3]{-2xy^4}$$ **2.** Factor completely. Write your answer using only positive exponents. $$\frac{2x(1-x^2)^{\frac{1}{3}}+\frac{2}{3}x^3(1-x^2)^{-\frac{2}{3}}}{(1-x^2)^{\frac{2}{3}}}$$ **3.** Factor completely. Write your answer using only positive exponents. $$4(3x+5)^{\frac{1}{3}}(2x+3)^{\frac{3}{2}}+3(3x+5)^{\frac{4}{3}}(2x+3)^{\frac{1}{2}}$$	**1.** $$-(x+5y)\sqrt[3]{2xy}$$ **2.** $$\frac{2x(3-2x^2)}{3(1-x^2)^{\frac{4}{3}}}$$ **3.** $$(3x+5)^{\frac{1}{3}}(2x+3)^{\frac{1}{2}}(17x+27)$$
1.1 Linear Equations	
1. Solve. $$\frac{x}{x^2-1}-\frac{x+3}{x^2-x}=\frac{-3}{x^2+x}$$ **2.**	**1.** -6 **2.**

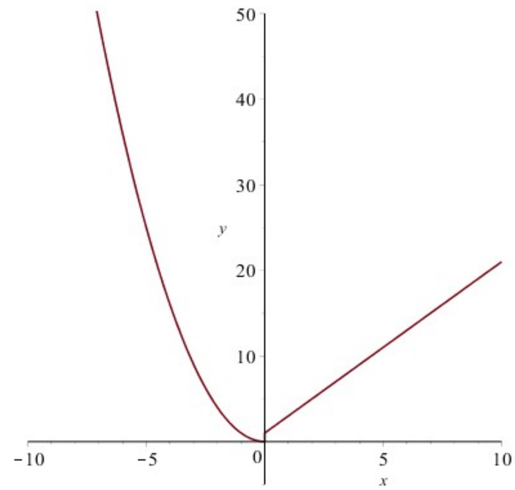
Solve for the indicated variable. $S = \dfrac{a}{1 - r}$, for r	$r = \dfrac{S - a}{S}$
3. The perimeter of a rectangle is 60 feet. Find its length and width if the length is 8 feet longer than the width.	**3.** length 19 ft; width 11 ft
1.2 Quadratic Equations	
1. Solve. $\dfrac{4(x - 2)}{x - 3} + \dfrac{3}{x} = \dfrac{-3}{x(x - 3)}$ **2.** Use the discriminant to determine how many solutions the quadratic equation has. $3x^2 + 5x - 8 = 0$ **3.** An open box is to be constructed from a square piece of sheet metal by removing a square of side 1 foot from each corner and turning up the edges. If the box is to hold 4 cubic feet, what should be the dimensions of the sheet metal?	**1.** $\left\{-\dfrac{3}{4}, 2\right\}$ **2.** Two solutions. **3.** 4 ft by 4 ft
1.4 Radical Equations; Equations Quadratic in Form; Factorable Equations	
1. Find the real solutions. $\sqrt{3 - 2\sqrt{x}} = \sqrt{x}$ **2.** Find the real solutions. $\left(\dfrac{v}{v + 1}\right)^2 + \dfrac{2v}{v + 1} = 8$	**1.** $\{1\}$ **2.** $\left\{-2, -\dfrac{4}{5}\right\}$

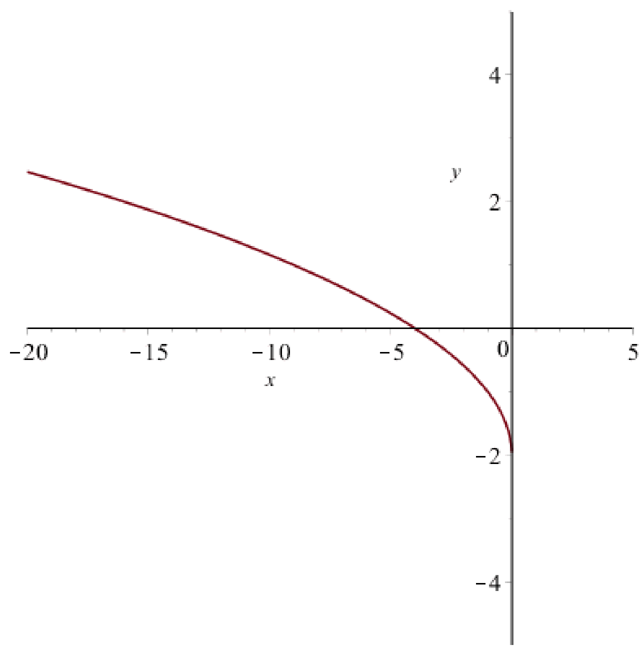
3. Find the real solutions. If $k = \dfrac{x+3}{x-3}$ and $k^2 - k = 12$, find *x*.	**3.** $\left\{\dfrac{3}{2}, 5\right\}$
1.5 Solving Inequalities	
1. Solve the inequalities. Write your answer using set builder notation. $-3 < \dfrac{2x-1}{4} < 0$	**1.** $\left\{x \mid -\dfrac{11}{2} < x < \dfrac{1}{2}\right\}$
2. Solve the inequality. Write your answer in interval notation. $0 < (2x-4)^{-1} < \dfrac{1}{2}$	**2.** $(3, \infty)$
3. Find *a* and *b*. If $2 < x < 3$, then $a < -4x < b$.	**3.** $a = -12,\ b = -8$
2.1 The Distance & Midpoint Formulas	
1. Find the area of the right triangle given by the points. $A = (-2,5);\ B = (1,3);\ C = (-1,0)$	**1.** $\dfrac{13}{2}$
2. Find all points having an *x*-coordinate of 2 whose distance from the point $(-2,-1)$ is 5.	**2.** $(2,2);\ (2,-4)$
3. Determine whether the triangle formed by the points $P_1 = (2,1);\ P_2 = (-4,1);\ P_3 = (-4,-3)$ forms an isosceles triangle, a right triangle or both.	**3.** Right triangle.
2.2 Graphs of Equations in Two Variables; Intercepts & Symmetry	
1. Find the coordinates of the *x* and *y*-intercepts. $y = x^2 - 1$	**1.** $(-1,0),\ (1,0),\ (0,-1)$

2. Find the coordinates of the x and y-intercepts. $9x^2 + 4y = 36$	**2.** $(-2,0)$, $(2,0)$, $(0,9)$
3. If $(-2,b)$ is a point on the graph of $2x + 3y = 2$, what is b?	**3.** $b = 2$
2.3 Lines	
1. Find an equation for the line with the given properties. Express your answer in slope-intercept form. Horizontal; containing the point $(-3,2)$.	**1.** $y = 2$
2. Find an equation for the line with the given properties. Express your answer in slope-intercept form. Perpendicular to the line $y = \frac{1}{2}x + 4$; containing the point $(1,-2)$.	**2.** $y = -2x$
3. Use slopes to show that the triangle whose vertices are $(-2,5)$, $(1,3)$, and $(-1,0)$ is a right triangle.	**3.** $P_1 = (-2,5)$, $P_2 = (1,3)$, $P_3 = (-1,0)$ $m_{P_1,P_2} = -\frac{2}{3}$, $m_{P_2,P_3} = \frac{3}{2}$ Lines are perpendicular therefore its a right triangle.
2.4 Circles	
1. Identify the radius and the centre of the circle. $2x^2 + 2y^2 - 12x + 8y - 24 = 0$	**1.** Centre $(3,-2)$; $r = 5$.
2. Find the standard form of the equation of the circle. Centre at the origin and containing the point $(-2,3)$.	**2.** $x^2 + y^2 = 13$
3. Find the standard form of the equation of the circle. Centre $(-1,3)$ and tangent to the line $y = 2$.	**3.** $(x+1)^2 + (y-3)^2 = 1$

11.3 The Ellipse	
1. Find the equation of the ellipse with vertices at $(\pm 4, 0)$; y-intercepts at ± 1.	**1.** $\frac{x^2}{16} + y^2 = 1$
2. Find the standard form of the equation. Identify centre and vertices and type of conic. $2x^2 + 3y^2 - 8x + 6y + 5 = 0$	**2.** $\frac{(x-2)^2}{3} + \frac{(y+1)^2}{2} = 1$ Centre: $(2, -1)$; Vertices: $(2 \pm \sqrt{3}, -1)$; Ellipse
3. Find the equation of the ellipse. Centre $(1, 2)$; vertex at $(4, 2)$; contains the point $(1, 3)$.	**3.** $\frac{(x-1)^2}{9} + (y-2)^2 = 1$
11.4 The Hyperbola	
1. Find the standard form of the equation of the hyperbola. Vertices $(-4, 0)$ and $(4, 0)$; Asymptote the line $y = 2x$.	**1.** $\frac{x^2}{16} - \frac{y^2}{64} = 1$
2. Find the standard form of the equation of the hyperbola. Vertices $(-1, -1)$ and $(3, -1)$; Asymptote the line $y + 1 = \frac{3}{2}(x - 1)$.	**2.** $\frac{(x-1)^2}{4} - \frac{(y+1)^2}{9} = 1$
3. Find the standard form of the equation of the hyperbola and identify the equation of the asymptotes. Write your answer in slope-intercept form. $y^2 - 4x^2 - 4y - 8x - 4 = 0$	**3.** $\frac{(y-2)^2}{4} - (x+1)^2 = 1$ $y = 2x + 4$ $y = -2x$
3.1 Functions	
1. Find $f(x+h)$ given $f(x) = \frac{x}{x^2 + 1}$.	**1.** $\frac{x+h}{x^2 + 2xh + h^2 + 1}$

2. Evaluate the difference quotient for the function. $f(x) = x^2 - x + 4$ **3.** Evaluate the difference quotient for the function. $f(x) = \dfrac{1}{x+3}$	**2.** $2x + \Delta x - 1$ **3.** $\dfrac{-1}{(x + \Delta x + 3)(x+3)}$
3.2 Graphs of Functions	
1. Find *a* so that $(-1, 2)$ is on the graph of $f(x) = ax^2 + 4$. **2.** Consider the function $f(x) = \dfrac{x+2}{x-6}$. **a.** Is the point $(3, 14)$ on the graph of *f*? **b.** If $x = 4$ what is $f(x)$? What point is on the graph of *f*? **c.** If $f(x) = 2$, what is *x*? What point(s) are on the graph of *f*? **d.** What is the domain of *f*? Write your answer in set-builder notation. **e.** List the coordinate(s) of the *x*-intercept(s). **f.** List the coordinate of the *y*-intercept.	**1.** $a = -2$ **2.** **a.** No. **b.** $f(4) = -3$; $(4, -3)$ **c.** 14; $(14, 2)$ **d.** $\{x \mid x \neq 6\}$ **e.** $(-2, 0)$ **f.** $\left(0, -\dfrac{1}{3}\right)$
3.3 Properties of Functions	
1. Determine algebraically whether the function is even, odd or neither. $h(x) = -\dfrac{x^3}{3x^2 - 9}$ **2.** Determine algebraically whether the function is even, odd or neither.	**1.** Odd. **2.** Odd.

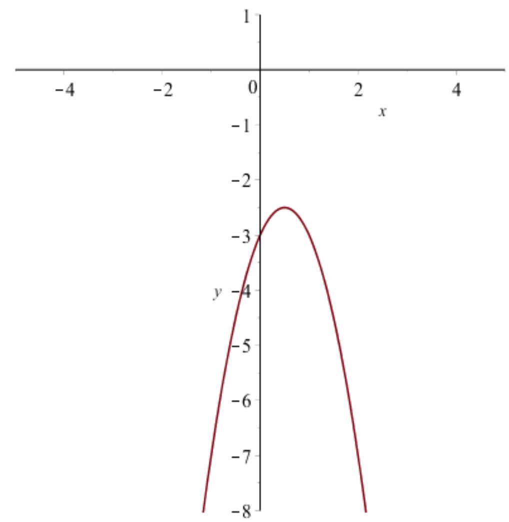
$F(x) = \frac{2x}{\lvert x \rvert}$ **3.** Express the slope of the secant line in terms of x and Δx for the function. That is, evaluate the difference quotient for the function. $f(x) = \frac{1}{x^2}$	**3.** $\frac{-2x - \Delta x}{(x + \Delta x)^2 x^2}$
3.4 Library of Functions	
1. Sketch the graph of the function. $f(x) = \begin{cases} x^2 & , x < 0 \\ 2 & , x = 0 \\ 2x + 1 & , x > 0 \end{cases}$	**2.** 
2. Consider the function. $f(x) = \begin{cases} 2x - 4 & , -1 \le x \le 2 \\ x^3 - 2 & , 2 < x \le 3 \end{cases}$ find: **a.** $f(0)$ **b.** $f(1)$ **c.** $f(2)$ **d.** $f(3)$ **3.**	**2.** **a.** -4 **b.** -2 **c.** 0 **d.** 25

If $f(x) = int(2x)$, find **a.** $f(1.2)$ **b.** $f(1.6)$ **c.** $f(-1.8)$	**3.** **a.** 2 **b.** 3 **c.** -4
3.5 Transformations	
1. Suppose that the *x*-intercepts of the graph of $y = f(x)$ are -2, 1, and 5. The *x*-intercepts of $y = f(x+3)$ are?	**1.** $(-5,0), (-2,0), (2,0)$
2. Find the function that is finally graphed after the following transformations are applied to the graph of $y = \sqrt{x}$. (1) Reflected about the *x*-axis. (2) Shifted up 2 units. (3) Shifted left 3 units.	**2.** $y = -\sqrt{x+3} + 2$
3. Graph the function using transformations. Start with the graph of the basic function and show all stages. $h(x) = \sqrt{-x} - 2$	**3.** 

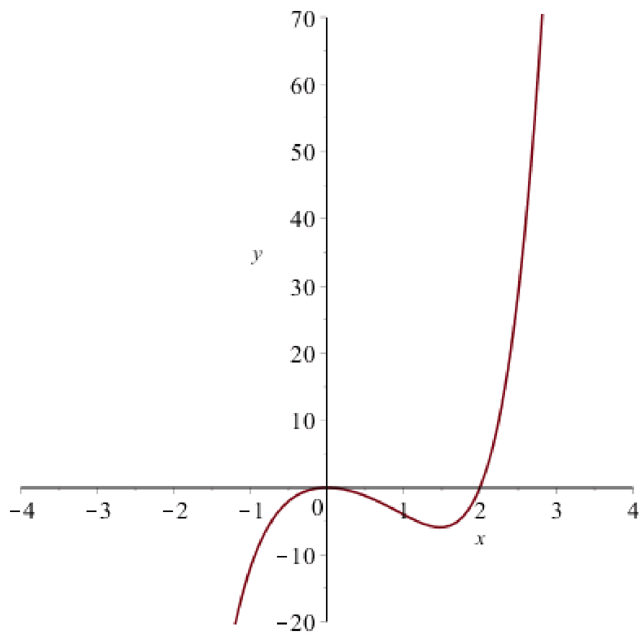
3.6 Building Functions	
1. A rectangle is inscribed in a circle of radius 2 centred at the origin. Let $P=(x,y)$ be the point in quadrant I that is a vertex of the rectangle and is on the circle.	**1.**
a. Express the area *A* of the rectangle as a function of *x*.	**a.** $A(x)=4x\sqrt{4-x^2}$
b. Express the perimeter *P* as a function of *x*.	**b.** $p(x)=4x+4\sqrt{4-x^2}$
2. A wire 10 meters long is to be cut into two pieces. One piece will be shaped as a square, and the other piece will be shaped as a circle.	**2.**
a. Express the total area *A* enclosed by the pieces of wire as a function of the length *x* of a side of the square.	**a.** $A(x)=x^2+\pi\left(\frac{5-2x}{\pi}\right)^2$ $=x^2+\frac{25-20x+4x^2}{\pi}$
b. What is the domain of *A*?	**b.** $\left\{x \mid 0<x<\frac{5}{2}\right\}$
3. Inscribe a right circular cylinder of height *h* and radius *r* in a sphere of fixed radius *R*. Express the volume *V* of the cylinder as a function of *h*.	**3.** $V(h)=\pi h\left(R^2-\frac{h^2}{4}\right)$

4.1 Linear Functions	
1. The cost *C,* in dollars, of renting a moving truck for a day is given by the function $C(x)=0.25x+35$, where *x* is the number of miles driven.	**1.**
a. What is the cost if you drive 40 miles?	**a.** \$45
b. If the cost of renting the moving truck is \$80, how	**b.** 180 mi

many miles did you drive? **c.** Suppose you want the cost to be no more than \$100. What is the maximum number of miles that you can drive?	**c.** 260 mi
2. Suppose that the quantity supplied S and the quantity demanded D of T-shirts at a concert are given by the following functions: $S(p) = -200 + 50p$ $D(p) = 1000 - 25p$ where p is the price of a T-shirt.	**2.**
a. Find the equilibrium price for T-shirts at this concert. What is the equilibrium quantity?	**a.** \$16; 600 T-shirts
b. Determine the prices for which quantity demanded is greater than quantity supplied.	**b.** $0 < p < 16$
3. *The point at which a company's profits equal zero is called the company's* ***break even point.*** *Let R represent a company's revenue, let C represent the company's costs,and let x represent the number of units produces and sold each day.* $R(x) = 8x$ $C(x) = \frac{9}{2}x + 17500$	**3.**
a. Find the firms break even point.	**a.** $x = 5000$
b. Find the values of x such that $R(x) > C(x)$.	**b.** $x > 5000$

<table>
<tr><th colspan="2">4.3 Quadratic Functions and Their Properties</th></tr>
<tr><td>1.
a.
Graph the function by determining whether its graph opens up or down and by finding its vertices, y-intercept, and x-intercepts.
$f(x) = -2x^2 + 2x - 3$</td><td>47.
a.
Vertex: $\left(\frac{1}{2}, -\frac{5}{2}\right)$ y-intercept: $(0, -3)$

</td></tr>
<tr><td>b.
Determine the domain and rang of the function.</td><td>b. Domain: $(-\infty, \infty)$
Range: $\left(-\infty, -\frac{5}{2}\right]$</td></tr>
<tr><td>c.
Determine where the function is increasing and where it is decreasing.</td><td>c.
Increasing: $\left(-\infty, \frac{1}{2}\right)$ Decreasing: $\left(\frac{1}{2}, \infty\right)$</td></tr>
<tr><td>2.
The graph of the function $f(x) = ax^2 + bx + c$ has vertex at $(0, 2)$ and passes through the point $(1, 8)$. Find a, b, and c.</td><td>2.
$a = 6,\ b = 0,\ c = 2$</td></tr>
<tr><td>3.
Suppose that a manufacture of a gas cloths dryer has found that, when the unit price is p dollars, the revenue R (in dollars) is
$R(p) = -4p^2 + 4000p$.
What unit price p should be charged to maximize revenue? What is the maximum revenue?</td><td>3.
$500; $1000000</td></tr>
<tr><th colspan="2">4.4 Quadratic Models</th></tr>
<tr><td>1.
The price p (in dollars) and the quantity x sold of a certain product obey the demand equation</td><td>1.
$10</td></tr>
</table>

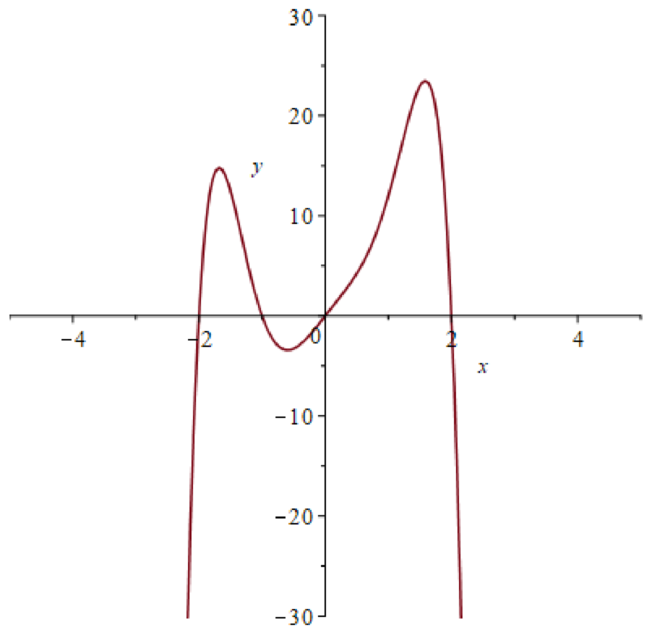
$x = -5p + 100, \quad 0 \le p \le 20$ What price should the company charge to maximize the revenue?	
2. A rain gutter is to be made of aluminum sheets that are 12 inches wide by turning up the edges 90°. What depth will provide maximum cross-sectional area and hence allow the most water to flow?	**2.** 3 in.
3. A track and field playing area is in the shape of a rectangle with semicircles at each end. The inside perimeter of the track is to be 1500 meters. What should the dimensions of the rectangle be so that the area of the rectangle is a maximum?	**3.** $\frac{750}{\pi} m \times 375 m$
4.5 Inequalities Involving Quadratic Functions	
1. What is the domain of the function. Write your answer in interval notation. $f(x) = \sqrt{x^2 - 16}$	**1.** $(-\infty, -4] \cup [4, \infty)$
2. Solve $f(x) > g(x)$. $f(x) = x^2 - x - 2$ $g(x) = x^2 + x - 2$	**2.** $(-\infty, 0)$
5.1 Polynomial Functions	
1. Form a polynomial function whose real zeros and degree are given. Answers may vary. Zeros: -3, 0, 4; degree 3	**1.** $f(x) = x(x+3)(x-4)$
2. Consider the function: $f(x) = -2x^2(x^2 - 2)$	**2.**
a-c. List each real zero along with its multiplicity. Does the graph touch or cross the *x*-axis at each real zero	**a-c.** $x = 0$ **:**multiplicity 2; touch $x = \pm\sqrt{2}$:multiplicity 1; cross
d. Determine the number of turning points on the graph.	**d.** At most 3.

e. Determine the leading term of the function and describe the end behavior.	**e.** $-2x^4$ The graph will look similar to a downwards facing parabola.
3. Consider the function: $f(x) = x^2(x-2)(x^2+3)$	**3.**
a. Find the coordinates of the x and y-intercepts.	**a.** $(0,0)$, $(2,0)$
b. Determine whether the graph of f crosses or touches the x-axis at each x-intercept.	**b.** $x = 0$: multiplicity 2; touch $x = 2$: multiplicity 1; cross
c. Find the leading term and determine the end behavior.	**c.** x^5 The graph will look similar to a cubic.
d. Determine the number of turning points on the graph of f.	**d.** At most 4.
f. Put all the information together to obtain the graph of f.	**f.** 

5.2 Graphing Polynomial Functions; Models

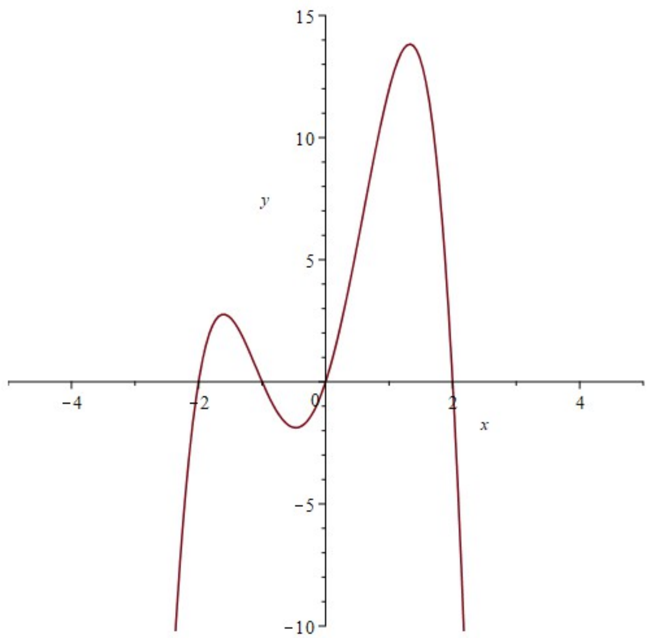
1.
Use the graphing steps to sketch the polynomial function $f(x) = -2x(x^3 + 1)(x^2 - 4)$.

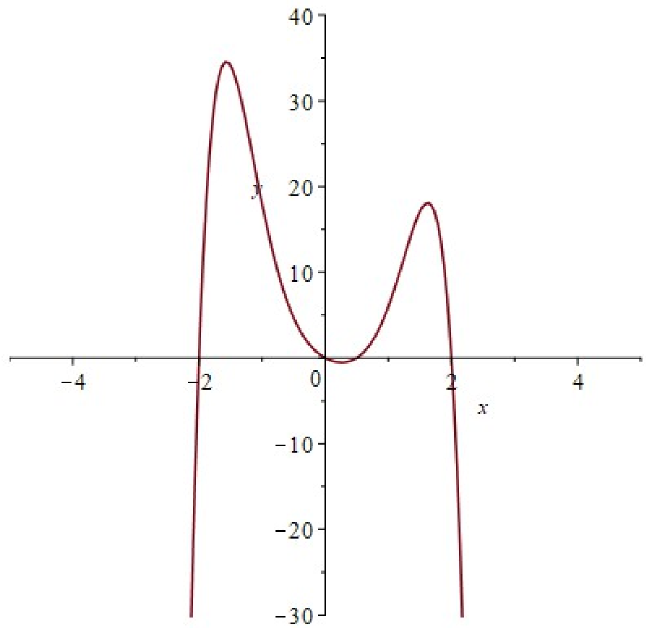
1.

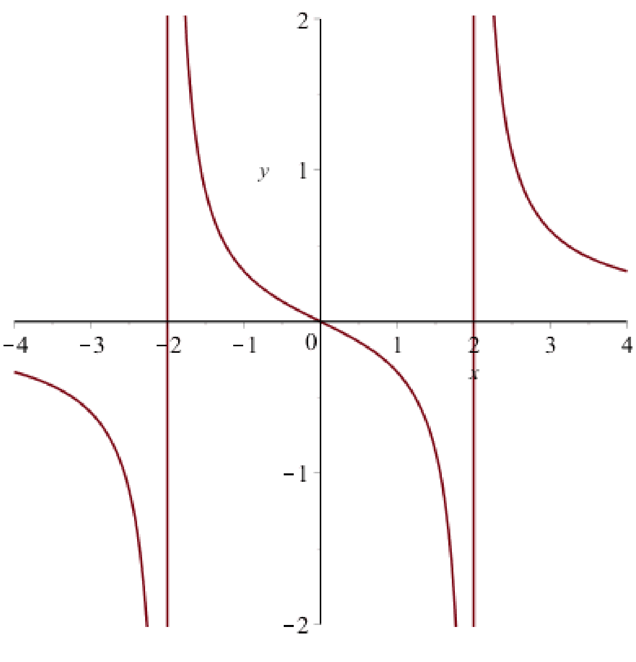


2.
Use the graphing steps to sketch the polynomial function $f(x) = 2x(x + 1)(4 - x^2)$.

2.



3. Use the graphing steps to sketch the polynomial function $f(x) = x(x^2+1)(4-x^2)(2x-1)$	**3.** 
5.3 Properties of Rational Functions	
1. Find the domain of the rational function. Write your answer in set-builder notation. $R(x) = \dfrac{3(x^2-x-6)}{4(x^2-9)}$	**1.** $\{x \mid x \neq \pm 3\}$
2. Find the equations of the vertical, horizontal and oblique asymptotes, if any, of the function. $T(x) = \dfrac{x^3}{x^4-1}$	**2.** Vertical asymptotes: $x = \pm 1$ Horizontal asymptote: $y = 0$
3. Find the equations of the vertical, horizontal and oblique asymptotes, if any, of the function. $R(x) = \dfrac{3x^4+4}{x^3+3x}$	**3.** Vertical asymptote: $x = 0$ Obliques asymptote: $y = 3x$

5.4 The Graph of a Rational Function	
1. Consider the function: $G(x) = \dfrac{x}{x^2 - 4}$	**1.**
a. Find the coordinates of the *x* and *y*-intercepts.	**a.** $(0,0)$
b. List the real zeros of the function along with its multiplicity. Does the graph cross or touch the *x*-axis at each real zero?	**b.** $x = 0$ multiplicity 1; cross
c. Find the equations of the vertical, horizontal and oblique asymptotes. Does the graph of the function intersect the asymptote(s)?	**c.** Vertical asymptotes: $x = \pm 2$ Horizontal asymptote: $y = 0$; intersected at $(0,0)$
d. Find the coordinate of the hole.	**d.** No hole.
e. Construct a sign table to determine where the graph is above or below the *x*-axis.	**e.** $-\infty \quad -2 \quad 0 \quad 2 \quad \infty$ - + - +
f. Put all the information together to obtain the graph of *G*.	**f.** 
2.	**2.**

Consider the function.

$$R(x) = \frac{x^2 + x - 12}{x^2 - x - 6}$$

a.
Find the coordinates of the x and y-intercepts.

b.
List the real zeros of the function. Does the graph cross or touch the x-axis at each real zero?

c.
Find the equations of the vertical, horizontal and oblique asymptotes. Does the graph of the function intersect the asymptote(s)?

d.
Find the coordinate of the hole.

e.
Construct a sign table to determine where the graph is above or below the x-axis.

f.
Put all the information together to obtain the graph of R.

a.
$(-4,0)$, $(0,2)$

b.

$x = -4$: multiplicity 1; cross

c.
Vertical asymptote: $x = -2$

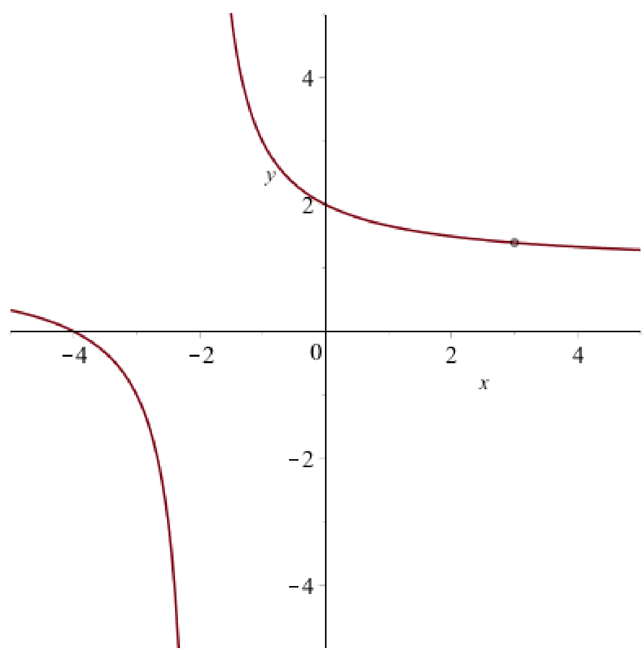
Horizontal asymptote: $y = 1$; Not intersected.

d.
$\left(3, \frac{7}{5}\right)$

e.

$-\infty$	-4	-2	3	∞
+	-	+	+	

f.



3.
Consider the function.

3.

$f(x) = x + \dfrac{1}{x}$

a.
Find the coordinates of the x and y-intercepts.

b.
List the real zeros of the function. Does the graph cross or touch the x-axis at each real zero?

c.
Find the equations of the vertical, horizontal and oblique asymptotes.

d.
Find the coordinate of the hole.

e.
Construct a sign table to determine where the graph is above or below the x-axis.

f.
Put all the information together to obtain the graph of R.

a.
No intercepts.

b.
No zeros.

c.
Vertical asymptote: $x = 0$
Oblique asymptote: $y = x$; Not intersected

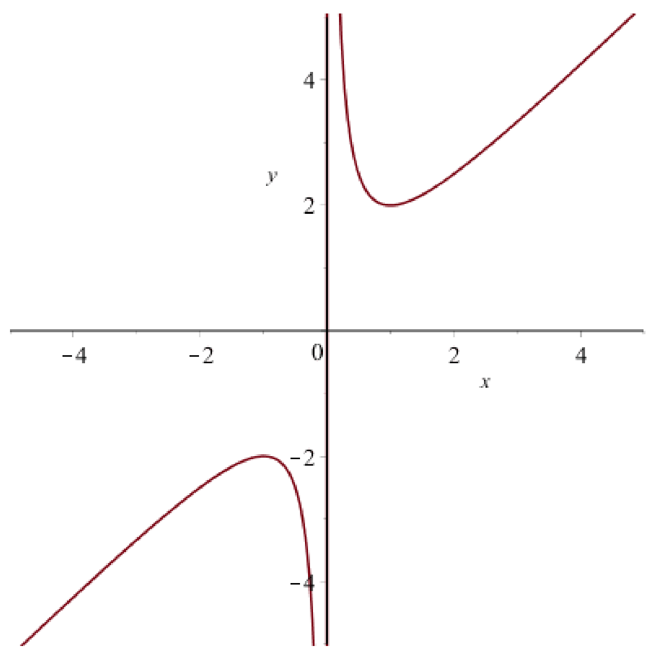
d.
No holes.

e.

$-\infty$		0		∞
	-		+	

.

f.



<table>
<tr><th colspan="2">5.5 Polynomial and Rational Inequalities</th></tr>
<tr><td>1.
Solve the inequality. Write your answer in interval notation.

$\frac{(x-2)^2}{x^2-1} \geqslant 0$</td><td>1.

$(-\infty,-1)\cup(1,\infty)$</td></tr>
<tr><td>2.
Solve the inequality. Write your answer in set-builder notation.

$\frac{1}{x-2} < \frac{2}{3x-9}$</td><td>2.

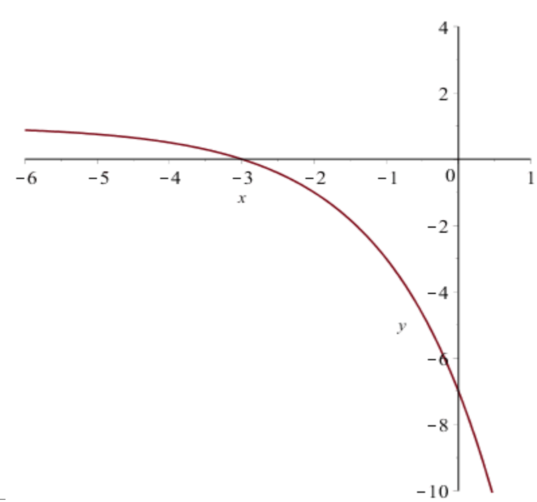
$\{x \mid x < 2 \text{ and } 3 < x < 5\}$</td></tr>
<tr><td>3.
What is the domain of the function. Write your answer in interval notation.

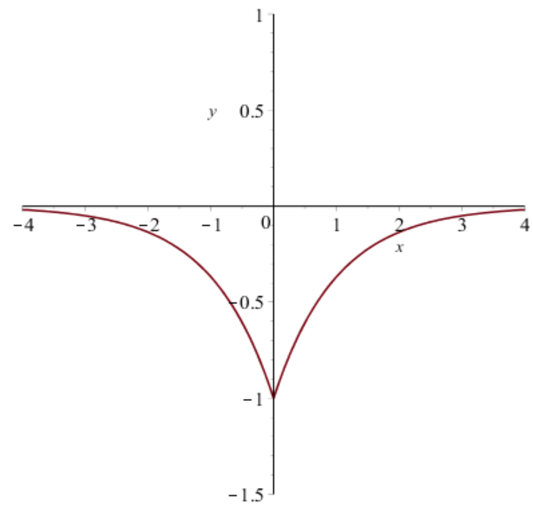
$f(x) = \sqrt{\frac{x-2}{x+4}}$</td><td>3.

$(-\infty,-4)\cup[2,\infty)$</td></tr>
<tr><th colspan="2">5.6 The Real Zeros of a Polynomial Function</th></tr>
<tr><td>1.
Use the Factor Theorem to determine whether $x-\frac{1}{2}$ is a factor of $f(x) = 2x^4 - x^3 + 2x - 1$.</td><td>1.

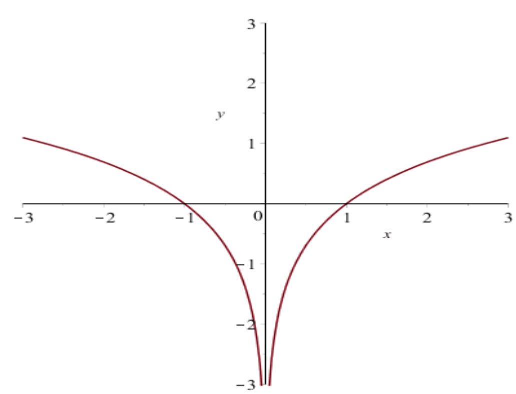
yes</td></tr>
<tr><td>2.
Factor completely.
$f(x) = 2x^3 - 4x^2 - 10x + 20$</td><td>2.
$f(x) = 2(x-2)(x-\sqrt{5})(x+\sqrt{5})$</td></tr>
<tr><td>3.
Solve.
$2x^4 - 19x^3 + 57x^2 - 64x + 20 = 0$</td><td>3.
$\left\{\frac{1}{2}, 2, 5\right\}$</td></tr>
<tr><th colspan="2">6.1 Composite Functions</th></tr>
<tr><td>1.
State the domain of the composite function $f \circ g$. Write your answer in set-builder notation.
$f(x) = x^2 + 1;\ \ g(x) = \sqrt{x-1}$</td><td>1.
$\{x \mid x \geqslant 1\}$</td></tr>
<tr><td>2.
Find functions f and g so that $f \circ g = H$.

$H(x) = \left|2x^2 + 3\right|$</td><td>2.
$f(x) = |x|$
$g(x) = 2x^2 + 3$</td></tr>
</table>

3. Express the volume V of a right circular cone as a function of the radius r if the height is twice the radius.	**3.** $V(r) = \frac{2}{3}\pi r^3$
6.2 Inverse Functions	
1. Verify that f and g are inverses of each other by verifying the condition $f(g(x)) = x$ **.** Note: technically you would also need to check $g(f(x)) = x$. $f(x) = \frac{2x+3}{x+4};\ \ g(x) = \frac{4x-3}{2-x}$	**1.** $f(g(x))$ $= f\left(\frac{4x-3}{2-x}\right)$ $= \frac{2\left(\frac{4x-3}{2-x}\right)+3}{\frac{4x-3}{2-x}+4}$ $= \frac{2(4x\ \ 3)+3(2-x)}{4x-3+(2-x)}$ $= \frac{5x}{5}$ $= x$
2. The function $f(x) = \frac{1}{x-2}$ is one-to-one. Find its inverse.	**2.** $f^{-1}(x) = \frac{2x+1}{x}$
3. The function $f(x) = \frac{2x+3}{x+2}$ is one-to-one. Find its inverse.	**3.** $f^{-1}(x) = \frac{-2x+3}{x-2}$
6.3 Exponential Functions	
1. Use transformations to graph the function. $f(x) = 1 - 2^{x+3}$	**1.** 

2. Solve. $4^x \cdot 2^{x^2} = 16^2$	**2.** $\{-4, 2\}$
3. Sketch the graph of the function. $f(x) = \begin{cases} -e^x & x < 0 \\ -e^{-x} & x \geqslant 0 \end{cases}$	**3.** 

6.4 Logarithmic Functions

1. Find the exact value. $\ln\sqrt{e}$	**1.** $\frac{1}{2}$
2. Solve the equation. $\log_2 8^x = -3$	**2.** -1
3. Graph the function. $f(x) = \begin{cases} \ln(-x) & x < 0 \\ \ln x & x > 0 \end{cases}$	**3.** 

6.5 Properties of Logarithmic Functions	
1. Write as a sum and/or difference of logarithms. $\ln \frac{5x\sqrt{1+3x}}{(x-4)^3}$	**1.** $\ln 5 + \ln x + \frac{1}{2}\ln(1+3x) - 3\ln(x-4)$
2. Write the expression as a single logarithm. $\ln\left(\frac{x}{x-1}\right) + \ln\left(\frac{x+1}{x}\right) - \ln(x^2-1)$	**2.** $-\ln(x-1)^2$
3. Find the value of $\log_2 3 \log_3 4 \log_4 5 \log_5 6 \log_6 7 \log_7 8$	**3.** 3

6.6 Logarithmic and Exponential Equations	
1. Solve. $2^{2x} + 2^x - 12 = 0$	**1.** $\left\{\frac{\ln 3}{\ln 2}\right\}$
2. Solve. $\log_2(x+1) - \log_4 x = 1$	**2.** 1
3. Solve. $\frac{e^x + e^{-x}}{2} = 1$	**3.** 0

6.7 Compound Interest	
1. Find the principal needed now to get \$1000 after 2 ½ years at 6% compounded daily. [*Decimals O.K.*]	**1.** \$860.72
2.	**2.**

If Tanisha has \$100 to invest at 8% per annum compounded monthly, how long will it be before she has \$150? [*Decimals O.K.*]	5.09 years
3. Jerome will be buying a used car for \$15000 in 3 years. How much money should he ask his parents for now so that, if he invests it at 5% compounded continuously, he will have enough to buy the car. [*Decimals O.K.*]	**3.** \$12910.62
6.8 Exponential Growth and Decay Models	
1. The population of a southern city follows the exponential law. If the population doubled in size over an 18-month period and the current population is 10000, what will the population be 2 years from now.	**1.** 25198
2. The half-life of radium is 1690 years. If 10 grams are present now, how much will be present in 100 years? [*Decimals O.K.*]	**2.** 9.598 g
3. The logistic growth model $P(t) = \dfrac{1000}{1 + 32.33\,e^{-0.439\,t}}$ represents the population (in grams) of a bacterium after *t* hours. How long does it take for the population to reach one half the carrying capacity? [*Decimals O.K.*]	**3.** 7.917 hr.
7.1 Angles and Their Measure	
1. Convert the angle in radians to degrees. $\dfrac{\pi}{12}$	**1.** 15°
2. Find the area of the sector of the circle of radius $r = 2$ inches, formed by a central angle $\theta = 30^{\circ}$.	**2.** $\dfrac{\pi}{3}$
3. The minute hand of a clock is 6 inches long. How far does the tip of the minute hand move in 15 minutes?	**3.** 3π

7.2 Right Triangle Trig I	
1. Find the exact value of each of the remaining five trigonometric functions of the acute angle θ . $\csc\theta = 2$	**1.** $\sin\theta = \frac{1}{2}$; $\cos\theta = \frac{\sqrt{3}}{2}$; $\tan\theta = \frac{1}{\sqrt{3}}$ $\sec\theta = \frac{2}{\sqrt{3}}$; $\cot\theta = \sqrt{3}$
2. Find the exact value of the expression. $\sin 38^\circ - \cos 52^\circ$	**2.** 0
3. Given $\tan\theta = 4$, find the exact value of **a.** $\sec^2\theta$ **b.** $\cot\theta$ **c.** $\cot\left(\frac{\pi}{2} - \theta\right)$ **d.** $\csc^2\theta$	**3.** **a.** 17 **b.** 1/4 **c.** 4 **d.** 17/16
7.3 Computing Values of Trig Functions of Acute Angles	
1. Find the exact value of the expression if $\theta = 60^\circ$ and $f(\theta) = \sin\theta$. $\frac{f(\theta)}{2}$	**1.** $\frac{\sqrt{3}}{4}$
2. Find the exact value of the expression. $\sec\frac{\pi}{4} + 2\csc\frac{\pi}{3}$	**2.** $\sqrt{2} + \frac{4}{\sqrt{3}}$
3. Find the exact value of the expression. $1 - \cos^2 30^\circ - \cos^2 60^\circ$	**3.** 0
7.4 Trig Functions of Any Angle	
1. A point on the terminal side of an angle θ is given. Find the exact value of each of the six	**1.**

trigonometric functions of θ . $\left(\frac{\sqrt{3}}{2}, \frac{1}{2}\right)$ **2.** Find the exact value of the expression. $\tan(21\pi)$ **3.** Find the exact value of $\sin 40^\circ + \sin 130^\circ + \sin 220^\circ + \sin 310^\circ$	$\sin\theta = \frac{1}{2}$; $\cos\theta = \frac{\sqrt{3}}{2}$; $\tan\theta = \frac{1}{\sqrt{3}}$ $\csc\theta = 2$; $\sec\theta = \frac{2}{\sqrt{3}} = \cot\theta = \sqrt{3}$ **2.** 0 **3.** 0
7.5 Unit Circle Approach	
1. Find the exact value of the expression. $\sec\frac{17\pi}{4}$ **2.** Find the exact value of the expression. $\sin\left(-\frac{9\pi}{4}\right) - \tan\left(-\frac{9\pi}{4}\right)$ **3.** If $f(x) = \tan x$ and $f(a) = 2$, find the exact value of: **a.** $f(-a)$ **b.** $f(a) + f(a+\pi) + f(a+2\pi)$	**1.** $\sqrt{2}$ **1.** $1 - \frac{1}{\sqrt{2}}$ **3.** **a.** -2 **b.** 6
7.6 Graphs of the Sine and Cosine Functions	
1. Determine the amplitude and the period of the function. $y = \frac{5}{3}\sin\left(-\frac{2\pi}{3}x\right)$	**1.** Amplitude: 5/3 Period: 3

2.

Graph the function. Be sure to lable the key points and show exactly 2 periods.

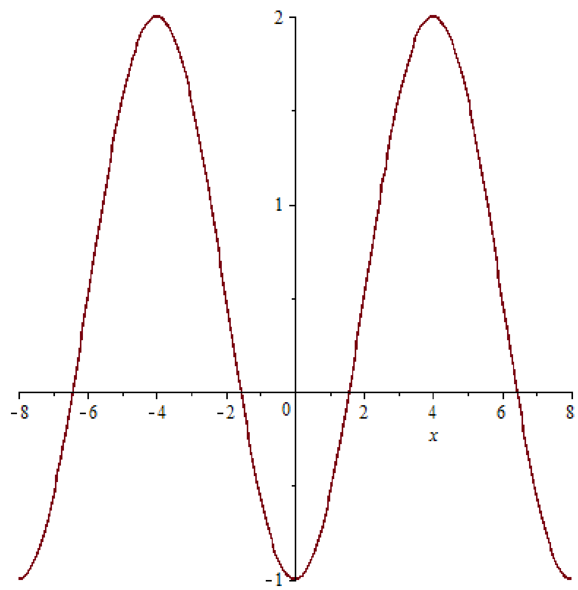
$$y = -\frac{3}{2}\cos\left(\frac{\pi}{4}x\right) + \frac{1}{2}$$

3.

Find $(f \circ g)(x)$ and $(g \circ f)(x)$ and graph each function. Show exactly one period.

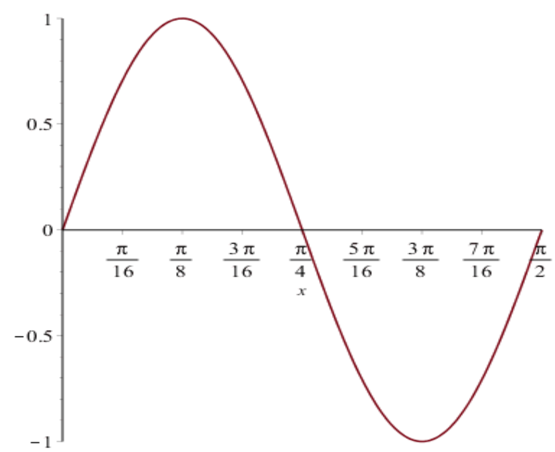
$$f(x) = \sin x; \;\; g(x) = 4x$$

2.

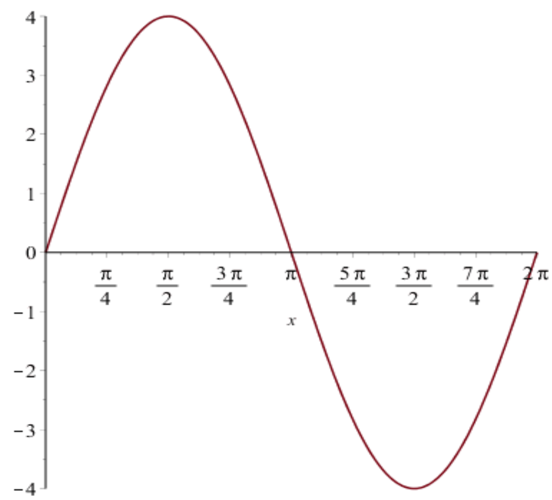


3.

$(f \circ g)(x) = \sin(4x)$



$(g \circ f)(x) = 4\sin x$



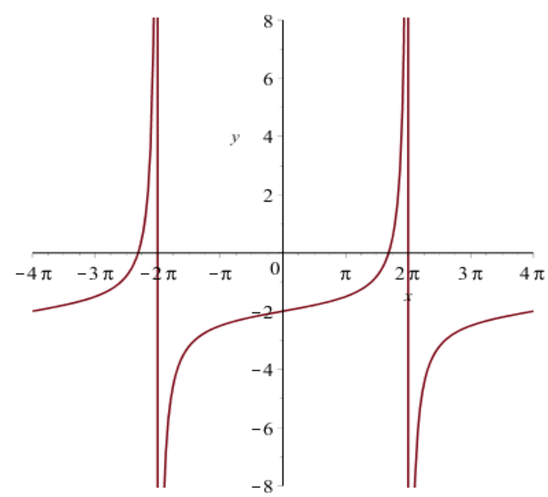
7.7 Graphs of Tangent, Cotangent, Secant, Cosecant

1.
Graph the function. Be sure to lable the key points and show exactly two periods.

$$y = \frac{1}{2}\tan\left(\frac{1}{4}x\right) - 2$$

2.
Graph the function. Be sure to lable the key points and show exactly two periods.

1.



<table>
<tr><td>

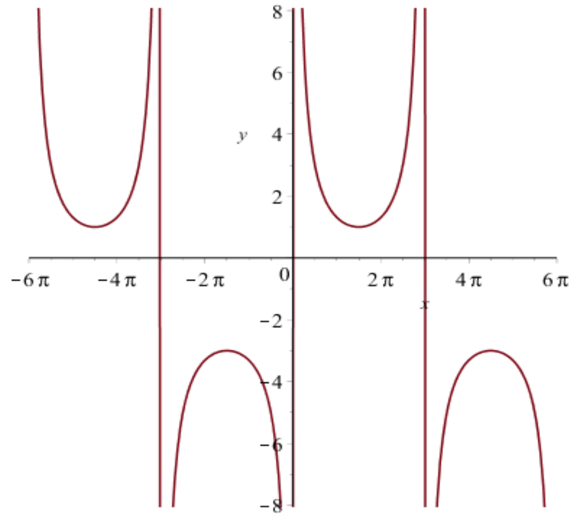
$$y = 2\csc\left(\frac{1}{3}x\right) - 1$$

3.
Find the average rate of change of *f* from 0 to $\frac{\pi}{6}$.

$$f(x) = \tan(2x)$$

</td><td>

2.



3.

$$\frac{6\sqrt{3}}{\pi}$$

</td></tr>
<tr><td colspan="2">

7.8 Phase Shift; Sinusoidal Curve Fitting

</td></tr>
<tr><td>

1.
Find the amplitude, period, and phase/horizontal shift of the function.

$$y = 4\sin(\pi x + 2) - 5$$

2.
Write the equation of a sine function that has the given characteristics.

Amplitude: 3
Period: 3π
Phase/Horizontal Shift: -1/3

3.

</td><td>

1.
Amplitude: 4
Period: 2
Phase Shift: $-\frac{2}{\pi}$

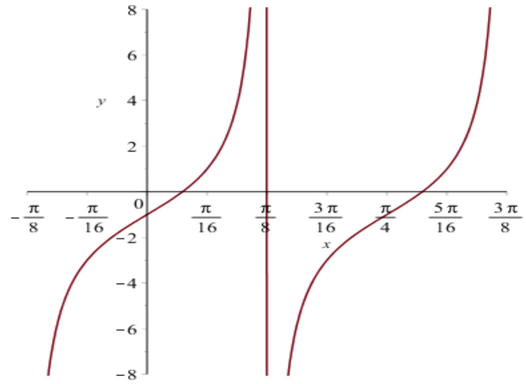
2.

$$y = 3\sin\left(\frac{2}{3}x + \frac{2}{9}\right)$$

3.

</td></tr>
</table>

<table>
<tr><td>Graph the function. Be sure to lable the key points and show exactly 2 periods.

$y = 2\tan(4x - \pi)$</td><td>
</td></tr>
<tr><td colspan="2">8.1 Inverse Sine, Cosine and Tangent Functions</td></tr>
<tr><td>1.
Find the exact value.

$\sin^{-1}\left(\sin\frac{9\pi}{8}\right)$

2.
Find the exact value.

$\cos\left(\cos^{-1}\left(-\frac{2}{3}\right)\right)$

3.
Find the exact solution.

$3\tan^{-1}x = \pi$</td><td>1.

$-\frac{\pi}{8}$

2.

-2/3

3.

$\sqrt{3}$</td></tr>
<tr><td colspan="2">8.2 Inverse Trig Functions II</td></tr>
<tr><td>1.
Find the exact value of the expression.

$\cos\left(\sin^{-1}\frac{\sqrt{2}}{2}\right)$

2.
Find the exact value of the expression.

$\sec\left(\tan^{-1}\frac{1}{2}\right)$

3.</td><td>1.

$\frac{1}{\sqrt{2}}$

2.

$\frac{\sqrt{5}}{2}$

3.</td></tr>
</table>

Write the trigonometric expression as an algebraic expression in *u*. $\cos\left(\tan^{-1}u\right)$	$\dfrac{1}{\sqrt{1+u^2}}$
8.3 Trig Equations	
1. Solve the equation on the interval $0 \leqslant \theta < 2\pi$. $\cos\left(2\theta - \dfrac{\pi}{2}\right) = -1$ **2.** Solve the equation. $\cos\left(2\theta\right) = -\dfrac{1}{2}$ **3.** Solve the equation on the interval $0 \leqslant \theta < 2\pi$. $\sin^2\theta - \cos^2\theta = 1 + \cos\theta$	**1.** $\left\{\dfrac{3\pi}{4}, \dfrac{7\pi}{4}\right\}$ **2.** $\theta = \dfrac{\pi}{3} + k\pi, \;\; \theta = \dfrac{2\pi}{3} + \; k\pi$ **3.** $\left\{\dfrac{\pi}{2}, \dfrac{2\pi}{3}, \dfrac{4\pi}{3}, \dfrac{3\pi}{2}\right\}$
8.4 Trigonometric Identities	
1. Establish the identity. $\dfrac{1+\sin\theta}{1-\sin\theta} = \dfrac{\csc\theta + 1}{\csc\theta - 1}$ **2.** Establish the identity.	**1.** $\dfrac{\csc\theta + 1}{\csc\theta - 1} = \dfrac{\dfrac{1}{\sin\theta} + 1}{\dfrac{1}{\sin\theta} - 1} =$ $\dfrac{\dfrac{1+\sin\theta}{\sin\theta}}{\dfrac{1-\sin\theta}{\sin\theta}} = \dfrac{1+\sin\theta}{1-\sin\theta}$ **2.**

$\dfrac{\cos^2\theta - \sin^2\theta}{1 - \tan^2\theta} = \cos^2\theta$	$\dfrac{\cos^2\theta - \sin^2\theta}{1 - \tan^2\theta} = \dfrac{\cos^2\theta - \sin^2\theta}{1 - \dfrac{\sin^2\theta}{\cos^2\theta}} =$ $\dfrac{\cos^2\theta - \sin^2\theta}{\left(\dfrac{\cos^2\theta - \sin^2\theta}{\cos^2\theta}\right)} = \cos^2\theta$
3. Establish the identity. $\ln\lvert\sec\theta + \tan\theta\rvert + \ln\lvert\sec\theta - \tan\theta\rvert = 0$	**3.** $\ln\lvert\sec\theta + \tan\theta\rvert + \ln\lvert\sec\theta - \tan\theta\rvert =$ $\ln\lvert(\sec\theta + \tan\theta)(\sec\theta - \tan\theta)\rvert =$ $\ln\lvert\sec^2\theta - \tan^2\theta\rvert =$ $\ln\lvert 1\rvert = 0$
8.5 Sum and Difference Formulas	
1. Find the exact value. $\cos\dfrac{7\pi}{12}$	**1.** $\dfrac{1}{4}(\sqrt{2} - \sqrt{6})$
2. Establish the identity. $\dfrac{\cos(\alpha + \beta)}{\cos\alpha\cos\beta} = 1 - \tan\alpha\tan\beta$	**2.** $\dfrac{\cos(\alpha + \beta)}{\cos\alpha\cos\beta} = \dfrac{\cos\alpha\cos\beta - \sin\alpha\sin\beta}{\cos\alpha\cos\beta} =$ $\dfrac{\cos\alpha\cos\beta}{\cos\alpha\cos\beta} - \dfrac{\sin\alpha\sin\beta}{\cos\alpha\cos\beta} =$ $1 - \tan\alpha\tan\beta$
3. Find the exact value. $\cos\left(\tan^{-1}\dfrac{4}{3} + \cos^{-1}\dfrac{5}{13}\right)$	**3.** $-\dfrac{33}{65}$
8.6 Double-angle and Half-angle Formulas	
1. Find the exact value of the expression. $\tan\dfrac{7\pi}{8}$	**1.** $1 - \sqrt{2}$
2. Establish the identity.	**2.**

$\cos^4\theta - \sin^4\theta = \cos(2\theta)$ **3.** Find the exact value of the expression. $\sin^2\left(2\cos^{-1}\left(\frac{4}{5}\right)\right)$	$\cos^4\theta - \sin^4\theta =$ $(\cos^2\theta - \sin^2\theta)(\cos^2\theta + \sin^2\theta) = \cos(2\theta)$ **3.** $(\frac{24}{25})^2$
13.1 Sequences	
1. Given that the pattern continues. Write down the *nth* term of the sequence. $1, -1, 1, -1, 1, -1, \cdots$ **2.** Express each sum using summation notation. $\frac{1}{2} + \frac{2}{3} + \frac{3}{4} + \cdots \ \frac{13}{13+1}$ **3.** Find the sum of the sequence. $\sum_{k=1}^{16}(k^2+4)$	**1.** $a_n = (-1)^{n-1}$ **2.** $\sum_{k=1}^{13}\frac{k}{k+1}$ **3.** 1560
13.2 Arithmetic Sequences & Finite Series	
1. Find the *nth* term of the arithmetic sequence whose initial term *a* and common difference *d* are given. What is the fifty-first term? $a_1 = \sqrt{2};\ \ d = \sqrt{2}$ **2.** Find the first term and the common difference of the arithmetic sequence described. Give a recursive formula for the sequence. Find a formula for the *nth* term. 8th term is 8; 20th term is 44 **3.** Find the sum.	**1.** $a_n = \sqrt{2}n;\ \ a_{51} = 51\sqrt{2}$ **2.** recursive formula: $a_1 = -13; a_n = a_{n-1} + 3;$ nth term: $a_n = -16 + 3n$ **3.**

$\sum_{n=1}^{80} (2n-5)$	6080
13.3 Geometric Sequences & Series	
1. Determine whether the given sequence is arithmetic, geometric, or neither. If the sequence is arithmetic, find the common difference; if it is geometric, find the common ratio. $\{4n^2\}$	**1.** Neither.
2. Find the indicated term of each geometric sequence. The 7th term of: $1, \frac{1}{2}, \frac{1}{4}, \cdots$	**2.** $a_7 = \frac{1}{64}$
3. Find the nth term of the geometric sequence. $a_6 = 243;\ r = -3$	**3.** $a_n = -(-3)^{n-1}$