

**Topic – Functions**

**Quiz #1 Review**

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**Composition of functions (Algebraically). For each of the following problems, find (a)  $(f \circ g)(x)$ , (b)  $(g \circ f)(x)$ , and (c)  $(f \circ g)(0)$ .**

9.  $f(x) = x^2$ ;  $g(x) = x - 1$                       10.  $f(x) = \sqrt[3]{x-1}$ ;  $g(x) = x^3 + 1$   
11.  $f(x) = 3x + 5$ ;  $g(x) = 5 - x$                       12.  $f(x) = x^3$ ;  $g(x) = \frac{1}{x}$   
13.  $f(x) = x^2$ ;  $g(x) = \frac{1}{x}$

**Test #1**

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5. Given that  $f(x) = 7x - 3$  and  $g(x) = x^2 - 1$ , what are the following:  
(a)  $g(f(0))$                       (b)  $g(f(x))$
6. Describe the transformation (in words) from function  $p(x)$  to  $q(x)$ .  
(a)  $q(x) = p(2x)$                       (b)  $q(x) = p(2 + x)$                       (c)  
 $q(x) = -3 + \frac{1}{2}p\left(\frac{1}{2}x - 6\right)$
7. What type of function is  $f(x) = a \cdot b^x$  for  $a > 0$  and  $b > 0$ ? Sketch a graph of this function.
8. Find the inverse relation of  $g(x) = \frac{1}{2}x^2 - 7$ . Is this inverse a function?

**Topic – Rational Functions**

**Quiz 1 Review**

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**Add or subtract and simplify**

1.  $\frac{5}{2x} + \frac{2}{3x^2}$                       2.  $\frac{3}{2x} + \frac{x}{2x^2 + 6x}$                       4.  $\frac{12}{x+5} + \frac{5}{x+1}$

Sketch the graph of the following rational functions. Identify the domain, vertical and horizontal asymptotes, end behavior, and  $x$  and  $y$  intercepts.

6.  $f(x) = \frac{3x-1}{2x-3}$                       7.  $g(x) = \frac{x^2+1}{x-1}$                       8.  $h(x) = \frac{x^2+3x-18}{4x}$

**Test #1**

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1. Find all vertical and horizontal asymptotes for the following two functions:

(a)  $f(x) = \frac{3x^2 - 1}{x^2 - 2}$                       (b)  $g(x) = \frac{x + 1}{x^2 + 2}$

2. What are the  $x$  and  $y$  intercepts of  $h(x) = \frac{2x + 12}{x^2 - 6x + 5}$ ?

3. What is the end behavior of  $h(x) = \frac{2x + 12}{x^2 - 6x + 5}$ ?

4. Simplify  $\frac{9x}{x^2 + 4x - 12} - \frac{54}{x^2 + 20x + 84}$ .

**Test Review #6**

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For each of the following functions find the following characteristics:

- |                           |                    |                      |
|---------------------------|--------------------|----------------------|
| (a) vertical asymptotes   | (d) $y$ intercepts | (g) slant asymptotes |
| (b) horizontal asymptotes | (e) holes          | (h) end behavior     |
| (c) $x$ intercepts        | (f) domain         |                      |

4.  $f(x) = \frac{x^2 - 4}{x^2 + 5x - 14}$

6.  $h(x) = \frac{4x^2 - 1}{x^2 + 4}$

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

7.  $i(x) = \frac{2x}{x^2 - 4}$

Decompose each of the following rational functions using partial fractions.

8.  $f(x) = \frac{-4(x + 11)}{x^2 + 2x - 15}$

9.  $g(x) = \frac{3x - 37}{x^2 - 3x - 4}$

**Topics – Vectors, Polar Coordinates, Complex Numbers in Trig Form**

**Test #4**

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4. Given point  $A(3, -6)$  and point  $B(7, 5)$ .

(a) What is the displacement vector from point  $A$  to point  $B$ ? That is, what is  $\overline{AB}$ ?

(b) What are the coordinates of the point  $p$  that is  $\frac{1}{5}$  of the way from  $A$  to  $B$ ?

5. Given  $\vec{a} = -6\vec{i} - 9\vec{j}$  and  $\vec{b} = 12\vec{i} + 7\vec{j}$ .

(a) What is  $\vec{a} \cdot \vec{b}$ ? That is, what is the dot product of  $\vec{a}$  and  $\vec{b}$ ?

(b) What is the angle between  $\vec{a}$  and  $\vec{b}$  when they are placed tail to tail?

(c) If two other vectors say  $\vec{c}$  and  $\vec{d}$  are perpendicular, then what is  $\vec{c} \cdot \vec{d}$ ?

**— Review the Dot Product of Vectors —**

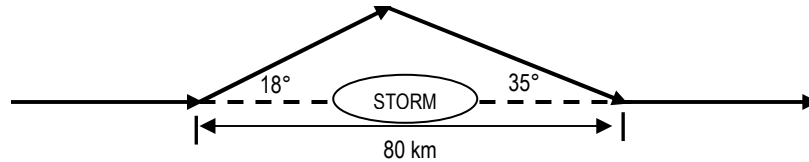
10. What are the components of a vector with a magnitude of 100 and a direction of  $-22.5^\circ$ ?

11. What are the magnitude and direction of  $\vec{w} = -10\vec{i} - 7\vec{j}$ ?

12. In the triangle shown above,  $m\angle A = 35^\circ$ ,  $a = 7$ , and  $c = 10$ . What are all the possible values of  $b$ , the third side of the triangle?

**Detour problem.** Suppose you are the pilot of an airplane. You must detour around a rain storm, as shown in the figure below. You turn your plane at an angle of  $18^\circ$  to your original path, fly for a while, turn, and then rejoin your original path at an angle of  $35^\circ$ , 80 km from where you left it.

13. How much farther did you have to fly because of the detour?  
14. What is the area of the region enclosed by the triangle?



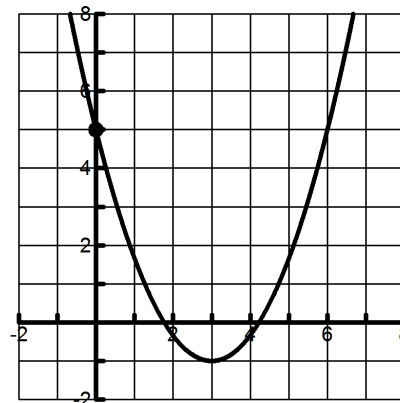
**Test #5 Review**

**Conic sections (see examples 1, 2, 3, 5, 6 on p. 549–553)**

5. Sketch the graph of  $\left(\frac{x-4}{3}\right)^2 + \left(\frac{y+3}{2}\right)^2 = 1$ .

What is the center? What are the  $x$ -radius and  $y$ -radius?

6. Write the equation of the graph in #5 in parametric form.  
7. Write the parametric equation of a hyperbola that is centered at the origin, opens up and down and has an  $x$ -radius of 4 and a  $y$ -radius of 1.  
9. Write the equation for the parabola shown to the right.



**Polar coordinates and equations**

10. Write the rectangular coordinates  $(1,7)$  in polar form.  
11. Write the polar coordinates  $(-3,105^\circ)$  in rectangular form.  
12. Write the equation  $r = 5 \csc \theta$  in rectangular coordinates.  
13. Write the equation  $(x+4)^2 + (y+2)^2 = 20$  in polar coordinates.  
14. Write the equation of a circle with a radius of 5 centered at the origin in polar coordinates.

**Complex numbers in trig form (you must show work)**

17. Write the complex number  $z = 1 + 7i$  in trig form.  
18. Write the complex number  $z = -3[\cos(105^\circ) + i \sin(105^\circ)]$  in rectangular form.  
19. If  $z = 3[\cos(35^\circ) + i \sin(35^\circ)]$  and  $w = -2 + 3i$ , find  $zw$  and  $z/w$   
20. Find  $w^5$ . You may write your answer in decimal form.