

Entering AP Pre-calculus means entering your first year of college-level mathematics. There is a major shift in expectations for students to be able to recall many skills at a moment's notice. We expect you to have mastered the following concepts. If you do not have these skills, you will find this course frustrating. This prerequisite packet should help you brush up and possibly relearn these topics.

1. **Cartesian coordinate plane:** Midpoint, distance, Equation and graph of a line, equation and graph of a circle, equation and graph of a quadratic.
2. **Solving equations/inequalities** algebraically and graphically: Linear equation, quadratic (factoring), polynomial (factoring), rational, absolute value. Know how to find zeros of polynomials using synthetic division.
3. Know the **parent graphs** of all Advanced Algebra functions and transformations.

**Geometry:**

4. The ratio for Sine, Cosine, Tangent and know to solve right triangles, both sides and angles, using these ratios.
6. The Pythagorean theorem and Special Right triangles
7. The Unit circle
8. Areas of basic polygons

**Exponents and Radicals**

9. Exponent Rules
  10. Operations with radicals
  11. Rational expressions and operations
  12. Inverses and synthetic division
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**I. Cartesian Coordinate plane**

Find the **distance** between the two points. Then find the **midpoint** between the two points.

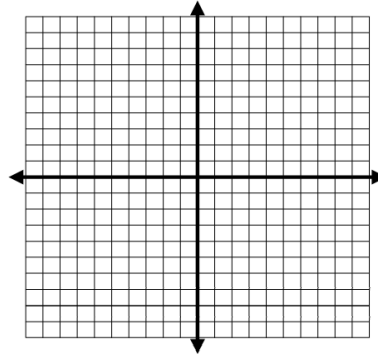
1.  $(-2,5), (6,-1)$

2.  $\left(\frac{3}{2}, -\frac{1}{2}\right), \left(-\frac{3}{2}, \frac{7}{2}\right)$

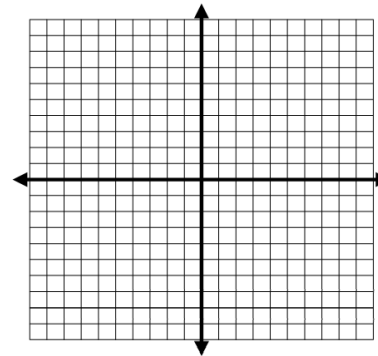
3.  $\left(\frac{5}{2}, -\frac{3}{2}\right), (1, -4)$

4. Write the equation of a line containing the following points. Graph the line.

$(-2,5), (6,-1)$



5. Write the equation of a circle with a center at  $(6, -1)$  containing the point A  $(-2, 5)$ . Graph the circle.

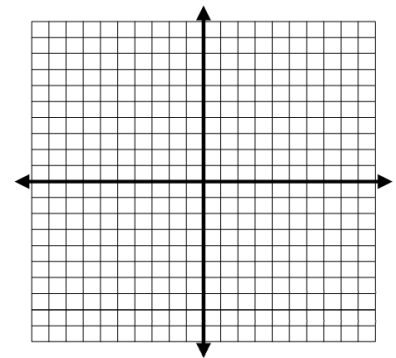
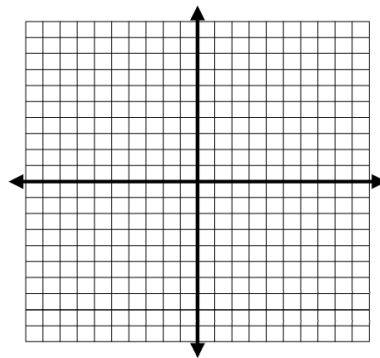
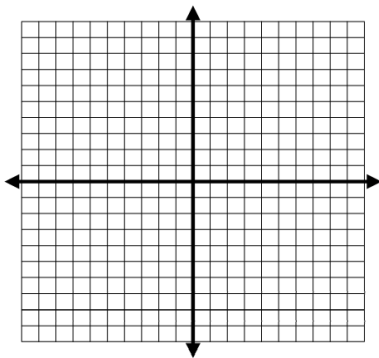


Graph the following quadratics from each form: vertex, factored, and standard forms.

6.  $y = 2(x - 3)^2 - 5$

7.  $f(x) = -\frac{1}{2}(x - 4)(x + 4)$

8.  $y = x^2 - 4x - 6$



**II. Solving Equations – Solve the following equations and inequalities. Write inequalities in interval notation.**

1.  $4|x+7|+3 \leq 27$

2.  $5|x+5|+3 = 28$

3.  $2x^3 + 13x^2 - 8x \geq 52$

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

5.  $\frac{x^2 - 4}{x} < 0$

6.  $\log_9(x-1) = 1.5$

7.  $x^2 + 5x + 6 = 0$

8.  $8x^2 - 6x - 5 = 0$

9.  $11x^2 - 14x - 16 = 0$

10. Find all zeros for f using synthetic division.

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

## All types of Factoring

### Factoring by GCF

1.  $3x^4 - 9x^2$

2.  $49xy + 28x - 14y$

3.  $18x^3y^5 - 12x^4y^2$

### Factoring Quadratic Expressions

1.  $x^2 - 3x + 2$

2.  $x^2 + 5x - 6$

3.  $2x^2 + 5x - 3$

4.  $3x^2 - 8x + 4$

5.  $3x^2 + 17x + 10$

6.  $10x^2 - 19x + 6$

### Special Factoring: Trinomial & Sum and difference of cubes

$$a^2 + 2ab + b^2 = (a + b)^2$$

$$a^3 + b^3 = (a + b)(a^2 - ab + b^2)$$

$$a^2 - 2ab + b^2 = (a - b)^2$$

$$a^3 - b^3 = (a - b)(a^2 + ab + b^2)$$

$$a^2 - b^2 = (a + b)(a - b)$$

1.  $4x^2 - 20x + 25$

2.  $49x^2 + 42xy + 9y^2$

3.  $16x^4 - 81$

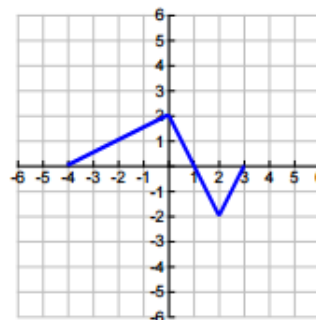
4.  $x^3 - 8$

5.  $125x^3 + y^3$

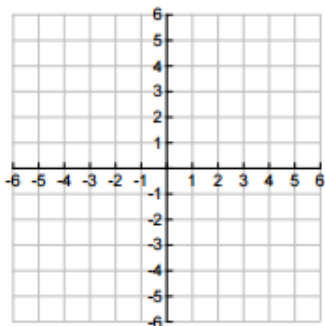
6.  $64 - 27y^6$

### 17: Function Transformation

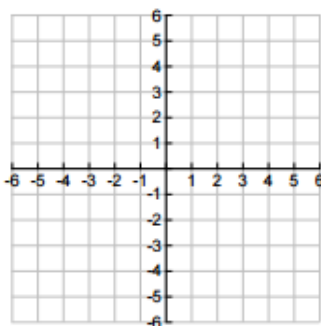
Use the graph of  $y = f(x)$  at the right to sketch the following transformations.



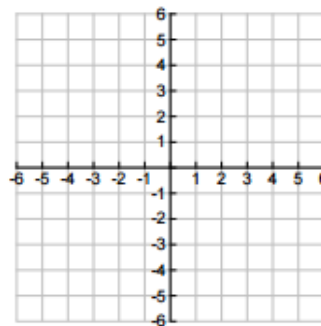
1.  $y = 2f(x)$



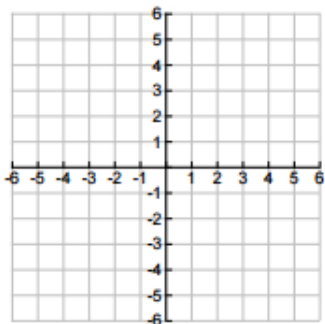
2.  $y = -f(x)$



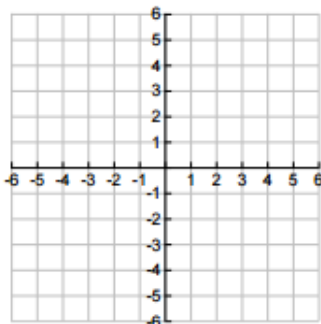
3.  $y = f(x-1)$



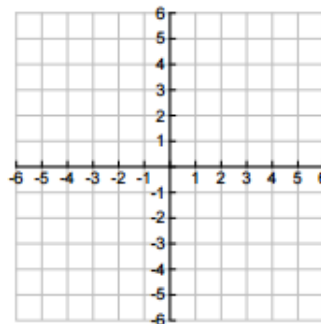
4.  $y = f(x) + 2$



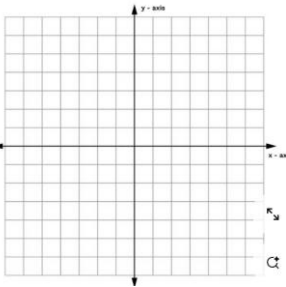
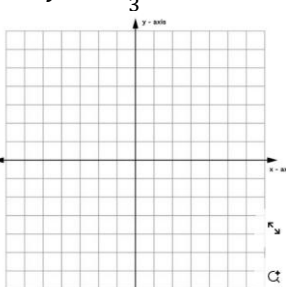
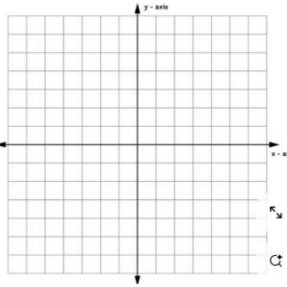
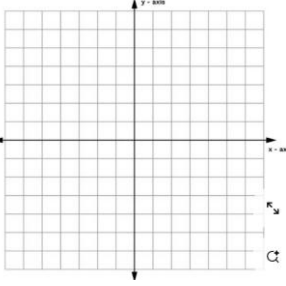
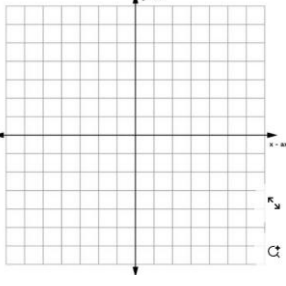
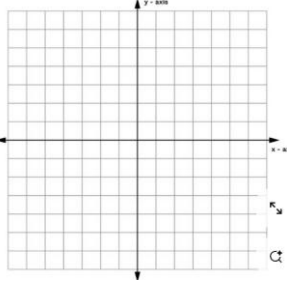
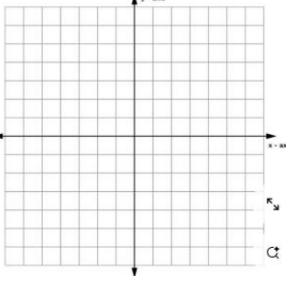
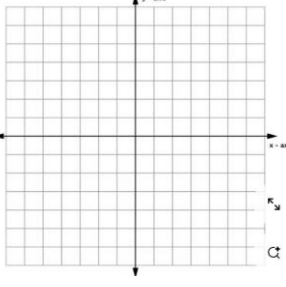
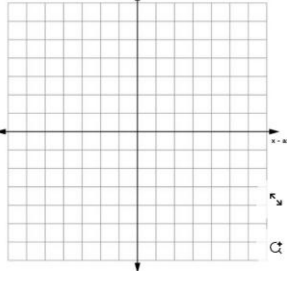
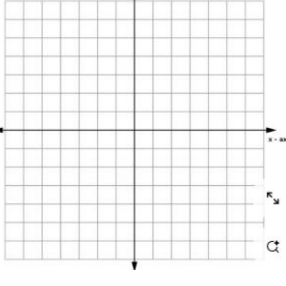
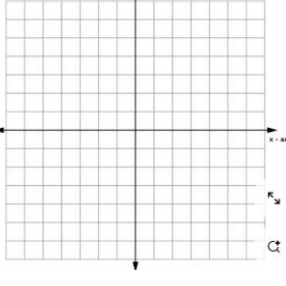
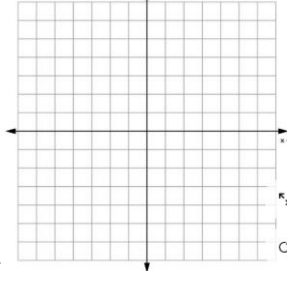
5.  $y = f(-x)$

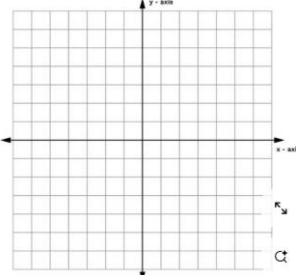
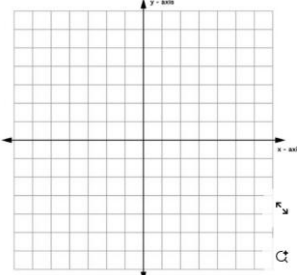
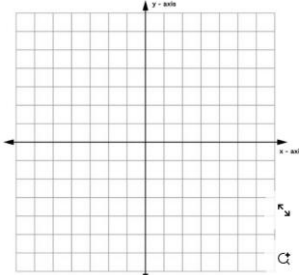
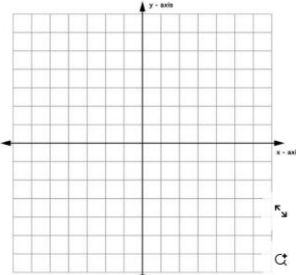
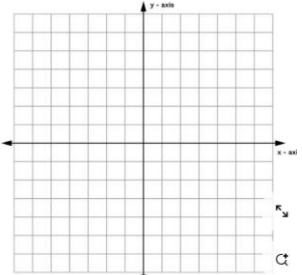
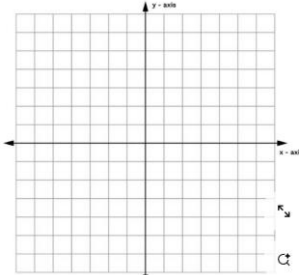
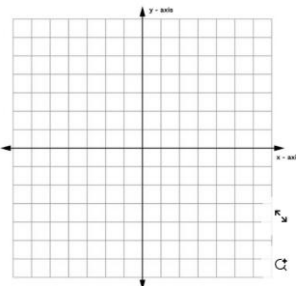
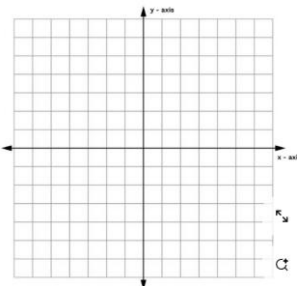
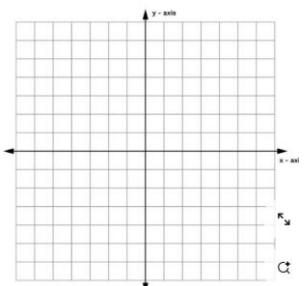
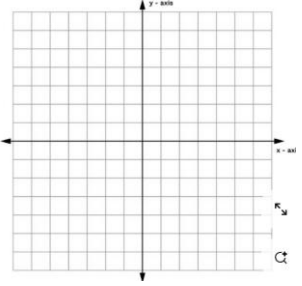
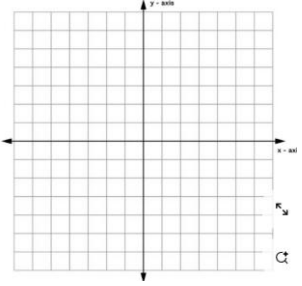
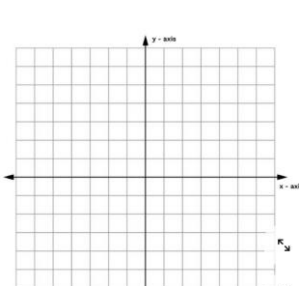


6.  $y = -2f(x+2) + 1$



Parent graphs  $y = a f(x - h) + k$

Category	Equation & Parent Graph	With 1 transformation	With 2 transformations
Linear Function	$y = x$ 	$y = -\frac{2}{3}x$ 	$y = 4x - 3$ 
Quadratic function	$y = x^2$ 	$y = -\frac{1}{2}x^2$ 	$y = 2x^2 - 5$ 
Cubic Function	$y = x^3$ 	$y = (x - 2)^3$ 	$y = \frac{1}{3}x^3 - 2$ 
Square root function	$y = \sqrt{x}$ 	$y = 3\sqrt{x}$ 	$y = \sqrt{x + 5} - 4$ 

<p>Cube root function</p>	$y = \sqrt[3]{x}$ 	$y = 4\sqrt[3]{x}$ 	$y = 2\sqrt[3]{x-2}$ 
<p>Exponential growth function</p>	$y = 2^x$ 	$y = 2^x - 4$ 	$y = 3(2)^x - 3$ 
<p>Exponential decay function</p>	$y = \left(\frac{1}{2}\right)^x$ 	$y = 3\left(\frac{1}{2}\right)^x$ 	$y = \left(\frac{1}{2}\right)^{x+2} - 5$ 
<p>Rational function</p>	$y = \frac{1}{x}$ 	$y = \frac{1}{x} + 2$ 	$y = \frac{1}{x-1} - 3$ 

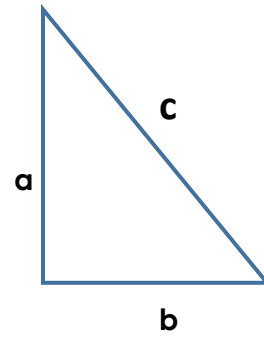
## Geometry Topics

### Pythagorean Theorem:

1.  $a = 4\sqrt{5}$   $b = 2$ , find  $c$ .

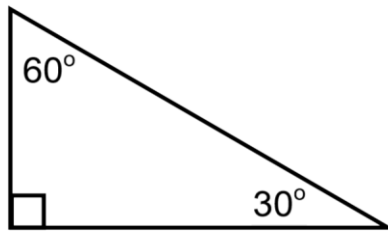
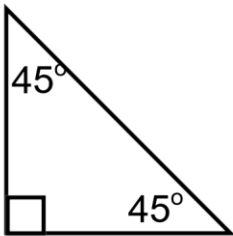
2.  $a = 2\sqrt{3}$   $c = 6$  find  $b$ .

3. If  $a = b$  and  $c = 10$ , find  $a$  and  $b$ .



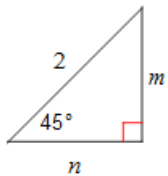
Use 30-60-90 rules from Geometry. **NO DECIMALS!!** Please research the rules, if you don't remember them.

### Rules:



Find the missing side lengths. Leave your answers as radicals in simplest form.

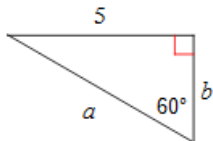
1.



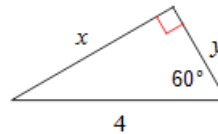
2.



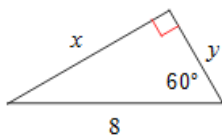
3.



4.

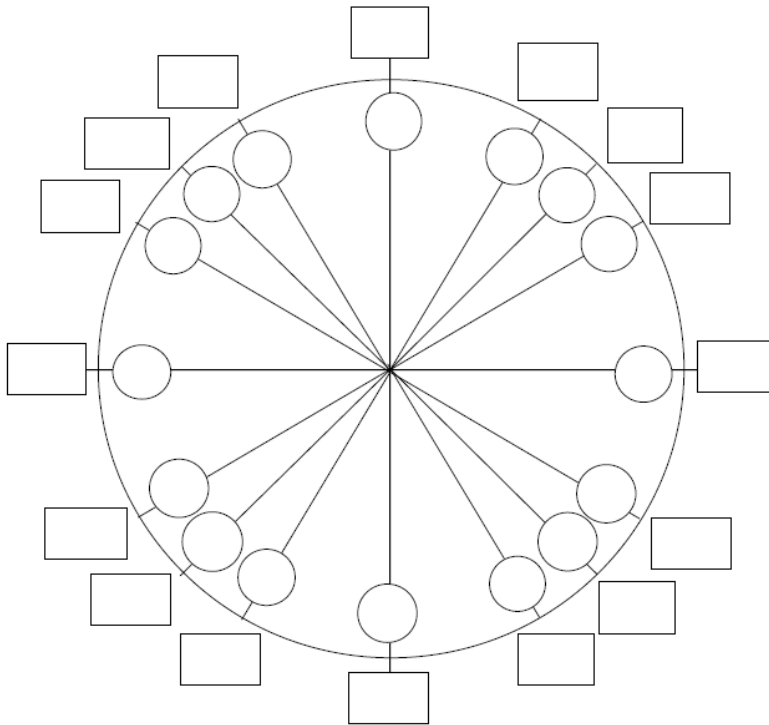


5.



Unit Circle- Fill out the unit circles using the directions on the bottom right hand side.

**Unit Circle –Degrees, Radians, and Trig Values**



Write the ratio for each:

$\sin \theta = \text{-----}$

$\text{csc } x = \text{-----}$

$\cos \theta = \text{-----}$

$\text{sec } x = \text{-----}$

$\tan \theta = \text{-----}$

$\cot x = \text{-----}$

**DIRECTIONS:**

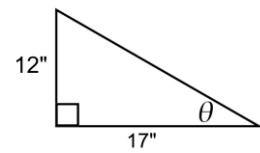
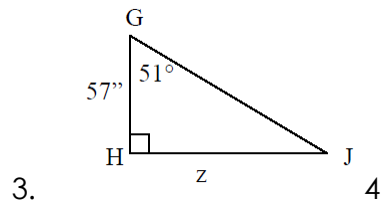
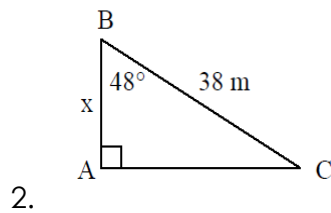
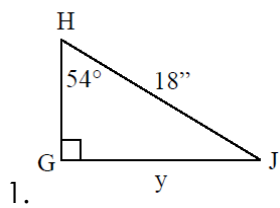
Place degree measures on the lines.

Place radian measures in the circles.

Place  $(\cos \theta, \sin \theta)$  inside the rectangle.

Place  $\tan \theta$  outside the rectangle.

Using trig: Find the missing sides or angles of the right triangles using sine, cosine and tangent. (SOH CAH TOA)



Area-write formulas and solve each for the area!

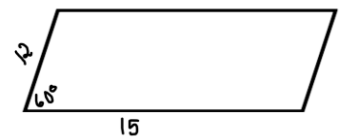
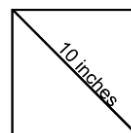
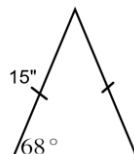
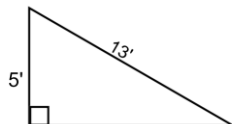
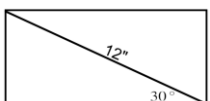
1. Rectangle

2. Triangle

3. Isosceles Triangle

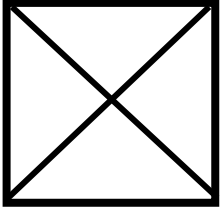
4. square

5. parallelogram

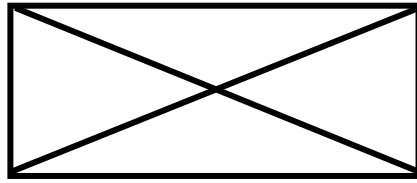


**Properties of quadrilaterals: sides, angles, diagonals. Mark congruent parts or relationships.**

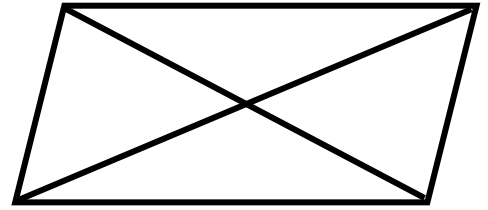
1. Squares



2. rectangles



3. parallelograms



### Vocabulary

Radius:

Diameter:

Vertices:

Diagonals:

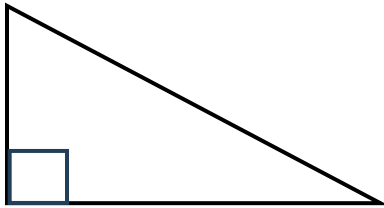
Central angle of circles/regular polygons: Find the central angles in:

a. Hexagon

b. Octagon

c. Decagon

**Know how to label and triangle and the relationships of the sides vs. angles.**



### Exponents and Radicals

Simplify the following. Do not leave any negative exponents.

1.  $(-2^2)^3$

2.  $-\left(\frac{2}{5}\right)^{-2}$

3.  $(3x^2y)^{-3}$

4.  $\frac{y^{-4}}{5x^{-2}}$

5.  $\frac{x^{-1}y}{xy^{-2}}$

6.  $\frac{3xy^9}{2y^{-2}} \cdot \frac{-7y}{42x^5}$

## Simplifying Radicals

1.  $\sqrt{80}$

2.  $\sqrt[4]{32}$

3.  $\sqrt[3]{54x^3}$

4.  $\frac{3}{\sqrt{8}}$

5.  $\sqrt{\frac{4}{75}}$

6.  $4\sqrt{3} \cdot \sqrt{21}$

**Rational expressions and operations.** Complete each operation and simplify completely.

1.  $\frac{3}{8} - \frac{5}{6}$

2.  $\frac{2}{x} + \frac{x-2}{x+3}$

3.  $\frac{\frac{x^2}{25}}{\frac{2x}{5}}$

4.  $\frac{(x^2-9)}{x^2-5x+6}$

5.  $\frac{\frac{x^3-8}{x^2-16}}{(x-2)(x+4)}$

Find the **inverse** of each function.

7.  $f(x) = \sqrt[3]{2x}$

8.  $g(x) = 2(x-5)^{\frac{1}{4}} + 8$

9.  $h(x) = \frac{x-5}{x+1}$

10.

Use synthetic division to find the result when  $x^3 + 5x^2 - 26x + 11$  is divided by  $x - 3$ . If there is a remainder, express the result in the form  $q(x) + \frac{r(x)}{b(x)}$ .