

Name \_\_\_\_\_

**Topic 1: Fractional & Negative Exponents**

Simplify using only positive exponents

1.  $-3x^{-3}$

2.  $-5\left(\frac{3}{2}\right)(4-9x)^{-\frac{1}{2}}(-9)$

3.  $2\left(\frac{2}{2-x}\right)\left[\frac{-2}{(2-x)^2}\right]$

4.  $(16x^2y)^{\frac{3}{4}}$

5.  $-\frac{x^{-\frac{1}{2}}}{2}\sin\sqrt{x}$

6.  $\frac{\sqrt{4x-16}}{\sqrt[4]{(x-4)^3}}$

7.  $-4\left(\frac{2x-1}{2x+1}\right)^{-3}\left[\frac{2(2x+1)-2(2x-1)}{(2x+1)^2}\right]$

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

9.  $\left(\frac{1}{x^{-2}} + \frac{4}{x^{-1}y^{-1}} + \frac{1}{y^{-2}}\right)^{-\frac{1}{2}}$

## Topic 2: Domain

Find the domain of the following functions:

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

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

$$3. y = \frac{x^2-5x-6}{x^2-3x-18}$$

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

$$5. y = \sqrt{x-3} - \sqrt{x+3}$$

$$6. y = \frac{\sqrt{2x-9}}{2x+9}$$

$$7. y = \frac{x^2+8x+12}{\sqrt[4]{x+5}}$$

$$8. y = \sqrt{x^2-5x-14}$$

$$9. y = \frac{\sqrt[3]{x-6}}{\sqrt{x^2-x-30}}$$

$$10. y = \log(2x-12)$$

$$11. y = \sqrt{\tan x}$$

$$12. y = \frac{x}{\cos x}$$

### Topic 3: Solving inequalities (absolute value)

Write the following absolute value expressions as piecewise expressions

1.  $y = |2x - 4|$

2.  $y = |6 + 2x| + 1$

3.  $y = |4x + 1| + 2x - 3$

Solve the following absolute value inequalities

4.  $|x - 3| > 12$

5.  $|x - 3| \leq 4$

6.  $|10x + 8| > 2$

7.  $|3x - 4| > -2$

8.  $|x - 6| > -8$

9.  $|x + 1| \leq |x - 3|$

#### Topic 4: Solving inequalities (quadratic)

Write the following absolute value expressions as piecewise expressions

1.  $|x^2 - 1|$

2.  $|x^2 + x - 12|$

3.  $|x^2 + 4x + 4|$

Solve the following by factoring and making appropriate sign charts.

4.  $x^2 - 16 > 0$

5.  $x^2 + 6x - 16 > 0$

6.  $x^2 - 3x \geq 10$

7.  $2x^2 + 4x \leq 3$

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

9.  $2\sin^2 x \geq \sin x \quad 0 \leq x < 2\pi$

### Topic 5: Special factorization

Factor completely

1.  $x^3 + 8$

2.  $x^3 - 8$

3.  $27x^3 - 125y^3$

4.  $x^4 + 11x^2 - 80$

5.  $ac + cd - ab - bd$

6.  $2x^2 + 50y^2 - 20xy$

7.  $x^2 + 12x + 36 - 9y^2$

8.  $x^3 - xy^2 + x^2y - y^3$

9.  $(x-3)^2(2x+1)^3 + (x-3)^3(2x+1)^2$

### Topic 6: Function transformation

If  $f(x) = x^2 - 1$ , describe in words what the following would do to the graph of  $f(x)$ :

1.  $f(x) - 4$

2.  $f(x - 4)$

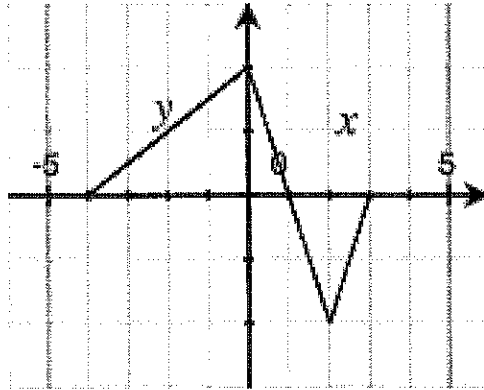
3.  $-f(x + 2)$

4.  $5f(x) + 3$

5.  $f(2x)$

6.  $|f(x)|$

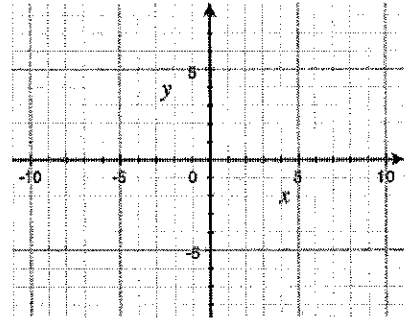
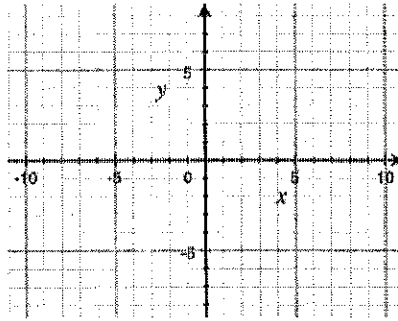
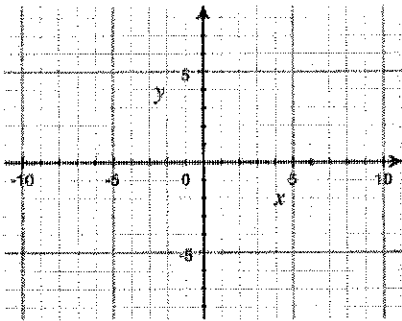
Here is a graph of  $y = f(x)$ . Sketch the following graphs



7.  $y = 2f(x)$

8.  $y = -f(x)$

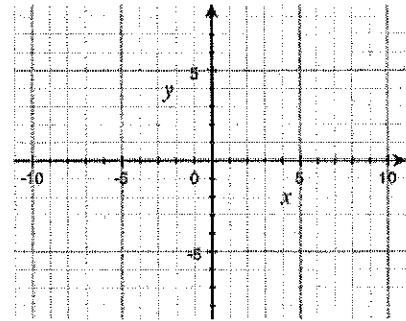
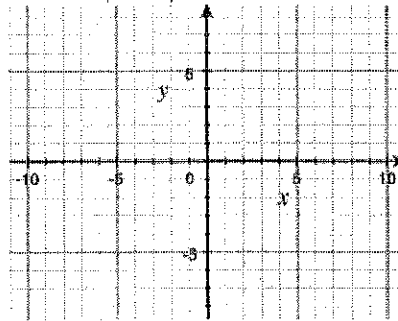
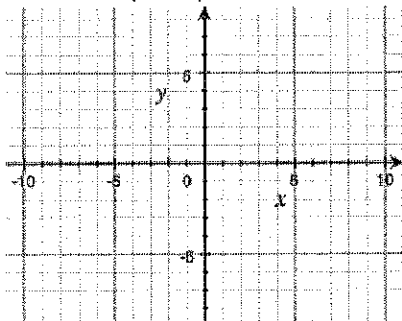
9.  $y = f(x - 1)$



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

11.  $y = |f(x)|$

12.  $y = f|x|$



**Topic 7: Factor theorem ( $p$  over  $q$  method/synthetic division)**

Use the  $p$  over  $q$  method and synthetic division to factor the polynomial  $P(x)$ . Then solve  $P(x) = 0$ .

1.  $P(x) = x^3 + 4x^2 + x - 6$

2.  $P(x) = x^3 + 5x^2 - 2x - 24$

3.  $P(x) = x^3 - 6x^2 + 3x - 10$

4.  $P(x) = x^3 + 2x^2 - 19x - 20$

5.  $P(x) = x^4 + 5x^3 + 6x^2 - 4x - 8$

6.  $P(x) = x^4 + 11x^3 + 41x^2 + 61x + 30$

### Topic 8: Even and odd functions

Show work to determine if the relation is even, odd, or neither

1.  $f(x) = 2x^2 - 7$

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

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

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

5.  $f|x| = |x| - x^2 + 1$

6.  $5x^2 - 6y = 1$

7.  $y = e^x - \frac{1}{e^x}$

8.  $3y^3 = 4x^3 + 1$

9.  $3x = |y|$



### Topic 9: Solving quadratic equations and quadratic formula

Solve each equation

1.  $7x^2 - 3x = 0$

2.  $4x(x-2) - 5x(x-1) = 2$

3.  $x^2 + 6x + 4 = 0$

4.  $2x^2 - 3x + 3 = 0$

5.  $2x^2 - (x+2)(x-3) = 12$

6.  $x + \frac{1}{x} = \frac{13}{6}$

7.  $x^4 - 9x^2 + 8 = 0$

8.  $x - 10\sqrt{x} + 9 = 0$

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

### Topic 10: Asymptotes

For each function, find the equations of both the vertical asymptote(s) and horizontal asymptotes (if they exist)

1.  $y = \frac{x}{x-3}$

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

3.  $y = \frac{x+4}{x^2+1}$

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

5.  $y = \frac{x^2-9}{x^3+3x^2-18x}$

6.  $y = \frac{2x^2+6x}{x^3-3x^2-4x}$

7.  $y = \frac{x^2-x-6}{x^3-x^2+x-6}$

8.  $y = \frac{2x^3}{x^3-1}$

9.  $y = \frac{\sqrt{x}}{2x^2-10}$

## Topic 11: Complex fractions

Simplify the following

$$1. \frac{x}{x - \frac{1}{2}}$$

$$2. \frac{\frac{1}{x} + 4}{\frac{1}{x} - 2}$$

$$3. \frac{x - \frac{1}{x}}{x + \frac{1}{x}}$$

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

$$5. \frac{1 - \frac{2}{3x}}{x - \frac{4}{9x}}$$

$$6. \frac{\frac{x^2 - y^2}{xy}}{\frac{x + y}{y}}$$

$$7. \frac{\frac{x^{-3} - x}{x^{-2} - 1}}$$

$$8. \frac{\frac{x}{1-x} + \frac{1+x}{x}}{\frac{1-x}{x} + \frac{x}{1+x}}$$

$$9. \frac{\frac{4}{x-5} + \frac{2}{x+2}}{\frac{2x}{x^2 - 3x - 10} + 3}$$

**Topic 12: Composition of functions**

If  $f(x) = x^2$ ,  $g(x) = 2x - 1$ , and  $h(x) = 2^x$ , find the following

1.  $f(g(2))$

2..  $f(g(2))$

3.  $f(h(-1))$

4.  $h(f(-1))$

5.  $g\left(f\left(h\left(\frac{1}{2}\right)\right)\right)$

6.  $f(g(x))$

7.  $g(f(x))$

8.  $g(g(x))$

9.  $f(h(x))$

### Topic 13: Solving Rational (fractional) equations

Solve each equation for  $x$

$$1. \frac{2}{3} - \frac{5}{6} = \frac{1}{x}$$

$$2. x + \frac{6}{x} = 5$$

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

$$4. \frac{x-5}{x+1} = \frac{3}{5}$$

$$5. \frac{60}{x} - \frac{60}{x-5} = \frac{2}{x}$$

$$6. \frac{2}{x+5} + \frac{1}{x-5} = \frac{16}{x^2-25}$$

$$7. \frac{x}{x-2} + \frac{2x}{4-x^2} = \frac{5}{x+2}$$

$$8. \frac{x}{2x-6} - \frac{3}{x^2-6x+9} = \frac{x-2}{3x-9}$$

$$9. \frac{2x+3}{x-1} = \frac{10}{x^2-1} + \frac{2x-3}{x+1}$$

### Topic 14: Solving Rational (fractional) equations

Solve the following problems.

If point  $P$  is on the terminal side of  $\theta$ , find all 6 trig functions of  $\theta$ . Draw a picture.

1.  $P(-2,4)$

2.  $P(\sqrt{5}, -2)$

3. If  $\cos\theta = \frac{5}{13}$ ,  $\theta$  in quadrant II,  
find  $\sin\theta$  and  $\tan\theta$

4. If  $\cot\theta = 3$ ,  $\theta$  in quadrant III,  
find  $\sin\theta$  and  $\cos\theta$

Find the exact value of the following without calculators:

5.  $\sin^2 225^\circ - \cos^2 300^\circ$

6.  $(6\sec 180^\circ - 4\cot 90^\circ)^2$

7.  $(4\cos 30^\circ - 6\sin 120^\circ)^{-2}$

Solve the following triangles (3 decimal place accuracy)

8.  $A =$              $a = 21.7$   
 $B = 16^\circ$          $b =$   
 $C = 90^\circ$          $c =$

9.  $A =$              $a = 6$  feet  
 $B =$                $b =$   
 $C = 90^\circ$          $c = 95$  inches

### Topic 15: Solving Trigonometric equations

Solve each equation on the interval  $[0, 2\pi)$

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

2.  $\cos^2 x = \cos x$

3.  $2\cos x + \sqrt{3} = 0$

4.  $4\sin^2 x = 1$

5.  $2\sin^2 x + \sin x = 1$

6.  $\cos^2 x + 2\cos x = 3$

7.  $2\sin x \cos x + \sin x = 0$

8.  $8\cos^2 x - 2\cos x = 1$

9.  $\sin^2 x - \cos^2 x = 0$