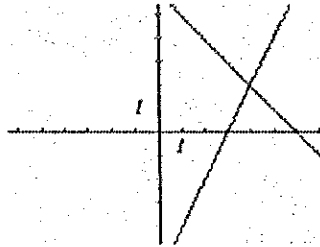


1. Graph the linear system and estimate the solution.

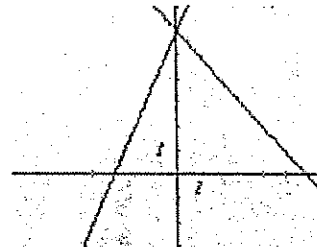
$$x + y = 6$$

$$2x = y$$

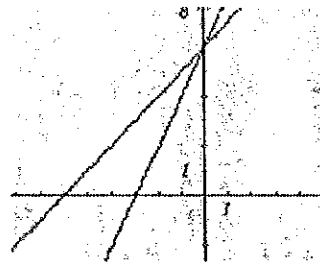
[A] (4, 2)



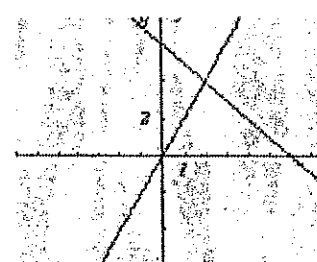
[B] (0, 6)



[C] (0, 6)



[D] (2, 4)



2. Solve the linear system:

$$3x - y = 5$$

$$x + 2y = 4$$

[A] (3, 4)

[B] (1, 2)

[C] (2, 1)

[D] (2, 0)

3. Solve the systems of equations:  $2x - 4y + z = 0$

$$4x + 4y + z = 24$$

$$5x - 4y - 5z = 12$$

[A] (4, 2, 0)

[B] (12, -10.5, 18)

[C] (12, -4.5, -6)

[D] (7, 3.5, 0)

4. Solve the system of equations:  $-5x - 5y + 5z = 5$

$$-x - 5y + z = 17$$

$$2x + 5y - 3z = -10$$

[A] (39, 4, 36)

[B] (-1, -4, -4)

[C] (1, 4, -4)

[D] (-39, 4, -36)

5. Tickets to a local movie were sold at \$8.00 for adults and \$6.50 for students. If 550 tickets were sold for a total of \$3920, how many adult tickets were sold?

[A] 320

[B] 303

[C] 250

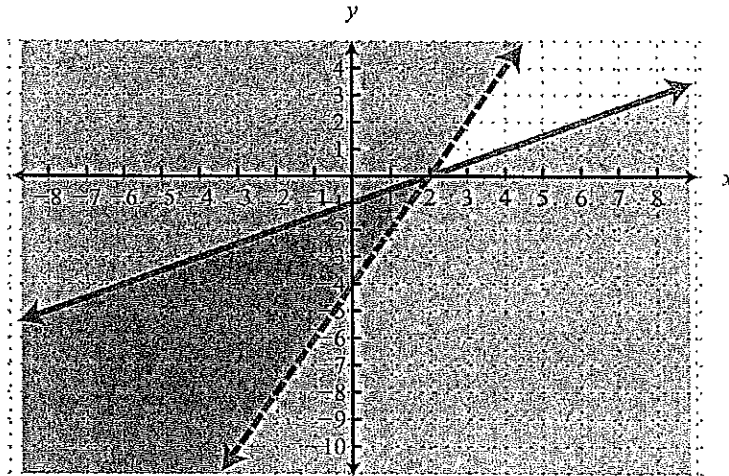
[D] 230

6. ABC Car Rental charges \$0.85 per mile plus a flat rate of \$39 per day to rent a car. Happy Ride, Inc. charges \$0.50 per mile plus a flat rate of \$74 per day to rent the same type of car. After how many miles is the cost to rent a car the same for both companies?

- [A] 10 miles      [B] 44 miles      [C] 84 miles      **[D] 100 miles**

7. Consider the graph below:

$$.85x + 39 = .50x + 74$$



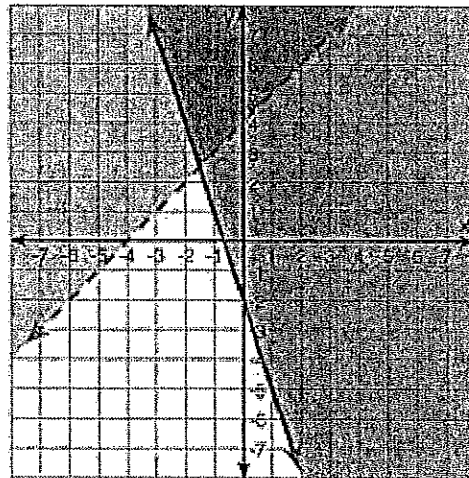
Which system of linear inequalities are represented in the graph?

- [A]  $y \leq \frac{1}{2}x + 2$   
 $y > 2x + 2$
- [B]  $y \leq \frac{1}{2}x - 1$**   
 $y > 2x - 4$
- [C]  $y \geq \frac{1}{2}x + 2$   
 $y < 2x + 2$
- [D]  $y \geq \frac{1}{2}x - 1$   
 $y < 2x - 4$

8. Which point is a solution to the system of inequalities?

- [A] (0, 0)  
**[B] (1, 7)**  
 [C] (-4, 0)  
 [D] (-2, -2)

FIND WHICH POINT IS IN THE OVERLAPPING REGION.



9. Find the maximum value of C subject to the given constraints.

$$C = 4x + 3y$$

Constraints:

$$x + y \leq 6 \rightarrow y \leq -x + 6$$

$$x - 2y \geq -6 \rightarrow y \leq \frac{1}{2}x + 3$$

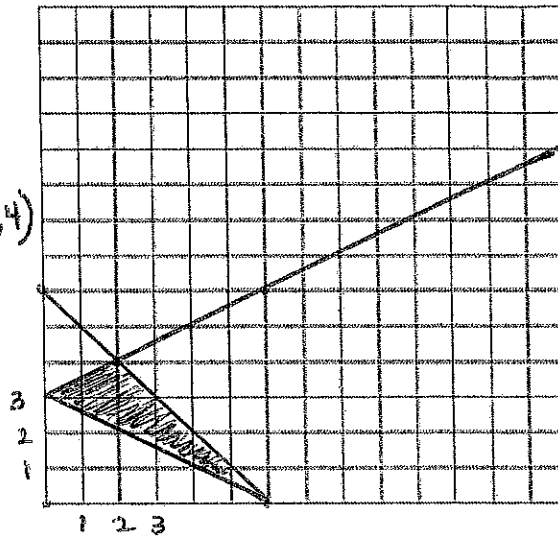
$$2x + 4y \geq 12 \rightarrow y \geq \frac{1}{2}x + 3$$

CHECK POINTS (6,0), (0,3), (2,4)

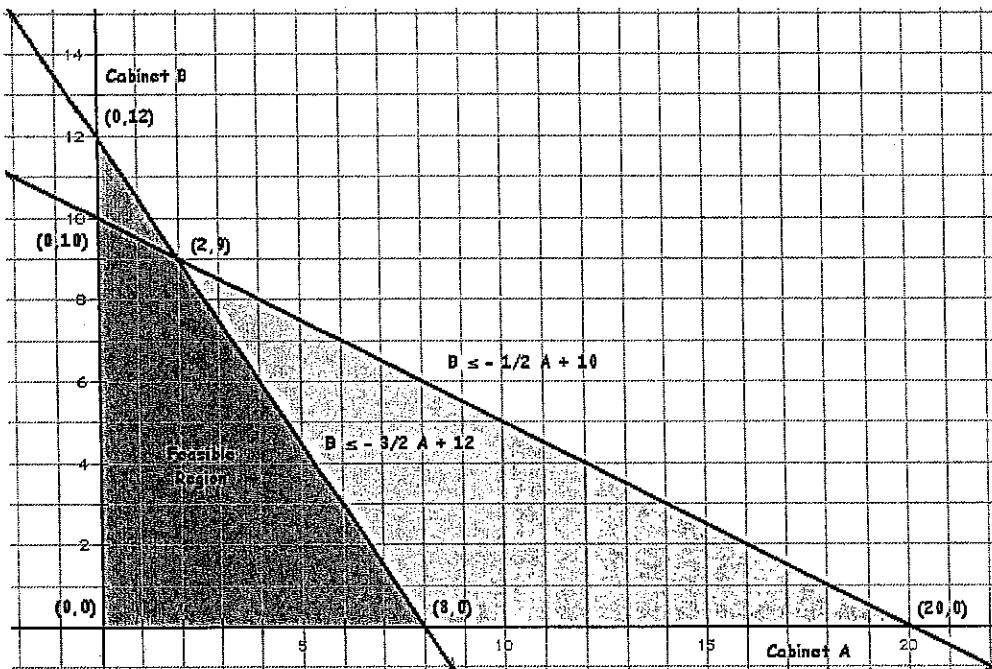
$$C = 4(6) + 3(0) = 24$$

$$C = 4(0) + 3(3) = 9$$

$$C = 4(2) + 3(4) = 20$$



10. Consider the graph below:



List all the points that should be considered when finding the maximum value.

$$(0, 10), (2, 9), (8, 0), (0, 0)$$

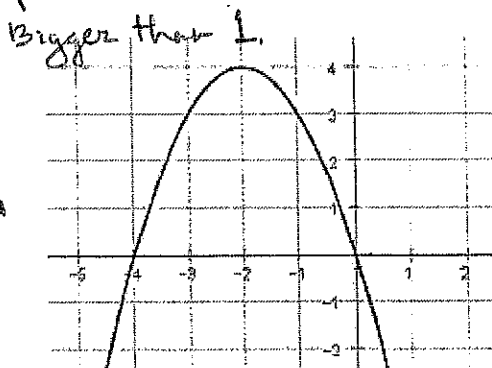
1. Which of the quadratic functions listed below is narrower than the parent function  $f(x) = x^2$ ?

[A]  $f(x) = x^2 + x + 5$   
~~[C]  $f(x) = 0.5x^2 - 3x$~~

[B]  $f(x) = -x^2 + x - 3$   
 [D]  $f(x) = 3x^2 + 2$

2. Which function matches the graph at the right?

[A]  $f(x) = x(x+4)$   
 [B]  $f(x) = x(x-4)$   
 [C]  $f(x) = -x(x+4)$  *GRAPH OPENS DOWN  
 X-INTS AT 0, -4.*  
 [D]  $f(x) = -x(x-4)$



3. Write the equation  $y = x^2 - 6x + 5$  in vertex form.

[A]  $y = x(x-6) + 5$

[B]  $y = (x-3)^2 + 14$

[C]  $y = (x-5)(x-1)$

[D]  $y = (x-3)^2 - 4$  *Complete the Square  
 $y = (x^2 - 6x + 9) + 5 - 9$   
 $(x-3)^2 - 4$*

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

[A]  $x = 0, -3$  *Factor  $x(x+3) = 0$*

[B]  $x = 3, -3$

[C]  $x = 1, 3$

[D]  $x = 0, 3$

5. Solve  $2x^2 + 3x - 9 = 0$ .

[A]  $x = -6, 3$

[B]  $x = 6, -3$

[C]  $x = -3, \frac{3}{2}$

[D]  $x = 3, -\frac{3}{2}$

6. Solve  $2x^2 - 5x + 1 = 0$ .

[A]  $x = \frac{5 \pm \sqrt{17}}{4}$

[B]  $x = \frac{-5 \pm \sqrt{17}}{4}$

[C]  $x = \frac{5 \pm 4\sqrt{2}}{4}$

[D]  $x = \frac{-5 \pm 4\sqrt{2}}{4}$

7. Solve  $x^2 - 4x + 6 = 0$ .

[A]  $x = 2 \pm \sqrt{10}$

[B]  $x = 2 \pm i\sqrt{2}$

[C]  $x = -2 \pm \sqrt{10}$

[D]  $x = -2 \pm i\sqrt{2}$

8. Solve  $5x^2 - 4 = 41$ .

[A]  $x = \pm \frac{\sqrt{37}}{5}$

[B]  $x = \pm \frac{3\sqrt{5}}{5}$

[C]  $x = \pm 3$

[D]  $x = \text{no real solution}$

9. Solve  $(8x-3)^2 = 30$ .

[A]  $x = \frac{3 \pm \sqrt{30}}{8}$       [B]  $x = \pm \frac{\sqrt{39}}{8}$       [C]  $x = \frac{-3 \pm \sqrt{30}}{16}$       [D]  $x = \pm \frac{\sqrt{39}}{64}$

10. The height  $h$ , in feet, of an object  $t$  seconds after it has been dropped from a height of  $s$  feet is  $h = -16t^2 + s$ . How long does it take an object to hit the ground if it is dropped from a height of 64 feet?

[A] 8.94 seconds      [B] 8 seconds      [C] 4 seconds       [D] 2 seconds

11. A ball is thrown upward from the ground ( $d = 0$ ). It reaches a maximum height of 25 feet 8 seconds after it is thrown. How long will it take it to reach the ground?

[A] 10 seconds      [B] 12 seconds      [C] 14 seconds       [D] 16 seconds

12. In the quadratic equation  $y = ax^2 + bx + c$ , which of the variables represents the value of the y-intercept?

[A]  $a$       [B]  $b$        [C]  $c$       [D]  $x$

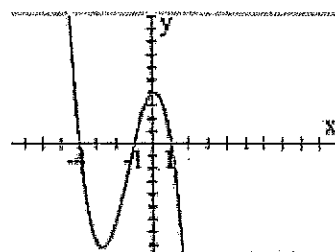
1. Describe the end behavior of the graph as  $x \rightarrow -\infty$  and  $x \rightarrow +\infty$ .

[A]  $x \rightarrow -\infty, f(x) \rightarrow +\infty$  and  $x \rightarrow +\infty, f(x) \rightarrow +\infty$

**[B]**  $x \rightarrow -\infty, f(x) \rightarrow +\infty$  and  $x \rightarrow +\infty, f(x) \rightarrow -\infty$

[C]  $x \rightarrow -\infty, f(x) \rightarrow -\infty$  and  $x \rightarrow +\infty, f(x) \rightarrow +\infty$

[D]  $x \rightarrow -\infty, f(x) \rightarrow -\infty$  and  $x \rightarrow +\infty, f(x) \rightarrow -\infty$



2. Which of the following functions would have end behavior

$x \rightarrow -\infty, f(x) \rightarrow +\infty$  and  $x \rightarrow +\infty, f(x) \rightarrow +\infty$

[A]  $f(x) = x^3 + 2$

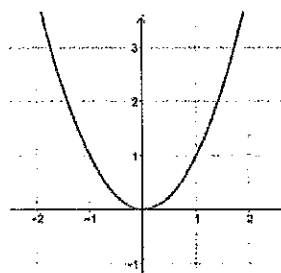
[B]  $f(x) = -x^3 + 2$

**[C]**  $f(x) = x^4 + 2$

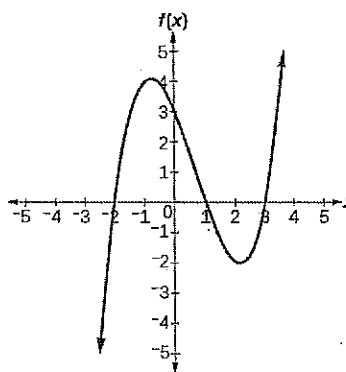
[D]  $f(x) = -x^4 + 2$

3. Match each graph to the type of function it represents. (write the letter that corresponds to the correct graph on the line next to the types listed below.)

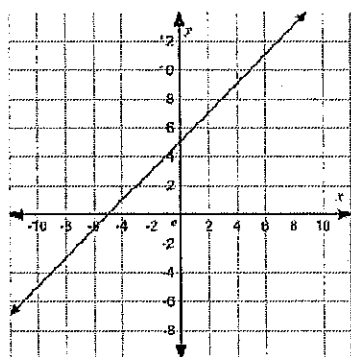
[A]



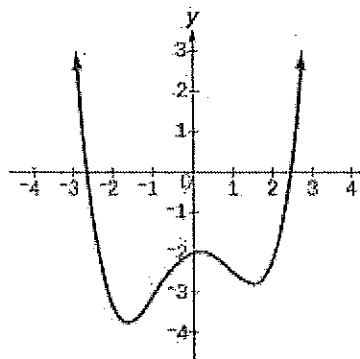
[B]



[C]



[D]



Linear C

Quadratic A

Cubic B

Quartic D

6. Divide  $(x^3 + 8) \div (x + 2)$

[A]  $x + 4$

[B]  $x^2 + 4$

[C]  $x^2 + 6x$

[D]  $x^2 - 2x + 4$

7. Write a polynomial function that has zeros -4, 2, -1 and has a leading coefficient of 1.

[A]  $f(x) = x^3 - 4x^2 + 2x - 1$

[B]  $f(x) = x^3 - 3x^2 - 6x + 8$

[C]  $f(x) = x^3 + 3x^2 - 6x - 8$

[D]  $f(x) = x^3 + 8$

8. Solve  $x^3 + 16x^2 = 0$

[A] 0, 16

[B] 0, 4

[C] 0, -16

[D] 4, -4

$$x^2(x + 16) = 0$$

$$x = 0 \text{ (double root)}, -16$$

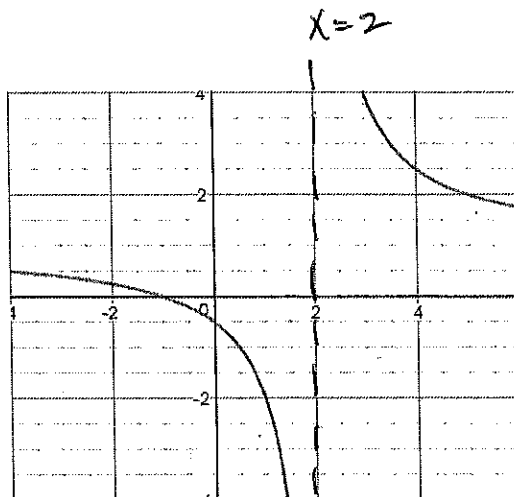
1. Which function matches the graph?

[A]  $f(x) = \frac{x+2}{x-1}$

[B]  $f(x) = \frac{x+1}{x-2}$  ← only vertical asymptote at  $x=2$

[C]  $f(x) = \frac{2}{x+1}$

[D]  $f(x) = \frac{2}{x+2}$



2. Identify the vertical asymptotes and horizontal asymptotes of the function:

$f(x) = \frac{2x(x+1)}{(x-2)(x-3)}$  degree = 2 } same degree, look at leading coeff.  $\frac{2}{1} = 2$   
 degree = 2 }  $\rightarrow y=2$   
 horizontal asymptote

V.A.  $\odot$   $x=2$  &  $x=3$

[A]  $x=2, x=3, y=2$  [B]  $x=2, x=3, y=0$

[C]  $x=-2, x=-3, y=0$

[D]  $y=2, y=3, x=2$

3. Identify the vertical asymptotes and horizontal asymptotes of the function:

$f(x) = \frac{3x}{x^2-3x-4}$  degree = 1 } lower degree on top, horizontal asymp.  $y=0$   
 degree = 2 }

factor  $\rightarrow$   $(x-4)(x+1)$

V.A.  $\odot$   $4, -1$

[A]  $x=4, x=1, y=3$  [B]  $x=-4, x=1, y=0$

[C]  $x=4, x=-1, y=0$  [D]  $x=-4, x=-1, y=3$

4. Solve:  $1 + \frac{4}{r-2} = \frac{5}{r-2}$  need common denom.  $(r-2)$

$\frac{r-2}{r-2} + \frac{4}{r-2} = \frac{5}{r-2} \Rightarrow r-2+4=5$   
 $r=3$  (not extraneous) ✓

5. Solve:  $\frac{(n+6)}{(n+6)} \cdot \frac{4}{n+1} - \frac{1}{n^2+7n+6} = \frac{3}{n^2+7n+6}$   $\Rightarrow 4(n+6) - 1 = 3$   
 $\downarrow$  FACTOR  
 $(n+6)(n+1)$   
 $4n+24-1=3$   
 $4n=-20$   
 $n=-5$



6. Solve:  $\frac{b+1}{b^2-2b} + \frac{6b^2-24b+18}{b^2-2b} = \frac{(2b-4)(b-2)}{b(b-2)}$  →  $b+1 + 6b^2-24b+18 = 2b^2-8b+8$   
 $4b^2-15b+11=0$   
 $(4b-11)(b-1)=0$   
 $b = \frac{11}{4}$  or  $b=1$  ✓

7. Find the domain and range:  $f(x) = \frac{2x(x+1)}{(x-2)(x-3)}$  ZEROS @  $x=0, -1$   
 HORIZONTAL ASYMPT. @  $y=2$   
 V.A.  $x=2, x=3$

D:  $(-\infty, 2) \cup (2, 3) \cup (3, \infty)$

R: OMIT

8. Find the domain and range:  $f(x) = \frac{2}{x+1}$

D:  $(-\infty, -1) \cup (-1, \infty)$

R:  $(-\infty, 0) \cup (0, \infty)$

9. The volume (v) of a cone varies jointly as the height (h) of the cone and the area of the base (b). A cone has a volume of 140 with height 15 and base 28. Find the volume of a cone with height 7 and base 12.

$v = kbh$   
 $140 = k(28)(15)$   
 $140 = k(420)$   
 $*k = \frac{1}{3}$  or  $.3\bar{3}$

→  $v = \frac{1}{3}(12)(7)$   
 $v = 28$

10. A pitcher's earned run average (a) varies directly as the number of earned runs (r) allowed and inversely as the number of innings (i) pitched. Joe Price had an earned run average of 2.55. He gave up 85 earned runs in 300 innings. What would his average be if he gave up 120 earned runs in 600 innings?

$a = \frac{kr}{i}$   $2.55 = \frac{k(85)}{300}$   $a = \frac{9(120)}{600}$   
 $*k = 9$   $a = 1.8$

11. The current (I) in an electrical conductor varies inversely as the resistance (r) of the conductor. The current is 2 amperes when the resistance is 960 ohms. What is the current when the resistance is 480 ohms?

$I = \frac{k}{r}$   $2 = \frac{k}{960}$   $I = \frac{1920}{480}$   
 $*k = 1920$   $I = 4 \text{ amps}$

12. The amount (a) that a family gives to charity varies directly as its income (i). Last year, the family earned \$32,000 and gave \$2560 to charity. How much will they give if they make \$42,000 this year?

$a = ki$   $a = .08(42,000)$   
 $2560 = k(32,000)$   $a = 3360$   
 $*k = .08$

FIND K FIRST!

KEY

# Rational Expressions Worksheet

## Reducing Rational Expressions

1. Reduce  $\frac{x^2-9}{x-3}$   $\frac{(x+3)(\cancel{x-3})}{\cancel{x-3}}$   $\circledast x+3$

2. Reduce  $\frac{y^2-5y-6}{y^2-1}$   $\frac{(y-6)(\cancel{y+1})}{(y-1)(\cancel{y+1})}$   $\circledast \frac{y-6}{y-1}$

3. Reduce  $\frac{x^2-3x+ax-3a}{x^2-ax-3x+3a}$  (group)  $\frac{x(x-3)+a(x-3)}{x(x-a)-3(x-a)} = \frac{(x+a)(\cancel{x-3})}{(\cancel{x-3})(x-a)} = \circledast \frac{x+a}{x-a}$

4. Reduce  $\frac{a-b}{b-a} = \circledast -1$

5. Reduce  $\frac{x^2-25}{5-x}$   $\frac{(x+5)(\cancel{x-5})}{-(x-5)}$   $\circledast -(x+5)$

6. Reduce  $\frac{2x^3+2x^2-24x}{x^3+2x^2-8x} = \frac{2x(x^2+x-12)}{x(x^2+2x-8)} = \frac{2x(x+4)(x-3)}{x(x+4)(x-2)} = \circledast \frac{2(x-3)}{x-2}$

## Multiplying and Dividing Expressions

1. Multiply  $\frac{8x^2}{27y^5} \cdot \frac{9y^3}{12x}$   $\circledast \frac{2x}{9y^2}$

2. Multiply  $\frac{x-3}{x^2-4} \cdot \frac{x+2}{x^2-6x+9}$   $\circledast \frac{1}{(x-2)(x-3)}$   
 $(\cancel{x+2})(x-2)$   $(x-3)(\cancel{x-3})$

3. Divide  $\frac{3(x-3)(x+5)(x-3)}{x^2-x-20} \cdot \frac{x^2+2x-15}{x^2-25}$

$$\frac{3(x-3)(x+5)(x-3)}{(x-5)(x+4)} \cdot \frac{(x+5)(x-5)}{(x+5)(x-5)} = \frac{3}{x+4}$$

4. Multiply  $(x^2-49)\left(\frac{x+4}{x+7}\right)$

$$(x-7)(x+7) \cdot \frac{(x+4)}{(x+7)} = (x-7)(x+4)$$

5. Multiply  $a(a+5)\left(\frac{a+4}{a^2-5a}\right)$

$$a(a+5) \cdot \frac{(a+4)}{a(a-5)} = (a+5)(a+4)$$

### Adding and Subtracting Expressions

1. Add  $\frac{-2(x+3)}{x^2-2x-3} + \frac{3(x+1)}{x^2-9}$

$$\frac{-2(x+3)}{(x-3)(x+1)} + \frac{3(x+1)}{(x+3)(x-3)} = \frac{-2x-6+3x+1}{(x-3)(x+1)(x-3)} = \frac{x-5}{(x-3)(x+1)(x-3)}$$

2. Add  $\frac{x}{x^2-1} + \frac{1}{x^2-1}$

$$\frac{x}{(x+1)(x-1)} + \frac{1}{(x+1)(x-1)} = \frac{x+1}{(x+1)(x-1)} = \frac{1}{x-1}$$

3. Subtract  $\frac{(x-5)(x+4)}{2x+10} - \frac{5(2)}{x^2-25}$

$$\frac{(x-5)(x+4)}{2(x+5)} - \frac{10}{(x+5)(x-5)} = \frac{x^2-x-30}{2(x+5)(x-5)} = \frac{(x-6)(x+5)}{2(x+5)(x-5)} = \frac{x-6}{2(x-5)}$$

4. Add  $\frac{5}{x} + \frac{3}{x}$

$$\frac{5}{x} + \frac{3}{x} = \frac{8}{x}$$

### Complex Expressions

1. Simplify  $\frac{3}{4} \cdot \frac{4}{5} \cdot \frac{2}{5}$

$$\frac{3}{4} \cdot \frac{4}{5} \cdot \frac{2}{5} = \frac{6}{5}$$

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

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

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

$$\frac{2x + \frac{2}{3} - 3}{x + \frac{1}{3}} = \frac{2x - \frac{7}{3}}{x + \frac{1}{3}} = \frac{\frac{6x-7}{3}}{\frac{3x+1}{3}} = \frac{6x-7}{3x+1}$$

4. Simplify  $\frac{x + \frac{1}{y}}{y + \frac{1}{x}}$

$$\frac{\frac{xy+1}{y}}{\frac{xy+1}{x}} = \frac{x}{y}$$

**Graphing Rational Functions**

REFER TO DESMOS OR GRAPHING CALC.

1. Graph each equation.

a.  $y = \frac{1}{x}$

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

2. Graph each equation.

a.  $y = \frac{6}{x-2}$

b.  $y = \frac{6}{x+2}$

3. Examine horizontal asymptotes.

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

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

## Rational Equations

1. Solve for a:  $\frac{6}{a-4} = \frac{3}{8}$

$$3(a-4) = 8(6)$$

$$3a - 12 = 48$$

$$3a = 60$$

$$a = 20 \quad \checkmark$$

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

$$3x + 2(x-2) = 6$$

$$3x + 2x - 4 = 6$$

$$5x = 10$$

$$x = 2$$

EXTRANEEDUS, SO NO SOLUTIONS

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

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

$$15 - [3(x-1)] = x-2$$

$$15 - 3x + 3 = x - 2$$

$$-4x = -20$$

$$x = 5 \quad \checkmark$$

4. Solve for x:  $3 + \frac{1}{x} = \frac{10}{x^2}$

$$\frac{3x^2}{x^2} + \frac{x}{x^2} = \frac{10}{x^2}$$

Factor or Q. Form.

$$3x^2 + x - 10 = 0$$

$$(3x-5)(x+2) = 0$$

~~UNUSUAL FACTOR~~

$$a = 3$$

$$b = 1$$

$$c = -10$$

$$\frac{-1 \pm \sqrt{1^2 - 4(3)(-10)}}{2(3)}$$

$$\frac{-1 \pm \sqrt{121}}{6}$$

$$\frac{-1 \pm 11}{6}$$

$$x = \frac{5}{3} \text{ or } -2$$

5. Solve for y:  $x = \frac{y-4}{y-2}$

$$x(y-2) = y-4$$

$$xy - 2x = y - 4$$

$$xy - y = 2x - 4$$

$$y(x-1) = 2x-4$$

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