

**Instructions:** All work must be shown in order to receive all points for all questions so practice showing all work. Practice **boxing your final answer**. Any answer that is a fraction must be in lowest terms and as mixed number for full credit. Since you can use a 5x8 notecard on the test use your notecard to practice or make one based on the problems you got wrong. Happy studying!

1. Find the domain of the rational expression. Give it in set builder notation for full credit. Show all work.

$$f(x) = \frac{x-5}{x^3 + 4x^2 - 9x - 36}$$

$$x^2(x+4) - 9(x+4) \quad D: \{x \mid x \in \mathbb{R}, x \neq \pm 3, -4\}$$

$$(x^2 - 9)(x+4)$$

$$(x-3)(x+3)(x+4)$$

$$\begin{array}{r} x-3 \neq 0 \\ +3 \quad +3 \\ \hline x \neq 3 \end{array} \quad \begin{array}{r} x+3 \neq 0 \\ -3 \quad -3 \\ \hline x \neq -3 \end{array} \quad \begin{array}{r} x+4 \neq 0 \\ -4 \quad -4 \\ \hline x \neq -4 \end{array}$$

$$\frac{x^2 - 81}{18 - 2x}$$

2. Simplify the rational expression.

$$= \frac{(x-9)(x+9)}{-2(x-9)} = \boxed{-\frac{x+9}{2}}$$

3. Divide. Make sure your answer is in simplest form.

$$\frac{7x-21}{x^2-11x+30} \div \frac{x^2-9}{x^2-3x-10}$$

$$\frac{7(x-3)}{(x-5)(x-6)} \cdot \frac{(x-5)(x+2)}{(x-3)(x+3)}$$

$$\frac{7(x-3)}{(x-5)(x-6)} \cdot \frac{(x-5)(x+2)}{(x-3)(x+3)} = \boxed{\frac{7(x+2)}{(x-6)(x+3)}}$$

4. Using the two functions find  $(f+g)(x)$

$$f(x) = \frac{2x+1}{x^2+2x-15} \quad \& \quad g(x) = \frac{3x-2}{2x^2-5x-3}$$

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

LCD =  $(x+5)(x-3)(2x+1)$

$9 \cdot 7 = 63$     $1 \cdot 63$   
 $3 \cdot 21$   
 $9 \cdot 7$   
 None different

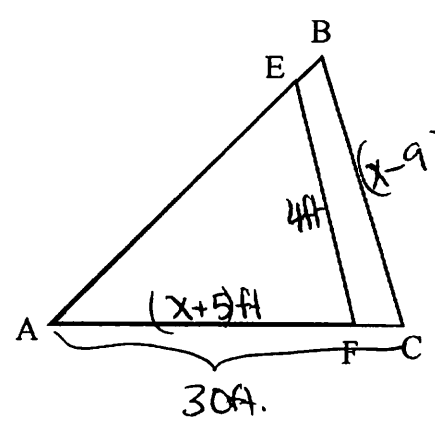
$$= \frac{4x^2+4x+1+3x^2+13x-10}{(2x+1)(x-3)(x+5)}$$

5. Simplify the following complex fractions. Show all work. Remember anything that can be factored must be even if it doesn't yield further simplification.

LCD =  $x+3$

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

4. Find  $x$  using your knowledge of similar triangles and then find the length of  $\overline{BC}$ . Show all work.



Large Triangle =  $\frac{BC}{EF} = \frac{AC}{AF}$

Small Triangle

So,  $\frac{x-9}{4} = \frac{30}{x+5}$

$$x^2 - 4x - 45 = 120$$

$165 = 1 \cdot 165$   
 $5 \cdot 33$   
 $3 \cdot 55$   
 $11 \cdot 15$

$$x^2 - 4x - 165 = 0$$

$$(x-15)(x+11) = 0$$

$x-15=0$   
 $+15 \quad +15$   
 $x=15$

~~$x+11=0$   
 $-11 \quad = -11$   
 $x=-11$~~

Extraneous

If  $BC = (x-9)$  feet &  $AC = 30$  feet While  $EF = 4$  feet and  $AF = (x+5)$  feet

$$BC = 15 - 9 = \boxed{6 \text{ ft.}}$$

5. Solve the problem using a variation setup not proportions. Round your final answer to the nearest tenth if necessary.

The intensity,  $I$  (in watts per square meter,  $W/m^2$ ), of a television signal varies inversely as the square of the distance  $d$  (in kilometers) from the transmitter. The intensity of the television signal is  $2.5 W/m^2$  at a distance of 10 km. Give a formula for the intensity and then use it to find the distance when the intensity is  $4 W/m^2$ . Note: Don't worry about the lack of agreement in distance units for intensity and distance.

① Translate

$$I = \frac{k}{d^2}$$

② Solve for  $k$  w/ 1<sup>st</sup> scenario

$$2.5 = \frac{k}{10^2}$$

$$k = (2.5)(100) = 250$$

③ Use  $k$  in formula

$$I = \frac{250}{d^2}$$

$$\frac{W}{m^2} = \frac{k}{m^2} \cdot m^2$$

$W = k$  Note!

④ Solve requested

$$4 = \frac{250}{d^2}$$

$$\frac{4}{4} d^2 = \frac{250}{4}$$

$$d^2 = 62.5$$

$$d = \pm \sqrt{62.5}$$

$$\approx \boxed{7.9 \text{ m}}$$

6. Solve. Box your final answers. Don't forget restrictions.

a)  $\frac{1}{x-2} + \frac{1}{x+2} = \frac{4}{x^2-4}$

Restrictions

$$x-2 \neq 0$$

$$x \neq 2$$

$$x+2 \neq 0$$

$$-2 \neq -2$$

$$x \neq -2$$

$$LCD = (x+2)(x-2)$$

$$x+2 + x-2 = 4$$

$$2x = 4$$

$$\frac{2x}{2} = \frac{4}{2}$$

$$x = 2$$

$\therefore$

**No Solution**

The negative doesn't make sense except that it could be in one of the other opposite direction.

b)  $\frac{5}{x+4} + \frac{3}{x+3} = \frac{12x+19}{x^2+7x+12}$

Restrictions

$$x+3 \neq 0$$

$$x \neq -3$$

$$x+4 \neq 0$$

$$x \neq -4$$

$$LCD = (x+3)(x+4)$$

Don't forget that these could be quadratic too!

$$5x+15 + 3x+12 = 12x+19$$

$$8x+27 = 12x+19$$

$$-8x \quad -8x$$

$$27 = 4x+19$$

$$-19 \quad -19$$

$$\frac{8}{4} = \frac{4x}{4}$$

$$x = 2$$

Not restricted

$$\therefore \boxed{x = 2}$$

7. Eli and Connor took a boat trip. They traveled 6 miles upstream against a 2 mile per hour current. They turned around and traveled back downstream along the same course, with the same current, to their starting point. Their entire trip took 4 hours. What was their rate in still water?

a) Set up a table to solve this problem.

$x = \text{rate of boat}$

	D	R	$T = D/R$
up	6mi	$x-2$	$\frac{6}{x-2}$
down	6mi	$x+2$	$\frac{6}{x+2}$

$T_u + T_D = 4$

$\frac{6}{x-2} + \frac{6}{x+2} = 4$

b) Write a function,  $T(x)$ , that indicates total time as a function of rate in still water,  $x$ .

$$T(x) = \frac{6}{x-2} + \frac{6}{x+2}$$

c) Give the representation of this problem using the function in b).

$$T(x) = 4 \text{ hr}$$

d) Solve this problem.

$$LCD = (x-2)(x+2)$$

$$\frac{6}{x-2} + \frac{6}{x+2} = 4$$

$$6(x+2) + 6(x-2) = 4(x+2)(x-2)$$

$$6x + 12 + 6x - 12 = 4x^2 - 16$$

The rate of the boat is 4mph

$$12x = 4x^2 - 16$$

$$4x^2 - 12x - 16 = 0$$

$$4(x^2 - 3x - 4) = 0$$

$$4(x-4)(x+1) = 0$$

$$x-4=0 \text{ or } x+1=0$$

$$x=4 \text{ or } x=-1$$

Check

$$\begin{aligned} \text{Time Up} &= \frac{6}{4-2} = \frac{6}{2} = 3 \text{ hr.} \\ \text{Time Down} &= \frac{6}{4+2} = \frac{6}{6} = 1 \text{ hr.} \end{aligned} \quad \left. \begin{array}{l} \\ \end{array} \right\} \text{Total} = 4 \text{ hr.}$$