

**Directions** Answer all questions in the space provided. Show all work and box your final answers. Answers with no work shown will not receive full credit. Good luck!

1. Compute and simplify the following.

(a)  $\frac{2}{\frac{2}{3}} - \frac{\frac{2}{3}}{2}$

$$\frac{2}{\frac{2}{3}} \cdot \frac{3}{3} - \frac{\frac{2}{3}}{2} \cdot \frac{3}{3} = \frac{6}{2} - \frac{2}{6}$$

$$= 3 - \frac{1}{3} = \frac{9}{3} - \frac{1}{3} = \boxed{\frac{8}{3}}$$

(b)  $\frac{\sqrt{48}}{\sqrt{3}} = \frac{\sqrt{16} \sqrt{3}}{\sqrt{3}} = \boxed{4}$

(c)  $(-27)^{-4/3} = \left( (-27)^{1/3} \right)^{-4} = (-3)^{-4} = \frac{1}{(-3)^4} = \boxed{\frac{1}{81}}$

2. Compute the product/quotient/sum/difference and simplify.

$$(a) x^{3/2} \left( \sqrt{x} - \frac{1}{\sqrt{x}} \right)$$

$$= x^{3/2} \left( x^{1/2} - x^{-1/2} \right) = x^{3/2 + 1/2} - x^{3/2 - 1/2}$$

$$= \boxed{x^2 - x}$$

$$(b) \frac{1}{x^2 - x - 6} - \frac{1}{x+2} - \frac{2}{x-3} \quad \text{LCD} = (x+2)(x-3)$$

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

$$= \frac{1 - x + 3 - 2x - 4}{(x+2)(x-3)} = \boxed{\frac{-3x}{(x+2)(x-3)}}$$

ALT:

$$(c) \frac{x^{-1} + y^{-1}}{(x+y)^{-1}}$$

$$= (x^{-1} + y^{-1})(x+y)$$

$$= x^{-1}(x+y) + y^{-1}(x+y)$$

$$= 1 + x^{-1}y + xy^{-1} + 1$$

$$= \boxed{2 + \frac{y}{x} + \frac{x}{y}}$$

OR

(SAME)

$$\left( \frac{1}{x} + \frac{1}{y} \right) (x+y)$$

$$\frac{y+x}{xy} \cdot (x+y)$$

$$\boxed{\frac{(x+y)^2}{xy}}$$

3. Solve each of the following equations by factoring.

(a)  $5x^3 - 40x^2 + 60x = 0$       GCF =  $5x$

$$5x(x^2 - 8x + 12) = 0$$

$$5x(x-6)(x-2) = 0$$

$$5x = 0 \quad x-6 = 0 \quad x-2 = 0$$

$$x = 0 \quad x = 6 \quad x = 2$$

$$\boxed{x = 0, 2, 6}$$

(b)  $3x^2 + 4 = -7x$

$$3x^2 + 7x + 4 = 0$$

$$(3x+4)(x+1) = 0$$

$$3x+4 = 0$$

$$x+1 = 0$$

$$3x = -4$$

$$x = -1$$

$$x = -\frac{4}{3}$$

$$\boxed{x = -\frac{4}{3}, -1}$$

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

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

$$(x^2 - 1)(x-4) = 0$$

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

$$x+1 = 0 \quad x-1 = 0 \quad x-4 = 0$$

$$x = -1$$

$$x = 1$$

$$x = 4$$

$$\boxed{x = \pm 1, 4}$$

4. Solve each of the following inequalities and express the solutions using interval notation.

(a)  $-2 < 8 - 2x \leq -1$

$$-10 < -2x \leq -9$$

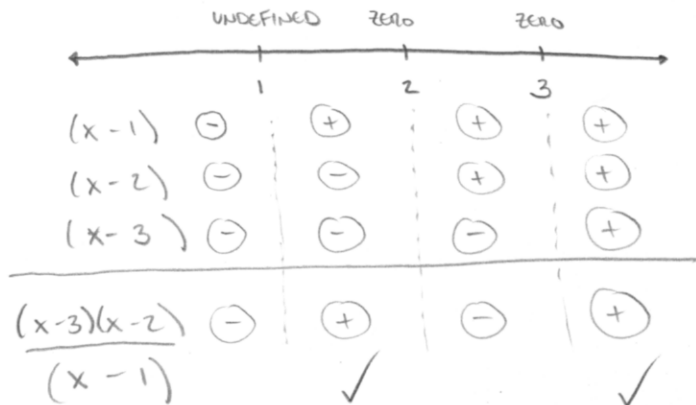
$$10 > 2x \geq 9$$

$$5 > x \geq \frac{9}{2}$$

$$\left[ \frac{9}{2}, 5 \right)$$

(b)  $\frac{x^2 - 5x + 6}{x - 1} \geq 0$

$$\frac{(x-3)(x-2)}{(x-1)} \geq 0$$



$$(1, 2] \cup [3, \infty)$$

(c)  $|3x + 2| < 4$

$$-4 < 3x + 2 < 4$$

$$-6 < 3x < 2$$

$$-2 < x < \frac{2}{3}$$

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

5. Find the center and radius of the circle described by the following equation.

$$x^2 + y^2 - 2x + 6y + 1 = 0$$

$$\begin{array}{ccccccc} x^2 - 2x & + & y^2 + 6y & = & -1 & & \\ & +1 & & +9 & & +1 & +9 \end{array}$$

$$(x-1)^2 + (y+3)^2 = 9$$

CENTER : (1, -3)
RADIUS : 3

6. Give an equation for the line that passes through the point  $(-1, -2)$  and is perpendicular to the line  $2x + 5y + 8 = 0$ .

$$5y = -2x - 8$$

$$y = -\frac{2}{5}x - \frac{8}{5}$$

↑

$$\text{SLOPE} = -\frac{2}{5}$$

$$\perp \text{ SLOPE} = \frac{5}{2}$$

pt-slope Form:

$$y - (-2) = \frac{5}{2}(x - (-1))$$

$y + 2 = \frac{5}{2}(x + 1)$
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OR

$y = \frac{5}{2}x + \frac{1}{2}$
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(SLOPE-INT. FORM)