

1. (a) **Evaluate** $x^2 - 2x$ if $x = -3$. Show the substitution correctly.

$$(-3)^2 - 2(-3) = 9 + 6 = \boxed{15}$$

(b) Name the property illustrated. Give the key word in full.

(i) $t + w = w + t$ Commutative property of addition

(ii) $a(wy) = (aw)y$ Associative property of multiplication

(iii) $a(w + y) = aw + ay$ Distributive property of multiplication over addition

2. (a) Find the **sum** of the polynomials: $3y^2 + 4y + 7$ and $y^2 - 5y + 11$

$$3y^2 + 4y + 7 + y^2 - 5y + 11 = \boxed{4y^2 - y + 18}$$

(b) Find the **difference** of the polynomials: $3y^2 + 4y + 7$ and $y^2 - 5y + 11$.

$$3y^2 + 4y + 7 - (y^2 - 5y + 11) = 3y^2 + 4y + 7 - y^2 + 5y - 11 = \boxed{2y^2 + 9y - 4}$$

(c) **Simplify** the expression $3(9 - 7x) + 7(4x + 3) = 3(9) - 3(7x) + 7(4x) + 7(3) =$

$$27 - 21x + 28x + 21 = \boxed{7x + 48.}$$

3. (a) Simplify $\frac{(x^2y^{-1})^{-5}}{(x^4y^{-3})^{-4}}$ and write with positive exponents only.

$$\frac{(x^2)^{-5}(y^{-1})^{-5}}{(x^4)^{-4}(y^{-3})^{-4}} = \frac{x^{-10}y^5}{x^{-16}y^{12}} = \frac{x^{-10}x^{16}}{y^{-5}y^{12}} = \boxed{\frac{x^6}{y^7}}$$

(b) Write the **product** in **scientific notation** $(3.5 \times 10^{35}) \times (8 \times 10^{27}) =$

$$3.5 \times 8 \times 10^{35} \times 10^{27} = 28 \times 10^{35+27} = 2.8 \times 10^1 \times 10^{62} = \boxed{2.8 \times 10^{63}.}$$

4. **Solve** the equations, and **check** your answer.

(a) $6x - 35 = 8(2x + 5)$ distribute: $6x - 35 = 16x + 40$, addition property: $6x - 16x = 40 + 35$,

collect like terms: $-10x = 75$, multiplication property : $x = 75/(-10)$, $x = -7.5.$

Check in original equation: $6(-7.5) - 35 = 8(2(-7.5) + 5)$, $-45 - 35 = 8(-10)$, $-80 = -80.$

4. (b) $\frac{3}{4}x + \frac{2}{3} = \frac{1}{6}x + 2$ Multiply by 12, the LCD of the fractional coefficients.

$$12\left(\frac{3}{4}x + \frac{2}{3}\right) = 12\left(\frac{1}{6}x + 2\right), \quad 12\left(\frac{3}{4}x\right) + 12\left(\frac{2}{3}\right) = 12\left(\frac{1}{6}x\right) + 6(2),$$

$$9x + 8 = 2x + 24, \quad 9x - 2x = 24 - 8, \quad 7x = 16, \quad x = \frac{16}{7}, \text{ or } 2\frac{2}{7}.$$

Check in original equation: $\frac{3}{4}\left(\frac{16}{7}\right) + \frac{2}{3} = \frac{1}{6}\left(\frac{16}{7}\right) + 2, \quad \frac{12}{7} + \frac{2}{3} = \frac{8}{21} + 2,$

$$\frac{36}{21} + \frac{14}{21} = \frac{8}{21} + \frac{42}{21}, \quad \frac{34}{21} = \frac{17}{15}, \quad \frac{50}{21} = \frac{50}{21}$$

5. (a) **Solve** for y in the equation $7x - 5y = 70.$ $-5y = 70 - 7x,$

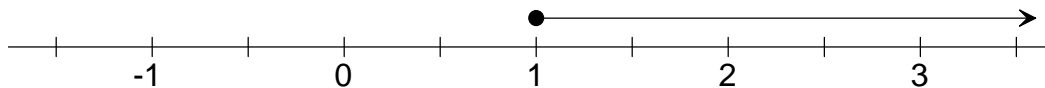
$$y = \frac{70 - 7x}{-5}, \text{ better: } y = \frac{7x - 70}{5}$$

(b) **Solve the inequality** $3x - 4 \leq 5x + 8, \quad 3x - 5x \geq 8 + 4,$

$$-2x \geq 12, \quad \frac{-2x}{-2} \leq \frac{12}{-2}, \quad x \leq -6$$

↑ Note: inequality is reversed here.

(c) **Graph the inequality** $1 \leq x$



6. Find the products

(a) $(5x + 4)(2x - 7) = (5x)(2x) + (5x)(-7) + 4(2x) + 5(-7) =$

$$10x^2 - 35x + 8x - 35 = 10x^2 - 27x - 35$$

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

$$9x^3 - 15x^2 - 6x + 12x^2 - 20x - 8 = 9x^3 - 3x^2 - 26x - 8$$

(c) $(3x + 7)^2 = (3x)^2 + 2(3x)(7) + 7^2 = 9x^2 + 42x + 49$

7. Find the **quotients**

(a)
$$\frac{6x^2y^2z - 12xy^3 + 9x^3y}{3xy} = \frac{6x^2y^2z}{3xy} - \frac{12xy^3}{3xy} + \frac{9x^3y}{3xy} = \boxed{2xyz - 4y^2 + 3x^2.}$$

(b) **long division**

$$\begin{array}{r}
 2x^2 - 2x - 2 \\
 x - 3 \overline{) 2x^3 - 8x^2 + 4x + 10} \\
 \underline{2x^3 - 6x^2} \\
 -2x^2 + 4x + 10 \\
 \underline{-2x^2 + 6x} \\
 -2x + 10 \\
 \underline{-2x + 6} \\
 4
 \end{array}$$

The quotient is $\boxed{2x^2 - 2x - 2 + \frac{4}{x-3}}$

Synthetic division
 can also be used:

$$\begin{array}{r|rrrrr}
 3 & 2 & -8 & 4 & 10 \\
 & & 6 & -6 & -6 \\
 \hline
 & 2 & -2 & -2 & 4
 \end{array}$$

IN THE FOLLOWING WORD PROBLEMS, SET UP AN APPROPRIATE EQUATION, SOLVE, CHECK, AND ANSWER WITH A SENTENCE.

8. The length of a rectangle is 2 meters more than 5 times the width. The perimeter of the rectangle is 64 meters. Find the dimensions of the rectangle, **using algebra**.

$$l = 5w + 2$$



$$P = 2(l + w), \quad 64 = 2(5w + 2 + w),$$

$$2(6w + 2) = 64, \quad 12w + 4 = 64, \quad 12w = 60,$$

$$w = 60 \div 12 = 5, \quad l = 5(5) + 2 = 27.$$

$$\text{Check: } 2(27 + 5) = 2(32) = 64.$$

$\boxed{\text{The rectangle is 5 meters by 27 meters.}}$

ELEMENTARY ALGEBRA TEST ONE FEB. 12, 2007 SOLUTIONS

SHOW ALL CALCULATIONS AND SIMPLIFY ANSWERS. PAGE 4 OF 4.

BEST EIGHT PROBLEMS COUNT, FOR A SCORE OUT OF 100.

9. One cyclist rides away at 8 miles per hour. 1.5 hours later another cyclist follows the first at 12 miles per hour. How long will it take the second cyclist to catch up with the first? How many miles has each cycled?

	Distance	Rate	Time
First cyclist	$8(t + 1.5)$	8	$t + 1.5$
2nd cyclist	$12t$	12	t

Let t be the 2nd cyclist's time in hours. The first left earlier and has a longer travel time.

$$12t = 8(t + 1.5),$$

$$12t = 8t + 12,$$

$$12t - 8t = 12,$$

$$4t = 12,$$

$$t = 12 \div 4 = 3,$$

$$t + 1.5 = 3 + 1.5 = 4.5.$$

$$\text{Check: } 8(t + 1.5) = 8(4.5) = 36, \quad 12t = 12(3) = 36$$

The second cyclist takes 3 hours to catch up. They each travel 36 miles.

(100 points, total.)