

Name KEY Date _____ Period _____

Worksheet 1.2—Factoring with Expressions & Equations

Show all work. Give simplified, exact values for all answers. **No Calculator**

I. Multiple Choice

- A 1. Which of the following equations is a solution to the equation $x(x+1) = 0$?
 (A) $x = 0, -1$ (B) $x = 0, 1$ (C) $x = -1$ only (D) $x = 0$ only (E) $x = 1$ only

$$\begin{aligned} x(x+1) &= 0 \\ x &= 0 \text{ or } x+1 = 0 \\ x &= 0 \text{ or } x = -1 \end{aligned}$$

- _____ 2. Which of the following represents an equation equivalent to the equation $\frac{2x}{3} + \frac{1}{2} = \frac{x}{4} - \frac{1}{3}$ that is cleared of fractions?

(A) $2x+1 = x-1$ (B) $8x+6 = 3x-4$ (C) $4x+3 = \frac{3}{2}x-2$
 (D) $4x+3 = 3x-4$ (E) $4x+6 = 3x-4$

$$\begin{aligned} 12 \left(\frac{2x}{3} + \frac{1}{2} \right) &= 12 \left(\frac{x}{4} - \frac{1}{3} \right) \quad \text{LCM} \\ 8x + 6 &= 3x - 4 \end{aligned}$$

- A 3. Which of the following is the complete factorization of $12x+2x^2-54$?
 (A) $2(x+9)(x-3)$ (B) $2(x-3)(x-9)$ (C) $(x+6)(2x-9)$ (D) $(2x+6)(x-9)$ (E) Prime

$$\begin{aligned} 12x + 2x^2 - 54 \\ 2x^2 + 12x - 54 \\ 2(x^2 + 6x - 27) \\ 2(x+9)(x-3) \end{aligned}$$

- C 4. What is a common factor of x^2-9 and x^2+x-6 ?
 (A) $x-3$ (B) x^2 (C) $x+3$ (D) $x-2$ (E) no common factor

$$\begin{aligned} x^2 - 9 &= (x-3)(x+3) \\ x^2 + x - 6 &= (x+3)(x-2) \end{aligned}$$

So, $x+3$ is a common factor

- D 5. In the equation $8m + 2 = 4m - 10$, $m =$
 (A) 1 (B) -1 (C) 3 (D) -3 (E) no solution

$$\begin{aligned} 8m + 2 &= 4m - 10 \\ 4m &= -12 \\ m &= -3 \end{aligned}$$

- B 6. Factor completely: $x^3 + 7x^2 - 7x - 49$
 (A) $(x^2 + 7)(x - 7)$ (B) $(x + 7)(x^2 - 7)$ (C) $(x^2 + 1)(x - 49)$
 (D) $(x^2 + 49)(x - 1)$ (E) $(x + 7)(x^3 - 7x)$

$$\begin{aligned} x^3 + 7x^2 - 7x - 49 \\ (x^3 + 7x^2) + (-7x - 49) \\ x^2(x + 7) - 7(x + 7) \\ (x + 7)(x^2 - 7) \end{aligned}$$

- E 7. Which of the following gives the complete factorization of $23x^2 - 8x + 3x^3$
 (A) $x(3x + 1)(x - 8)$ (B) $(3x - 8)(x + 1)$ (C) $(3x - 1)(x + 8)$
 (D) $x(3x - 1)(x - 8)$ (E) $x(3x - 1)(x + 8)$

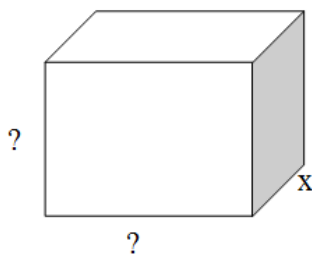
$$\begin{aligned} 23x^2 - 8x + 3x^3 \\ 3x^3 + 23x^2 - 8x \\ x(3x^2 + 23x - 8) \\ x(3x - 1)(x + 8) \end{aligned}$$

- C 8. The sum of twice an unknown, x , times itself added to seven times that unknown is -3 . Which of the following could be the value of the unknown x ?

- (A) -2 (B) 2 (C) -3 (D) 3 (E) $\frac{1}{2}$

$$\begin{aligned} 2x \cdot x + 7x &= -3 \\ 2x^2 + 7x + 3 &= 0 \\ (2x + 1)(x + 3) &= 0 \\ 2x + 1 = 0 \text{ or } x + 3 = 0 \\ x = -\frac{1}{2} \text{ or } x = -3 \end{aligned}$$

Use the following picture below to help answer questions 9 & 10. Each question is separate and unrelated to each other.



- D 9. The volume, V , of the rectangular prism shown is given by $V(x) = 2x^3 - 10x^2 + 12x$. If one side's length is given by x , which expression could be the product of the remaining two sides?

- (A) $(x+2)(2x-6)$ (B) $(x+2)(x-3)$ (C) $(x-2)(x-3)$
 (D) $(2x-4)(x-3)$ (E) $(2x-4)(2x-6)$

$$V = lwh = x \cdot P, \text{ where } P = lw$$

$$2x^3 - 10x^2 + 12x = Px$$

$$x(2x^2 - 10x + 12) = Px$$

$$\begin{aligned} \text{so } P &= 2x^2 - 10x + 12 \\ &= 2(x^2 - 5x + 6) \\ &= 2(x-3)(x-2) \end{aligned}$$

$$\begin{aligned} P &= [2(x-3)](x-2) \\ &\text{or} \\ &= (x-3)[2(x-2)] \\ P &= (2x-6)(x-2) \\ &\text{or} \\ &= (x-3)(2x-4) \end{aligned}$$

- D 10. The Surface area, S , of a similar (but different) rectangular prism as in Problem 9 is equal to 90 cm^2 and given by the function $S(x) = 22x^2 + 2x - 2$. If one of the side lengths is given by x cm, what is the length of this side?

- (A) $\frac{1}{2} \text{ cm}$ (B) 1 cm (C) $\frac{3}{2} \text{ cm}$ (D) 2 cm (E) 3 cm

$$22x^2 + 2x - 2 = 90$$

$$22x^2 + 2x - 92 = 0$$

$$2(11x^2 + x - 46) = 0$$

$$2(11x + 23)(x - 2) = 0$$

$$\begin{aligned} 11x + 23 &= 0 \quad \text{or} \quad x - 2 = 0 \\ x &= -\frac{23}{11} \quad \text{or} \quad x = 2 \text{ cm} \end{aligned}$$

← unreasonable

II. Short Answer

11. Solve the following equations for the indicated variable. Show all steps.

(a) $3(5z-3) - 4(2z+1) = 5z-2$

$$15z - 9 - 8z - 4 = 5z - 2$$

$$7z = 11$$

$$z = \frac{11}{7}$$

(b) $\frac{t+5}{8} + \frac{t-2}{2} = \frac{1}{3}$

$$24 \left(\frac{t+5}{8} + \frac{t-2}{2} \right) = \left(\frac{1}{3} \right) 24$$

$$3(t+5) + 12(t-2) = 8$$

$$3t + 15 + 12t - 24 = 8$$

$$15t = 17$$

$$t = \frac{17}{15}$$

12. Solve each quadratic equation for the indicated variable using the indicated method.

(a) $4x^2 + 3 = 8x$

$$\begin{aligned} 4x^2 - 8x + 3 &= 0 \\ (2x-3)(2x-1) &= 0 \\ 2x-3=0 \text{ or } 2x-1=0 \\ x=\frac{3}{2} \text{ or } x=\frac{1}{2} \end{aligned}$$

(b) $4x^2 = 25$

$$\begin{aligned} x^2 &= \frac{25}{4} \\ x &= \pm \sqrt{\frac{25}{4}} \\ x &= \pm \frac{5}{2} \end{aligned}$$

(c) $x(3x+11)=20$

$$\begin{aligned} 3x^2 + 11x - 20 &= 0 \\ (3x-4)(x+5) &= 0 \\ 3x-4=0 \text{ or } x+5=0 \\ x=\frac{4}{3} \text{ or } x=-5 \end{aligned}$$

(d) $7x = -5x^2$

$$\begin{aligned} 5x^2 + 7x &= 0 \\ x(5x+7) &= 0 \\ x=0 \text{ or } 5x+7=0 \\ x=0 \text{ or } x=-\frac{7}{5} \end{aligned}$$

13. The area of a rectangle is given by the expression $6x^2 + x - 1$. If the width of the rectangle is 2 units, then in terms of x , what is the simplified, expanded expression for the perimeter of this rectangle?



Area: $A = lw = 6x^2 + x - 1$

$$l = \frac{6x^2 + x - 1}{w}$$

Perimeter:

$$P = 2(l + w)$$

$$P = 2\left(\frac{6x^2 + x - 1}{w} + w\right)$$

for $w=2$

$$P = 2\left(\frac{6x^2 + x - 1}{2} + 2\right)$$

$$P = 6x^2 + x - 1 + 4$$

$$P = 6x^2 + x + 3$$

$$\text{So, } P(x) = 6x^2 + x + 3 \quad (\text{or } P(x) = A(x) + 4)$$

14. **Literal Equation:** A literal equation is an equation that has several letters as variables representing quantities. These formulas, as they're also called, can be manipulated to solve for any unknown. Solve each of the following literal equations for the indicated variable.

(a) $5am^2 = bm$ for $m \neq 0$

$$5am^2 - bm = 0$$

$$m(5am - b) = 0$$

$$\text{So, } m=0 \text{ or } 5am - b = 0$$

$$(m \neq 0) \text{ so, } 5am = b$$

$$m = \frac{b}{5a}$$

(b) $q + aq - bq - c = d$ for q

$$q + aq - bq = d + c$$

$$q(1 + a - b) = d + c$$

$$q = \frac{d + c}{1 + a - b}$$