

## Thinkwell's Placement Test 2 Answer Key

If you answered 7 or more Test 2 questions correctly, we recommend Thinkwell's Intermediate Algebra (Algebra 1). If you answered fewer than 7 Test 2 questions correctly, we recommend Thinkwell's Prealgebra.

### 1. Answer: $x > 71$

#### Explanation

Since the entire expression  $x - 8$  is being divided by 9, begin by multiplying each side of the inequality by 9 to undo the division. Then, simplify and solve the inequality.

$$\begin{aligned} -\frac{x-8}{9} &< -7 \\ 9\left(-\frac{x-8}{9}\right) &< 9(-7) && \text{Multiply both sides by 9.} \\ -(x-8) &< -63 && \text{Simplify.} \\ -x+8 &< -63 && \text{Distribute the negative.} \\ -x &< -71 && \text{Subtract 8 from both sides.} \\ x &> 71 && \text{Divide each side by } -1. \text{ Reverse the inequality symbol.} \end{aligned}$$

Note that the inequality symbol was reversed in the last step because the inequality was divided by a *negative* number.

This concept is covered in Thinkwell's Prealgebra lecture "Solving Two-Step Inequalities."

### 2. Answer: \$3,243.79

#### Explanation

Substitute 4000 for  $A$ , 0.0325 for  $r$ , 2 for  $n$  (since semiannually means 2 times each year), and 6.5 for  $t$  (since 78 months is

6 years and 6 months, or 6.5 years) in the compound interest formula,  $A = P \cdot \left(1 + \frac{r}{n}\right)^{n \cdot t}$ , and then solve for  $P$  to find the principal.

$$\begin{aligned} A &= P \cdot \left(1 + \frac{r}{n}\right)^{n \cdot t} && \text{Use the formula for} \\ &&& \text{compound interest.} \\ 4000 &= P \cdot \left(1 + \frac{0.0325}{2}\right)^{2 \cdot 6.5} && \text{Substitute.} \\ 4000 &= P \cdot (1.01625)^{13} && \text{Simplify.} \\ P &= \frac{4000}{(1.01625)^{13}} && \text{Divide each side} \\ &&& \text{by } 1.01625^{13}. \\ P &= 3243.78991\dots && \text{Simplify.} \end{aligned}$$

Round this amount to the nearest cent,  $\$3243.78991 \approx \$3243.79$ . So, the principal was about \$3,243.79.

This concept is covered in Thinkwell's Prealgebra lecture "Compound Interest."

### 3. Answer: $x$ -intercept $(-4, 0)$ , $y$ -intercept $(0, 2)$

#### Explanation

Substitute 0 into the equation for  $y$  and solve for  $x$  to find the  $x$ -coordinate of the  $x$ -intercept.

$$\begin{aligned} -x + 2y &= 4 && \rightarrow && -x + 2(0) = 4 \\ &&& && -x = 4 \\ &&& && x = -4 \quad \text{Thus, the } x\text{-intercept is } (-4, 0). \end{aligned}$$

Substitute 0 into the equation for  $x$  and solve for  $y$  to find the  $y$ -coordinate of the  $y$ -intercept.

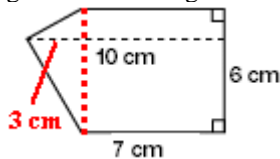
$$\begin{aligned} -x + 2y &= 4 && \rightarrow && -(0) + 2y = 4 \\ &&& && 2y = 4 \\ &&& && y = \frac{4}{2} = 2 \quad \text{Thus, the } y\text{-intercept is } (0, 2). \end{aligned}$$

This concept is covered in Thinkwell's Prealgebra lecture "Graphing Using Intercepts."

4. **Answer: 51 cm<sup>2</sup>**

Explanation

Divide the polygon into a rectangle and a triangle and then find the sum of the areas of those polygons.



The rectangle has length 7 cm and width 6 cm.

The base of the triangle is 3 cm and the height is 3 cm. Notice that the height of the triangle, 3 cm, can be found by subtracting 7 cm from 10 cm.

Find the area of each polygon.

$$\text{Rectangle: } A = (7)(6) = 42 \text{ cm}^2$$

$$\text{Triangle: } A = (1/2)(6)(3) = 9 \text{ cm}^2$$

Find the sum of the areas.  $42 \text{ cm}^2 + 9 \text{ cm}^2 = 51 \text{ cm}^2$

*This concept is covered in Thinkwell's Prealgebra lecture "Area of Composite Figures."*

5. **Answer: 12 cm**

Explanation

In the Pythagorean Theorem,  $a^2 + b^2 = c^2$ ,  $a$  and  $b$  represent the measures of the legs of a right triangle and  $c$  represents the measure of the right triangle's hypotenuse. (The hypotenuse is always the side opposite of the right angle, and it is always the longest side.) The measure of one leg is given to be 5 cm. Therefore, substitute 5 into the Pythagorean Theorem for  $a$ , or for  $b$ . Here, 5 will be substituted for  $a$ . The measure of the hypotenuse is given to be 13 cm. Therefore, substitute 13 for  $c$ .

$$a^2 + b^2 = c^2 \rightarrow 5^2 + b^2 = 13^2$$

Solve for  $b$  to find the measure of the other leg.  $5^2 + b^2 = 13^2$

$$25 + b^2 = 169 \quad \text{Evaluate the powers.}$$

$$b^2 = 144 \quad \text{Subtract 25 from both sides.}$$

$$\sqrt{b^2} = \sqrt{144} \quad \text{Take the square root of both sides.}$$

$$b = 12 \quad \text{Simplify.}$$

*This concept is covered in Thinkwell's Prealgebra lecture "Square Roots and the Pythagorean Theorem."*

6. **Answer:  $\frac{25n^6}{9m^6}$**

Explanation

Apply the following properties (rules) of exponents to simplify the expression. Power of a Power  $(a^m)^n = a^{m \cdot n}$

Power of a Product  $(ab)^n = a^n b^n$  Power of a Quotient  $\left(\frac{a}{b}\right)^n = \frac{a^n}{b^n}$  Negative Power of a Quotient  $\left(\frac{a}{b}\right)^{-n} = \left(\frac{b}{a}\right)^n$

$$\begin{aligned} \text{Simplify. } \left(\frac{3m^3}{5n^3}\right)^{-2} &= \left(\frac{5n^3}{3m^3}\right)^2 && \text{Negative Power of a Quotient Property} \\ &= \frac{(5n^3)^2}{(3m^3)^2} && \text{Power of a Quotient Property} \\ &= \frac{(5)^2 (n^3)^2}{(3)^2 (m^3)^2} && \text{Power of a Product Property} \\ &= \frac{5^2 n^{3 \cdot 2}}{3^2 m^{3 \cdot 2}} && \text{Power of a Power Property} \\ &= \frac{25n^6}{9m^6} && \text{Simplify the exponents and evaluate} \\ &&& \text{the powers with whole number bases.} \end{aligned}$$

*This concept is covered in Thinkwell's Prealgebra lecture "Quotient Properties of Exponents."*

7. **Answer:**  $j^4 - 12j^3 - 6j^2 + 8j$

Explanation

Distribute the negative to remove the 2nd set of parentheses. Then, combine the like terms by adding (or subtracting) the coefficients.

$$\begin{aligned} &(-j^4 - 4j^3 - 2j^2) - (-2j^4 + 8j^3 + 4j^2 - 8j) \\ &\quad -j^4 - 4j^3 - 2j^2 + 2j^4 - 8j^3 - 4j^2 + 8j \quad \text{Distribute the negative to the expression within the 2nd set of parentheses.} \\ &(-j^4 + 2j^4) + (-4j^3 - 8j^3) + (-2j^2 - 4j^2) + 8j \quad \text{Group the like terms.} \\ &\quad (j^4) + (-12j^3) + (-6j^2) + 8j \quad \text{Combine the like terms.} \\ &\quad j^4 - 12j^3 - 6j^2 + 8j \quad \text{Remove extraneous parentheses. Write addition of a negative as subtraction.} \end{aligned}$$

This concept is covered in Thinkwell's Prealgebra lecture "Adding and Subtracting Polynomials."

8. **Answer:**  $-6y^3z^7 + 3y^4z^6 - 12y^2z^4$

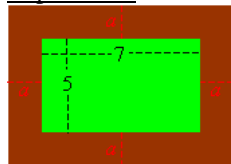
Explanation

$$\begin{aligned} &-3y^2z^3(2yz^4 - y^2z^3 + 4z) \\ &\quad (-3y^2z^3)(2yz^4) - (-3y^2z^3)(y^2z^3) + (-3y^2z^3)(4z) \quad \text{Distribute } -3y^2z^3 \text{ to each term in parentheses.} \\ &(-3 \cdot 2)(y^2 \cdot y)(z^3 \cdot z^4) - (-3 \cdot 1)(y^2 \cdot y^2)(z^3 \cdot z^3) + (-3 \cdot 4)(y^2)(z^3 \cdot z) \quad \text{Group the coefficients and the powers with like bases in each term.} \\ &\quad (-6)(y^{2+1})(z^{3+4}) - (-3)(y^{2+2})(z^{3+3}) + (-12)(y^2)(z^{3+1}) \quad \text{Multiply the coefficients and use the product of powers property.} \\ &\quad -6y^3z^7 + 3y^4z^6 - 12y^2z^4 \quad \text{Simplify the exponents.} \end{aligned}$$

This concept is covered in Thinkwell's Prealgebra lecture "Multiplying Monomials by Polynomials."

9. **Answer:**  $4a^2 + 24a$

Explanation



Find the total area (the frame and picture combined) and then find the area of the picture. Subtract the area of the picture from the total area to find the area of the frame only. Each figure is a rectangle, so the area is found by multiplying the length by the width.

The total area is the area of the large rectangle. The length of the large rectangle is  $7 + a + a$ , or  $7 + 2a$ . The width of the large rectangle is  $5 + a + a$ , or  $5 + 2a$ . Multiply these binomials,  $7 + 2a$  and  $5 + 2a$ , to find an expression for the area of the large rectangle.

$$\begin{aligned} A_{\text{large}} &= (7 + 2a)(5 + 2a) \\ &= 35 + 14a + 10a + 4a^2 \quad \text{FOIL} \\ &= 35 + 24a + 4a^2 \quad \text{Combine like terms.} \end{aligned}$$

The picture is the area of a  $5 \times 7$  unit rectangle. So, the length is 7 and the width is 5. Multiply to find the area of the small rectangle.

$$A_{\text{small}} = (7)(5) = 35 \text{ units}^2$$

Subtract the area of the small rectangle (the picture) from the area of the large rectangle (the total area).

$$A_{\text{frame}} = A_{\text{large}} - A_{\text{small}} = (35 + 24a + 4a^2) - 35 = 24a + 4a^2 = 4a^2 + 24a$$

This concept is covered in Thinkwell's Prealgebra lecture "Multiplying Binomials."

10. **Answer:**  $(x + 8)(x - 3)$

Explanation

To factor  $x^2 + 5x - 24$ , find two factors of  $-24$  whose sum is 5.

Write  $-24$  as a product of two factors.  $-24$  and 1 or 24 and  $-1$   
 $-12$  and 2 or 12 and  $-2$   
 $-8$  and 3 or  $8$  and  $-3$  *The sum of these factor is 5.*  
 $-6$  and 4 or 6 and  $-4$

Express as the product of two binomials.  $x^2 + 5x - 24 = (x + 8)(x - 3)$

This concept is covered in Thinkwell's Prealgebra lecture "Factoring Trinomials."