# • Analysis •

## 1. Correct Answer: $7x^3$

- The student was expected to know how to find the square root of an expression. In this case, he needed to find the square root of 49 (7) and the square root of $x^6$ ($x^3$ because $x^3 \cdot x3 = x^6$).

 *SKILL: Simplify a radical expression.*

## 2. Correct Answer: $x = 180$

- **Sample Solutions:**

**1.**

$$\begin{aligned} 8 &= 0.03x + 2.6 \\ 8 - 2.6 &= 0.03x \\ 5.4 &= 0.03x \\ 5.4 \div 0.03 &= x \\ 180 &= x \end{aligned}$$

**2.**

$$\begin{aligned} 8 &= 0.03x + 2.6 \\ 100(8) &= 100(0.03x + 2.6) \\ 800 &= 3x + 260 \\ 800 - 260 &= 3x \\ 540 &= 3x \\ 540 \div 3 &= x \\ 180 &= x \end{aligned}$$

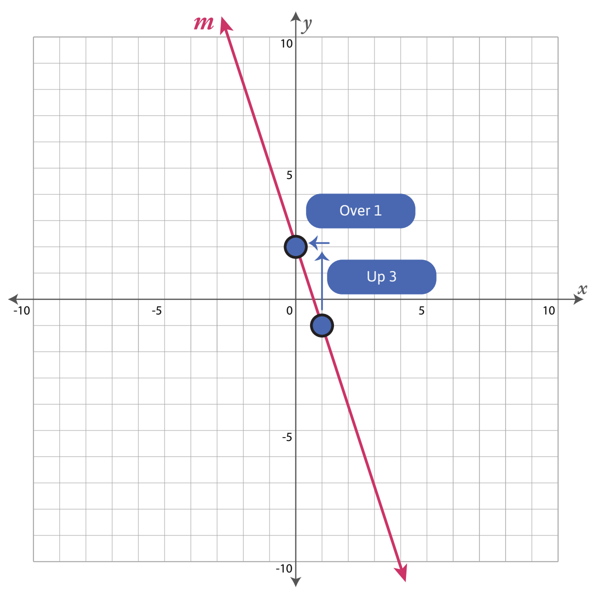
- The student needs to be able to solve two-step equations with decimal and fractional values.

 *SKILL: Solve a two-step equation involving decimal numbers.*

## 3. Correct Answer: $y = -3x + 2$

- The student needed to use the standard formula for a line, $y = mx + b$, where $m$ = the slope of the line and $b$ = the $y$-intercept. He needed to choose any two points on the graph, such as (1, -1) and (0, 2), and either count over and up (as shown here) or subtract the $y$ values and the $x$ values to find the slope:

 - 2–(-1) = 3; 0 – 1 = -1
 - slope ($m$) = $\frac{3}{-1}$ = -3




- Next, the student needed to find the $y$-intercept. The graph crosses the $y$-axis at +2. Substituting the slope and $y$-intercept into the standard formula, the equation of the graph becomes $y = -3x + 2$.

 *SKILL: Write an equation for a graph.*

### 4. Correct Answer: $y = \frac{1}{4}x - 1$

- Write the equation of a line that is perpendicular to the graph of the line created by $y = -4x - 1$ and goes through the point (0, -1).
- The student needed to know that perpendicular lines have slopes that are reciprocals (multiplicative inverses) of one another and have opposite signs. Since the slope of the original line was -4 (the number next to the variable), the slope of the new line must be the reciprocal with the opposite sign: . There are many lines that can be perpendicular to the given line, so it was important to know that the new line goes through the point (0, -1), which is the $y$-intercept. Using the standard formula for a line ($y = mx + b$), the equation of the new line would be $y = \frac{1}{4}x - 1$.

*SKILL: Write the equation for a line that is perpendicular to a given line.*

### 5. Correct Answer: $x = 5$ and $y = 3$ OR (5, 3)

- **Sample Solutions:**

**1.**

$$\begin{aligned} y &= 8 - x \\ 2x - (8 - x) &= 7 \\ 2x - 8 + x &= 7 \\ 3x - 8 &= 7 \\ 3x &= 15 \\ x &= 5 \\ 5 + y &= 8 \\ y &= 3 \\ &(5,\ 3) \end{aligned}$$

**2.**

$$\begin{cases} x + y = 8 \\ 2x - y = 7 \end{cases}$$

$$\begin{aligned} 3x + 0y &= 15 \\ 3x &= 15 \\ x &= 5 \\ 5 + y &= 8 \\ y &= 3 \\ &(5,\ 3) \end{aligned}$$

**3.**

$$\begin{cases} 2x + 2y = 16 \\ 2x - y = 7 \end{cases}$$

$$\begin{aligned} 0x + 3y &= 9 \\ 3y &= 9 \\ y &= 3 \\ x + 3 &= 8 \\ x &= 5 \\ &(5,\ 3) \end{aligned}$$

- In the first solution, the first equation was rewritten to isolate the variable $y$. The value of $y$ $(8 - x)$, could then be substituted into the second equation to find the value of $x$ (5). Once this was done, the value of $x$ was substituted back into the first equation to find the value of $y$ (3).
- In the second solution, the two equations were added together, term by term. The $y$ and $-y$ gave a sum of zero, which enabled the student to find the value of $x$ (5). Once this was done, the value of $x$ was substituted back into the first equation to find the value of $y$ (3).
- In the third solution, each term in the first equation was multiplied by 2. The second equation was subtracted from the first equation, term by term, enabling the student to find the value of $y$ (3). This was substituted back into the first equation to find the value of $x$ (5).

*SKILL: Solve a system of equations.*

## 6. Correct Answer: -10, -8, and -6

**1.** The student should have named the three integers using variables. If the first integer is $n$, the second must be $n + 2$ because the integers are odd and therefore two numbers apart. This means the third integer is four numbers apart from the original and can be named as $n + 4$.

The student was expected to write an equation to represent the problem, using these expressions for the integers.

| *the sum of the first two integers* | *equals* | *three times the third* |
|---|---|---|
| $n + (n + 2)$ | = | $3(n + 4)$ |

$$2n + 2 = 3n + 12$$
$$2n = 3n + 10$$
$$-n = 10$$
$$n = -10$$

**2.** The student should then have solved for the variable $n$.

$$n = -10$$
$$n + 2 = -10 + 2 = -8$$
$$n + 4 = -10 + 4 = -6$$

**3.** The student should have used this information to find the other two integers.

- The three integers are -10, -8, and -6.

*SKILL: Solve a problem involving consecutive integers.*

## 7. Correct Answer: $2x^2 - 7x - 15$

- **Possible Solutions:**

**1.** The student could have used the Distributive Property to multiply each term in the first binomial by the second binomial.

$$(2x + 3)(x - 5) = 2x(x - 5) + 3(x - 5) = (2x^2 - 10x) + (3x - 15) = 2x^2 - 7x - 15$$

**2.** The student could have used the FOIL strategy (multiply first terms together, outer terms, inner terms, and last terms).

$$(2x + 3)(x - 5) = 2x(\mathrm{x}) + 2x(-5) + 3(x) + 3(-5) = 2x^2 - 10\mathrm{x} + 3x - 15 = 2x^2 - 7x - 15$$

*SKILL: Multiply binomials.*

## 8. Correct Answer: $4(x + 3)(x - 3)$

- **Possible Solutions:**

**1.** Recognize that $4x^2 - 36$ is the difference of two squares.

$$4x^2 - 36 = (2x + 6)(2x - 6) = 2(x + 3) \cdot 2(x - 3) = 4(x + 3)(x - 3)$$

**2.** Factor out the greatest common factor (4) and then find the difference between two squares.

$$4x^2 - 36 = 4(x^2 - 9) = 4(x + 3)(x - 3)$$

*SKILL: Factor a polynomial.*

## 9. Correct Answer: $x$ = -3, $x$ = -1 or $x$ = {-3, -1}

- **Sample Solutions:**

**1.**

$$\begin{aligned} 2x^2+8x-6&=-12\\ x^2+4x-3&=-6\\ x^2+4x+3&=0\\ (x+3)(x-1)&=0\\ &\begin{cases} x+3=0; x=-3\\ x+1=0; x=-1\end{cases}\\ x&=\{-3,-1\}\end{aligned}$$

**2.**

$$\begin{aligned} 2x^2+8x-6&=-12\\ 2x^2+8x+6&=0\\ x^2+4x+3&=0\\ (x+3)(x-1)&=0\\ &\begin{cases} x+3=0; x=-3\\ x+1=0; x=-1\end{cases}\\ x&=\{-3,-1\}\end{aligned}$$

**3.**

$$\begin{aligned} 2x^2+8x-6&=-12\\ 2x^2+8x+6&=0\\ (2x+6)(x+1)&=0\\ &\begin{cases} 2x+6=0; x=-3\\ x+1=0; x=-1\end{cases}\\ x&=\{-3,-1\}\end{aligned}$$

- In the first solution, the equation was simplified by dividing all terms by the common factor of 2. Then 6 was added to both sides to set the equation equal to zero. The polynomial was factored into two binomials, each of which was set equal to zero. This gave the two possible solutions of -3 and -1.
- In the second solution, 12 was added to both sides to set the equation equal to zero. Then the common factor of 2 was divided out, and the polynomial was factored into two binomials, as in the first solution.
- In the third solution, 12 was also added to both sides to set the equation equal to zero. Then the resulting polynomial was factored into two binomials. Both were set equal to zero, resulting in the same two solutions: -3 and -1.

*SKILL: Factor a polynomial to solve an equation.*

## 10. Correct Answer:

- **Sample Solutions:**

**1.**

$$\left(81^{\frac{1}{2}}\right)^{-3}=\left(\sqrt{81}\right)^{-3}=9^{-3}=\frac{1}{9^3}=\frac{1}{729}$$

**2.**

$$\left(81^{\frac{1}{2}}\right)^{-3}=\left((9^2)^{\frac{1}{2}}\right)^{-3}=9^{-3}=\frac{1}{9^3}=\frac{1}{729}$$

**3.**

$$\left(81^{\frac{1}{2}}\right)^{-3}=\frac{1}{\left(81^{\frac{1}{2}}\right)^3}=\frac{1}{(9)^3}=\frac{1}{729}$$

- In the first solution, the student recognized that $81^{\frac{1}{2}}$ means the square root of 81, which is 9. Then he recognized that a negative exponent meant that he needed to find the inverse of $9^3$ (729).
- In the second solution, the student rewrote 81 as $9^2$. When he raised $9^2$ to the ½ power, he multiplied the exponents, giving $9^1$, or 9. Then he recognized that a negative exponent meant that he needed to find the inverse of $9^3$ (729).
- In the third solution, the student first rewrote the negative exponent as the inverse. Then he simplified by finding the square root of 81 (9) and raising it to the third power.

*SKILL: Evaluate an expression with exponents.*

## 11. Correct Answer: $\frac{100\text{ cm}}{1\text{ m}}$

- The student was expected to know the relationship between meters and centimeters: 1 m = 100 cm. Since the measurement being changed is in meters, the ratio needs to have meters underneath in order to cancel out the unit. If the student had been asked to complete the calculation, the solution would have looked like this:

  *SKILL: Use a unit multiplier to convert measurements.*

  $$5.2\text{m}\cdot\frac{100\text{ cm}}{1\text{ m}}=\frac{5.2\ \cancel{\text{m}}\cdot 100\text{ cm}}{1\ \cancel{\text{m}}}=520\text{ cm}$$

## 12. Correct Answer: $2.5\cdot 10^{-4}$

- In order to solve this problem, the student needed to understand that scientific notation is a rewriting of a number in exponential notation, using the place value of the first nonzero digit. In this case, the first nonzero digit is 2, and it is in the ten-thousandths place. In other words, the number could be rewritten as $2.5\cdot\frac{1}{10{,}000}$ or $2.5\cdot 0.0001$. Since the power of ten is shown as a fraction or decimal, the exponent must be negative, which means it would be rewritten as $10^{-4}$.

  *SKILL: Write a number in scientific notation.*

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**13. A student who has mastered the prerequisite concepts should be able to complete the written assessment in about 45 minutes.**

**14. A student who has mastered the prerequisite concepts should feel confident in his or her ability to solve the problems and should not need to ask for assistance.**