1. If $y \neq 0$, when $\frac{x^2}{y} = 5$, $25y^2 - x^4 = ?$

A. -25
B. -24
C. 0
D. 24
E. 25

2. If $x, y,$ and z are nonzero real numbers and $2xy - z = yz$, which of the following equations for x must always be true?

A. $x = zy + y + 2$

B. $x = 2yz - y$

C. $x = \sqrt{yz} - y$

D. $x = \frac{yz - z}{2y}$

E. $x = \frac{yz + z}{2y}$

3. For the equation $4x - 3a = -b$, which of the following expressions gives x in terms of a and b?

A. $\frac{3a-4}{b}$

B. $\frac{3a-b}{4}$

C. $\frac{3a+4}{4}$

D. $\frac{-b-3a}{4}$

E. $3a - b - 4$

4. Which of the following is $3(m+n)^2 = 13$ solved for n?

A. $\pm\sqrt{\frac{13}{3}} - m$

B. $\pm\sqrt{\frac{13}{3}} + m$

C. $\pm\sqrt{\frac{3}{13}} + m$

D. $\pm\sqrt{\frac{13}{3} - m}$

E. $\pm\sqrt{\frac{3}{13}} - m$

5. If $x = 6z$ and $y = 15z$, which of the following is the relationship between x and y for each nonzero value of z?

A. $x = 2x - 1$

B. $y = 5y$

C. $x = y$

D. $x = \frac{2}{5}y$

E. $y = \frac{2}{5}x$

6. If $\sqrt{\left(14 - \sqrt{x}\right)} = 3 - \sqrt{5}$, then $x = ?$

A. 0
B. 20
C. 25
D. 30
E. 180

7. For all nonzero $a, b,$ and c such that $2a = \frac{b}{c}$, which of the following *must* be equivalent to ab?

A. $\frac{c}{2a}$

B. $2ac^2$

C. $\frac{b^2}{2c}$

D. $\frac{a^2}{2c}$

E. $\frac{2c}{b}$

8. The relation between enthalpy and energy is $H = E + 8.31nT$, where H is the change in enthalpy, E is the change in energy, n is the change in moles, and T is the change in temperature. Which of the following expressions gives n in nonzero terms of H, E, and T?

A. $\frac{H-E}{8.31}$

B. $\frac{8.31T}{H-E}$

C. $\frac{H-E}{8.31T}$

D. $8.31E(H-T)$

E. $8.31T\left(H-E\right)$

9. Which of the following is *not* true for all (m,n) that satisfy the equation $\frac{n}{2}=\frac{m}{3}$ for $n, m \neq 0$?

A. $\frac{m}{2}=\frac{n}{2}$

B. $3n=2m$

C. $m=\frac{3}{2}n$

D. $n+m=\frac{5}{2}m$

E. $n \neq m$

10. If $x-y \neq 0$ and $\frac{3y+5x}{x-y}=\frac{5}{7}$, then $\frac{y}{x}=?$

A. $\frac{-15}{13}$

B. $\frac{15}{8}$

C. $\frac{5}{7}$

D. $\frac{12}{43}$

E. 3

11. If $\frac{2y-3x}{4y-5x}=\frac{3}{10}$, then $\frac{y}{x}=?$

A. $\frac{15}{8}$

B. $\frac{16}{30}$

C. $\frac{3}{10}$

D. $\frac{3}{16}$

E. 3

12. When $y=-x^3$, which of the following expressions is equal to $\frac{1}{y}$?

A. $\frac{1}{-x^3}$

B. x^{-3}

C. $\frac{1}{-x^{-3}}$

D. $\frac{1}{-x}$

E. $-x^3$

13. Given that $A, B, C,$ and D are all positive real numbers satisfying $A^2=\frac{1}{2}B^2$, $C=D$, and $B=\sqrt{D}$, which of the following equations is NOT necessarily true?

A. $B^2=C$

B. $A=\sqrt{\frac{1}{2}D}$

C. $A=\frac{1}{2}D$

D. $A^2=\frac{1}{2}C$

E. $A=\frac{\sqrt{2}}{2}B$

14. For all real numbers x and y such that x is the quotient of y divided by 5, which of the following represents the difference of y and 5 in terms of x?

A. $x-5$

B. $\frac{x}{5}-5$

C. $5x-5$

D. $5(x-5)$

E. $\frac{x-5}{5}$

15. The area of a rectangle is A square units. The length is l units, and the width $5n+3$ units longer than l. What is n in terms of A and l?

A. $n=\dfrac{A-l^2-3l}{5l}$

B. $n=\dfrac{l^2+3l-A}{5l}$

C. $n=\dfrac{A-3l}{5l}$

D. $n=\dfrac{A-l-3}{5l}$

E. $n=\dfrac{A-3l}{5}$

ANSWER KEY

1. C **2. E** **3. B** **4. A** **5. D** **6. E** **7. C** **8. C** **9. A** **10. A** **11. A** **12. A** **13. C** **14. C** **15. A**

ANSWER EXPLANATIONS

1. **C.** We wish to write one variable in the terms of the other. For this problem, it is easier to write y in terms of x. We are given $\frac{x^2}{y}=5$, so multiplying by y on both sides and dividing by 5 on both sides gives us $\frac{x^2}{5}=y$. Now we can substitute in $y=\frac{x^2}{5}$ into the equation $25y^2-x^4$. This is equal to $25\left(\frac{x^2}{5}\right)^2-x^4=25\left(\frac{x^4}{25}\right)-x^4 \rightarrow x^4-x^4=0$.

2. **E.** We wish to write x in terms of y and z, so our goal is to move the equation around so that x is on a side by itself. We do this by first adding z to both sides of the equation, giving us $2xy=yz+z$. Then, we divide both sides by $2y$, giving us $x=\frac{yz+z}{2y}$.

3. **B.** We wish to write x in terms of a and b, so our goal is to move the equation around so that x is on a side by itself. We do this by first adding $3a$ to both sides of the equation, giving us $4x=3a-b$. Then, we divide both sides by 4, giving us $x=\frac{3a-b}{4}$.

4. **A.** We wish to write n in terms of m, so our goal is to move the equation around so that n is on a side by itself. We do this by first dividing both sides by 3, giving us $(m+n)^2=\frac{13}{3}$. Then, taking the square root of both sides gives us $m+n=\pm\sqrt{\frac{13}{3}}$. Finally, subtracting m on both sides gives us $n=\pm\sqrt{\frac{13}{3}}-m$.

5. **D.** To solve this, we want to first write z in terms of y so we can plug in that expression into the variable z to evaluate x in terms of y. So, our first step is to write z in terms of y by dividing both sides of the second equation by 15. This gives us $\frac{y}{15}=z$. Now, we plug in $\frac{y}{15}$ for the z value in $x=6z$ to get $x=6\left(\frac{y}{15}\right) \rightarrow \frac{2y}{5} \rightarrow \frac{2}{5}y$.

6. **E.** We want to isolate x, so we first square both sides of the equation. This gives us $14-\sqrt{x}=\left(3-\sqrt{5}\right)^2$. FOILing out the right side of the equation, we get $14-\sqrt{x}=9-6\sqrt{5}+5$. Subtracting 14 on both sides, we get $-\sqrt{x}=-6\sqrt{5}$. Squaring both sides gives us $x=6^2*5=36*5=180$.

7. **C.** Dividing $2a=\frac{b}{c}$ by 2 on both sides, we get $a=\frac{b}{2c}$. To solve for the value of ab, we can plug in $a=\frac{b}{2c}$ into ab to get $ab=\frac{b}{2c}(b)\text{g}\frac{b^2}{2c}$.

8. **C.** Subtracting E from both sides of the equation, we get $H-E=8.31nT$. Dividing both sides of the equation by $8.31T$, we get $\frac{H-E}{8.31T}=n$.

9. **A.** Multiplying the equation, we get $3n = 2m$, which eliminates answer choice (B). Dividing both sides of $3n = 2m$ by 2 gives us $\frac{3n}{2} = m$, which eliminates answer choice (C). Dividing both sides of $3n = 2m$ by 3 gives us $\frac{2m}{3} = n$, and adding m to both sides to this equation gives us $\frac{2m}{3} + m = n + m \rightarrow \frac{2m}{3} + \frac{3m}{3} = n + m \rightarrow \frac{5m}{3} = n + m$, which eliminates answer choice D. For all values of n and m not equal to zero, answer choice E is true. Lastly, Answer choice A is false for all values of n and m except when n and m both equal 0, but the problem states that $n, m \neq 0$. So, the only answer that is false is A.

10. A. Cross-multiplying the equation, we get $(3y + 5x)7 = (x - y)5$. Distributing the 7 and 5, we get $21y + 35x = 5x - 5y$. Now, we subtract $5x$ from both sides to get $21y + 30x = -5y$. Then, we subtract $21y$ from both sides to get $30x = -26y$. To find the value of we can divide both sides by x to get $30 = \frac{-26y}{x}$. Then divide both sides by -26, which is $-\frac{30}{26} = \frac{y}{x}$. $-\frac{30}{26}$ simplifies to $-\frac{15}{13}$.

11. A. Cross-multiplying the equation, we get $10(2y - 3x) = 3(4y - 5x)$. Distributing out the x and 3, we get $20y - 30x = 12y - 15x$. Combining like terms, we get $8y = 15x$. Dividing both sides by 8, we get $y = \frac{15x}{8}$. Then finally, to find the value of $\frac{y}{x}$, we divide both sides of the equation by x to get $\frac{y}{x} = \frac{15}{8}$.

12. A. Since $y = -x^3$, $\frac{1}{y} = \frac{1}{-x^3}$ by plugging in $y = -x^3$ in the denominator.

13. C. Since $B = \sqrt{D}$ and $C = D$, then by substitution, $B = \sqrt{C} \rightarrow B^2 = C$ so answer choice (A) is true. Since $A^2 = \frac{1}{2}B^2$ and $B = \sqrt{D}$, by substitution, $A^2 = \frac{1}{2}\sqrt{D}^2 \rightarrow A^2 = \frac{1}{2}D \rightarrow A = \sqrt{\frac{1}{2}D}$ so answer choice (B) is true. Since answer choice (B) is always true, answer choice (C) is not always true unless $A = 1$ so the correct answer is (C). Verifying that the rest of the answer choices are always true, we see that from answer choice (B) we know that $A = \sqrt{\frac{1}{2}D}$ and $D = C$, so $A = \sqrt{\frac{1}{2}C} \rightarrow A^2 = \frac{1}{2}C$ and answer choice (D) is true. Lastly, since $A^2 = \frac{1}{2}B^2$, taking the square root on both sides, answer choice (E) is true: $A = \frac{B}{\sqrt{(2)}} = \frac{\sqrt{2}}{2}B$.

14. C. x is the quotient of y divided by 5, which means $x = \frac{y}{5} \rightarrow 5x = y$. The difference between y and 5, using our new expression for y, is $5x - 5$.

15. A. The width of the rectangle is $l + 5n + 3$. The area of the rectangle, A, is $l(l + 5n + 3)$. Distributing gives us $l^2 + 5nl + 3l = A$. We isolate the term containing n: $5nl = A - l^2 - 3l$. Finally, isolate n: $n = \frac{A - l^2 - 3l}{5l}$.