

1. **Level:** Easy | **Domain:** ALGEBRA

Skill/Knowledge: Linear equations in two variables | **Testing point:** Converting English to Algebra to create a two variable equation

Key Explanation: Choice A is correct. She burns 20 calories when she walks every minute. Therefore, she burned $20x$ calories after x minutes. She also burns 35 calories every minute she cycles and therefore burns $35y$ calories after y minutes. The equation would therefore be $20x + 35y = 340$. Subtracting $20x$ from both sides of this equation yields
 $35y = 340 - 20x$.

Distractor Explanation: Choice B is incorrect because it states that the difference between the calories burned from cycling and burned from walking is equal to 340. Choice C and Choice D are incorrect. The rate of 20 calories per minute can only be multiplied by x minutes of walking. And the rate of 35 calories per minute can only be multiplied by y minutes of cycling.

2. **Level:** Easy | **Domain:** PROBLEM-SOLVING AND DATA ANALYSIS

Skill/Knowledge: Two-variable data: models and scatterplots | **Testing point:** Identifying points on a scatter plot

Key Explanation: Choice B is the correct answer because the number of dots that have a higher value than the line of best fit are the dots above the line i.e 6.

Distractor Explanation: Choice A is incorrect as this is the number of dots on the graph. Choice C is incorrect as this is the number of dots below the line of best fit. Choice D is incorrect; it may be a conceptual error or lack of understanding of the question.

3. **Level:** Easy | **Domain:** ADVANCED MATH
Skill/Knowledge: Nonlinear functions | **Testing point:** Using the remainder theorem

Key Explanation: Choice B is correct. The remainder theorem states that if $f(x)$ is divided by $x-a$, the remainder would be $f(a)$. Therefore when $f(a) = 0$, then $x-a$ is a factor of the function $f(x)$. In this case, $f(3) = 0$, therefore $x-3$ is a factor of the equation $f(x)$.

Distractor Explanation: Choices A, C, and D are incorrect. Based on the table, dividing $(x+2)$, x , or $(x-5)$ from $f(x)$ will not yield a remainder of 0.

4. **Level:** Easy | **Domain:** ALGEBRA
Skill/Knowledge: System of two linear equations in two variables. | **Testing point:** Solving for one variable in a system of linear equations

Key Explanation: Simplify the first equation by using the distributive property which yields $t - 5 + 2s - 6 = 8$. Adding 5 and 6 to both sides of the equation yields $t + 2s = 19$. Simplify the second equation by using the distributive property which yields $2t - 10 - 3s + 9 = -19$. Adding 10 and subtracting 9 from both sides of the equation yields $2t - 3s = -18$. To find the value of s , use the elimination method and multiply -2 by the first equation. This yields $-2t - 4s = -38$. Then, add the two equations which yield $-7s = -56$. Dividing -7 from both sides of the equation yields $s = 8$.

5. **Level:** Easy | **Domain:** ALGEBRA
Skill/Knowledge: Linear equations in one variable
Testing point: Solving linear equations in one variable

Key Explanation: Choice D is correct. Simplify the equation by using distributive property, which yields

$$3x - 6 - 2x + 2 = -x + 2x + 4 - 8.$$

Combining like terms yields $x - 4 = x - 4$. This

shows that the equation is the same on both sides. So, any value of x makes the equation true. Therefore, the equation has infinitely many solutions.

Distractor Explanation: **Choice A** is incorrect because to have no solutions, solving the equation will result in a false statement. **Choice B** is incorrect because to have one solution, solving the equation will yield x equal to a number. **Choice C** is incorrect because linear equations do not have 2 solutions.

6. **Level:** Hard | **Domain:** ADVANCED MATH
Skill/Knowledge: Equivalent expressions |
Testing point: Converting between exponents and radicals

Key Explanation: **Choice B** is correct. To simplify the variable with different exponents, add the exponents of $g^{\frac{4}{5}}$ and $g^{\frac{2}{5}}$ which yields $g^{\frac{6}{5}}$. Making 2 have the same exponent as g yields $32^{\frac{1}{5}} \cdot g^{\frac{6}{5}}$.

Putting them inside the radical sign yields $\sqrt[5]{32g^6}$

Distractor Explanation: **Choice A** is incorrect because the 2 did not have any exponent and thus should have been left outside the root or converted to the fifth. **Choice C** and **Choice D** are incorrect and may result from interchanging the numerator and denominator of the exponent.

7. **Level:** Medium | **Domain:** PROBLEM-SOLVING AND DATA ANALYSIS
Skill/Knowledge: Inference from sample statistics and margin of error | **Testing point:** Finding the margin of error

Key Explanation: To find the margin of error, first find the midpoint of the sample mean mass.

This yields $\frac{120+182}{2} = 151$. The margin of error

would be the difference between the midpoint and either of the sample mean masses. Subtracting 151 from 182 yields 31.

8. **Level:** Hard | **Domain:** ALGEBRA
Skill/Knowledge: Linear functions | **Testing point:** Solving a linear function

Key Explanation: **Choice A** is correct. To find $f(6)$, first find the value of x which will be plugged into the equation $f(2x)$. Equating $2x$ to 6 and solving for x yields $x = 3$. Plugging 3 to $9x-7$ yields 20. Therefore, $f(6) = 20$.

Distractor Explanation: **Choice B** is incorrect and may result from plugging 6 directly into the equation. **Choice C** is incorrect and may result from substituting x with $2x$ and plugging 6 into the equation. **Choice D** is incorrect and may result from plugging 2 directly into the equation.

9. **Level:** Medium | **Domain:** PROBLEM-SOLVING AND DATA ANALYSIS
Skill/Knowledge: One-variable data: distributions and measures of center and spread |
Testing point: Finding the mean and median

Key Explanation: **Choice A** is correct because. The median of the above data set of 21 students

will be the $\frac{21+1}{2}$, which is the 11th shoe size,

which is then represented by 3. The mean shoe size can then be calculated by adding the products of the shoe size and their corresponding frequency and dividing the sum by the total number of students. This yields a sum of 67. Dividing the sum by 21 yields a mean of 3.19. Therefore, the mean will be larger than the median.

Distractor Explanation: Choice B and C are incorrect as they are both false statements.

Choice D is incorrect because there is sufficient information to answer the question.

10. **Level:** Medium | **Domain:** ADVANCED MATH
Skill/Knowledge: Equivalent expressions |
Testing point: Using exponent rules

Key Explanation: To solve for a , first make the bases equal. Converting 27^x to a base 3 yields 3^{3x} . Converting 81^{-x} to a base 3 yields $(3^4)^{-x}$ or 3^{-4x} . The equation will now become $3^{3x} \div 3^{-4x} = 3^{ax}$. On the right side of the equation, the bases are divided, which means that the exponents must be subtracted. Subtracting the exponents yields $3^{(3x - (-4x))} = 3^{ax}$ or simply $3^{7x} = 3^{ax}$. Equating the exponents yields $7x = ax$. Dividing both sides of the equation by x yields $7 = a$.

11. **Level:** Hard | **Domain:** GEOMETRY AND TRIGONOMETRY
Skill/Knowledge: Lines, angles, and triangles |
Testing point: Finding the sum of the Interior angles of a polygon

Key Explanation: Choice C is correct. The sum of interior angles in a polygon is represented by $180^\circ(n-2)$. A hexagon has 6 sides and therefore the sum of interior angles in the hexagon will be $180(6-2) = 720^\circ$. 720 degrees in radian form will be $\frac{720}{180} = 4\pi$. Therefore $b = 4$.

Distractor Explanation: Choice A is incorrect and may result in calculating $\frac{180}{720}$. **Choice B** is incorrect and may result in calculating $\frac{720}{720}$. **Choice D** is incorrect and may result in

calculating $\frac{720}{360}$.

12. **Level:** Easy | **Domain:** PROBLEM-SOLVING AND DATA ANALYSIS
Skill/Knowledge: Percentages | **Testing point:** Finding the percentage increase

Key Explanation: Choice C is correct. If 80 is increased by 200%, that means that the new value will be 300% of 80 which is 240. An alternative solution is to find 200% of 80 and add it to 80 which yields 240.

Distractor Explanation: Choice A is incorrect because it is the percentage. **Choice B** is incorrect because it is the increase without adding the original. **Choice D** is incorrect because it is the sum of 80 and 200.

13. **Level:** Easy | **Domain:** ADVANCED MATH
Skill/Knowledge: Nonlinear functions | **Testing point:** Using the quadratic formula

Key Explanation: To solve for the quadratic equation, use the quadratic formula

$$\frac{-b \pm \sqrt{b^2 - 4ac}}{2a}, \text{ where } a = 2, b = -4 \text{ and } c =$$

-7. Substituting the values to the formula yields

$$\frac{-(-4) \pm \sqrt{(-4)^2 - 4(2)(-7)}}{2(2)}. \text{ Simplifying this yields}$$

$$\frac{4 \pm \sqrt{72}}{4} \text{ or } 1 \pm \frac{\sqrt{72}}{4}. \text{ Simplifying } \sqrt{72} \text{ yields}$$

$$6\sqrt{2}. \text{ Therefore, the expression becomes } 1 \pm \frac{6\sqrt{2}}{4}$$

$$\text{or } 1 \pm \frac{3\sqrt{2}}{2}. \text{ Since the expression is now in the}$$

$$\text{same format as } 1 \pm \frac{a\sqrt{2}}{2}, \text{ then } a = 3.$$

14. **Level:** Easy | **Domain:** ALGEBRA
Skill/Knowledge: Linear functions | **Testing point:** Interpretation of terms in a linear function

Key Explanation: Choice B is correct. This is because 262 is the y -intercept of the model and represents the number of houses on day 0, which is the beginning of October.

Distractor Explanation: Choice A is incorrect because the number of houses at the end of October is represented by $h(x)$. Choice C is incorrect as the number of houses sold per day would be 8. Choice D is incorrect as the number of houses sold on the first day of October is represented when $x = 8$.

15. **Level:** Medium | **Domain:** GEOMETRY AND TRIGONOMETRY
Skill/Knowledge: Right triangles and trigonometry | **Testing point:** Working with special triangles

Key Explanation: Choice A is correct. A $90 - 60 - 30$ triangle has a hypotenuse of $2x$, a shorter leg of x , and a longer leg of $x\sqrt{3}$. The area of this triangle can then be found by the formula

$\frac{1}{2} \times \text{base} \times \text{height}$. Substituting the base and the

height yields $\frac{1}{2} \times x \times x\sqrt{3}$ or $\frac{x^2\sqrt{3}}{2}$. The given

side AC is the hypotenuse of the triangle. So, $32 = 2x$ which yields $x = 16$. Substituting 16 to the

formula yields $\frac{16^2\sqrt{3}}{2}$ or $128\sqrt{3}$.

Distractor Explanation: Choice B and Choice D are incorrect and may result from using $\sqrt{2}$ instead of $\sqrt{3}$. Choice C is incorrect because this is one of the sides of the triangle.

16. **Level:** Easy | **Domain:** ADVANCED MATH
Skill/Knowledge: Equivalent expressions | **Testing point:** Matching coefficients

Key Explanation: Using distributive property on the left side of the equation yields

$$5xy + 3 - 6xy + 2xy^2 - 2 = axy^2 + bxy + c.$$

Combining like terms yields $2xy^2 - xy + 1 = axy^2 + bxy + c$. Comparing the coefficients on both sides of the equation, yields $a = 2$, $b = -1$, and $c = 1$. Therefore, $a + b = 1$.

17. **Level:** Easy | **Domain:** ADVANCED MATH
Skill/Knowledge: Nonlinear equations in one variable and systems of equations in two variables
Testing point: Finding the product of the roots of a quadratic equation

Key Explanation: Choice B is correct. In a quadratic equation ($ax^2 + bx + c = 0$), the product of the roots can be found by $\frac{c}{a}$. Using the given equation, $c = -24$ and $a = 3$. Thus, the product of the roots will be $\frac{-24}{3}$ or -8 .

Distractor Explanation: Choice A is incorrect as this is the value of a . Choice C is incorrect and may result from calculating $\frac{b}{a}$. Choice D is incorrect and may result from calculating the sum of the roots which is $\left(\frac{-b}{a}\right)$.

18. **Level:** Medium | **Domain:** ADVANCED MATH
Skill/Knowledge: Nonlinear functions | **Testing point:** Using the vertex form of a quadratics equation

Key Explanation: Choice B is correct. The general equation of a parabola is given by $y = a(x - h)^2$

+ k , where (h, k) denotes the coordinate of the vertex. In this case, $h = 3$ and $k = 10$. Thus, the equation becomes $y = a(x-3)^2 + 10$. The sign of a denotes the orientation of the parabola. If a is positive, the parabola opens upward. If a is negative, the parabola opens downward. In this case, the parabola opens downward so the value of a must be negative. Therefore, the equation of the parabola is $y = -2(x-3)^2 + 10$.

Distractor Explanation: Choice A and Choice C are incorrect since their a is positive which would suggest that the graph opens upwards however the graph opens downwards. Choice D is incorrect and may result from using $(-3, 10)$ as the vertex instead of $(3, 10)$.

19. **Level:** Easy | **Domain:** ALGEBRA

Skill/Knowledge: Linear equations in one variable
Testing point: Matching coefficients

Key Explanation: Using the distributive property, the equation becomes $6 - 6x = ax + b$ or $-6x + 6 = ax + b$. Comparing the coefficient and the constant on both sides of the equation yields $a = -6$ and $b = 6$. Therefore, the product of a and b is -36 .

20. **Level:** Easy | **Domain:** ADVANCED MATH

Skill/Knowledge: Nonlinear functions | **Testing point:** Finding the average rate of change

Key Explanation: Choice D is correct. To find the average rate of change between two points on a curve is the same as finding the gradient between the two points. In this case, the points are $(0, -8)$ and $(2, -16)$. $\frac{(-16) - (-8)}{0 - 2}$ which yields the slope as -4 .

Distractor Explanation: Choice A is incorrect. This is the value of the difference in the y coordinates between the two points. Choice B is incorrect as this is the negative value of option A. Choice C is incorrect as this is the positive value of option D.

21. **Level:** Medium | **Domain:** ALGEBRA

Skill/Knowledge: Linear equations in one variable
Testing point: Finding the value of x in a linear equation

Key Explanation: Choice B is correct. To find the value of x , multiply both sides of the equation by $\frac{4}{3}$.
This yields $(x - 5) = 27 \times \frac{4}{3}$ or simply $(x - 5) = 36$.

Distractor Explanation: Choice A is incorrect and may result from calculating the value of x .

Choice C is incorrect and may result from multiplying $\frac{3}{4}$ to both sides of the equation instead of $\frac{4}{3}$.

Choice D is incorrect and may result from conceptual or calculation errors.

22. **Level:** Hard | **Domain:** ALGEBRA

Skill/Knowledge: Linear inequalities in one or two variables | **Testing point:** Finding solution to a system of linear inequalities

Key Explanation: Choice C is correct. To solve such questions, the best method would be to substitute the points to the inequalities and check if the statements are true or false.
Substituting $(3, 1)$ to the first inequality yields $1 > -2(3) - 1$ or $1 > -7$, which is true.
Substituting $(3, 1)$ to the second inequality

yields $3(1) < 3 + 9$ or $3 < 12$, which is also true. Therefore, the coordinate $(3, 1)$ lies inside the intersection of the two inequalities.

Distractor Explanation: Choice A is incorrect. Substituting $(-2, 1)$ to both inequalities will result in one false statement.

Choice B is incorrect. Substituting $(1, 4)$ to both inequalities will result in one false statement.

Choice D is incorrect. Substituting $(-3, 3)$ to both inequalities will result in false statements.