

1. **Level:** Medium | **Domain:** ADVANCED MATH
Skill/Knowledge: Nonlinear functions | **Testing point:** Determining the equation of a parabola from its graph

Key Explanation: Choice C is correct. The general equation of a parabola is given by $y = a(x - h)^2 + k$ where (h, k) is the vertex. Based on the graph, the vertex of the parabola is at $(-1, -6)$. Substituting the coordinate of the vertex to the general equation yields $y = a(x + 1)^2 - 6$. Since the graph opens upward, the leading coefficient is greater than zero. This means that a is positive and based on the choices, a is equal to 3. Substituting 3 to the equation of the parabola yields $y = 3(x + 1)^2 - 6$. Expanding the right side of the equation yields $y = 3x^2 + 6x - 3$.

Distractor Explanations: Choice A is incorrect and may result from an error in expanding the equation of the parabola. Choices B and D are incorrect because a is negative, which means that the graph opens downward.

2. **Level:** Easy | **Domain:** ADVANCED MATH
Skill/Knowledge: Nonlinear functions | **Testing point:** Determining the products of the solutions to a quadratic equation

Key Explanation: To find the product of the solutions, use the formula $\left(\frac{c}{a}\right)$, where a is the coefficient of x^2 and c is the constant. From the given equation $a = 3$ and $c = -15$. Therefore, the product of the solutions is $\left(\frac{-15}{3}\right)$, which is equal to -5 .

3. **Level:** Medium | **Domain:** PROBLEM-SOLVING AND DATA ANALYSIS
Skill/Knowledge: Probability and conditional probability | **Testing point:** Calculating probability of simple events

Key Explanation: Choice C is correct. The probability of a simple event occurring can be calculated using the formula

$$p = \frac{\text{no. of favorable outcomes}}{\text{total no. of possible outcomes}}$$

Since a heart is picked at first and is not put back in the deck, there are only 12 hearts left in a deck of now 51 cards. The probability of picking a heart card for the second time would then, therefore, be $\frac{12}{51}$,

which is 12 heart cards out of the 51 cards on the deck.

Distractor Explanations: Choice A is incorrect. This would be the probability of picking the first heart from the deck of 52 cards. Choice B is incorrect and may result from not subtracting the first card picked from the initial total number of cards. Choice D is incorrect because it represents the probability of not picking a second heart.

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

Key Explanation: Choice B is correct. To solve this, use the distributive property which yields $6xy^2 + 18x^2y - 6x^2y - 2xy^2$. Combining like terms yields $4xy^2 + 12x^2y$.

Distractor Explanations: Choices A, C, and D are incorrect and may result from a conceptual or calculation error.

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

Skill/Knowledge: Percentages | **Testing point:** Using discounts and percentage increase

Key Explanation: Since the price of the dress first increases by 15%, then it becomes $115\% \times 200 = 230$. Therefore, the price after 15th May is \$230. However, she bought it at a discounted price. Applying the discount, the amount that she paid for the dress is $70\% \times 230 = \$161$.

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

Skill/Knowledge: Nonlinear equations in one variable and systems of equations in two variables
Testing point: Using the difference of two squares to solve a system of equations

Key Explanation: **Choice A** is correct. The first equation contains the difference of two squares which is in the form of $a^2 - b^2$. This can be factored into $(a + b)(a - b)$.

Therefore,

$$(x - y)(x + y) = x^2 - y^2.$$

The first equation then becomes

$(x - y)(x + y) = 12$. Substituting the value of $(x - y)$ from the second equation into the first equation yields $2(x + y) = 12$.

Dividing both sides of the equation by 2 yields

$$(x + y) = 6.$$

Distractor Explanations: **Choice B** is incorrect and may result from solving the value of x . **Choice C** is incorrect and may result from solving the value of y . **Choice D** is incorrect and may result from solving the value of $y - x$.

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

Skill/Knowledge: Systems of two linear equations in two variables | **Testing point:** Solving system of linear equations for x and y

Key Explanation: **Choice A** is correct. Solve for the value of x and y by using the elimination method.

Multiplying to the first equation yields

$$3(2x + y = 2) \text{ or } 6x + 3y = 6.$$

Subtracting the second equation from the first equation yields $6x + 3y - 3y + x = 6 - 20$.

Combining like terms yields $7x = -14$. Dividing both sides of the equation by 7 yields $x = -2$. To find y , replace x with the value -2 in the first equation.

This yields $6(-2) + 3y = 6$ or $-12 + 3y = 6$.

Adding 12 to both sides of the equation yields $3y = 18$.

Dividing both sides of the equation by 3 yields $y = 6$.

The value of $xy = (-2)(6) = -12$.

Distractor Explanations: **Choices B** and **C** are incorrect because these are the values of x and y respectively. **Choice D** is incorrect because it would be the value of $\frac{y}{x}$.

8. **Level:** Medium | **Domain:** ADVANCED MATH
Skill/Knowledge: Nonlinear equations in one variable and systems of equations in two variables
Testing point: Solving absolute value equations

Key Explanation: Isolate the absolute value by dividing both sides of the equation by 2.

$$\text{This yields } \frac{2|x + 4|}{2} = \frac{12}{2} \text{ or } |x + 4| = 6.$$

Solve the values of x by equating the content of the absolute value to the positive and negative values of the constant.

Determine the first value of x using $x + 4 = 6$.

Subtracting 4 from both sides of the equation yields $x = 2$.

Determine the second value of x using $x + 4 = -6$.

Subtracting 4 from both sides of the equation yields $x = -10$.

Since the problem only requires the positive value of x , the answer is 2.

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

Skill/Knowledge: One-variable data: distributions and measures of center and spread

Testing point: Evaluating and comparing measures of center and spread

Key Explanation: Choice B is correct. The data being added would be an outlier on the higher end of the data set. The add-on changes the maximum of the data set and this would mean that the range would increase. The outlier would also increase the mean. The median will remain the same and will still be 1.39 because it is the 7th number in the new set of data. The standard deviation will increase as the data point is an outlier.

Distractor Explanations: Choices A, C, and D are incorrect. They are false statements.

10. **Level:** Medium | **Domain:** GEOMETRY AND TRIGONOMETRY

Skill/Knowledge: Area and volume | **Testing point:** Area of a circle in an inscribed polygon

Key Explanation: Choice B is correct. Since the circle is inscribed in a square, the side length of the square is equivalent to the diameter of the circle. Therefore, if the diameter is 14cm, the radius would be half, which is 7cm. The area would therefore be $7^2\pi$ or 49π .

Distractor Explanations: Choice A is incorrect. It is the area of a circle if the radius is 14cm. Choice C is incorrect because this is the circumference of the circle. Choice D is incorrect because this is twice the value of the circle's area.

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

Skill/Knowledge: Linear functions | **Testing point:** Using linear transformations

Key Explanation: The function $f(x)$ translated 2 units to the left will become $f(x + 2)$.

This yields $y = 3(x + 2) + 5$ or $y = 3x + 11$.

The function $f(x)$ translated 1 unit up will become $f(x) + 1$.

This yields $y = 3x + 11 + 1$ or $y = 3x + 12$.

Therefore, the new y -intercept is 12.

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

Skill/Knowledge: Linear inequalities in one or two variables | **Testing point:** Finding the solutions to an inequality

Key Explanation: Choice D is correct. To find the solution, substitute the choices for each inequality and verify if the statements are true or false.

Plugging in Choice D (3, 1) to the first inequality yields $(-2)(1) > -4$ or $2 > -4$ which is true.

Plugging (3, 1) into the second inequality yields $3(3) - 1 > 3$ or $5 > 3$ which is also true.

Since both statements are true when the point (3, 1) is plugged into both inequalities, then the correct answer is Choice D.

Distractor Explanations: Choice A is incorrect. Plugging in (1, 2) to both inequalities yields $-4 > -4$ and $1 > 3$ which are both false statements.

Choice B is incorrect. Plugging in (1, 3) to both inequalities yields $-6 > -4$ and $0 > 3$ which are both false statements.

Choice C is incorrect. Plugging in (2, 4) to both inequalities yields $-8 > -4$ and $2 > 3$ which are both false statements.

13. **Level:** Medium | **Domain:** GEOMETRY AND TRIGONOMETRY

Skill/Knowledge: Circles | **Testing point:** Using the midpoint formula and the equation of a circle

Key Explanation: Choice B is correct. The standard equation of a circle is given by $(x - h)^2 + (y - k)^2 = r^2$ where (h, k) is the center and r is the radius. The endpoints of the circle are $(-6, 10)$ and $(2, 10)$. The midpoint of these two

points would be $\left(\frac{-6+2}{2}, \frac{10+10}{2}\right) = (-2, 10)$

which is also the coordinates of the center of the circle. The radius of the circle can be solved by calculating the distance between the center and one of the endpoints of the diameter. Substituting $(2, 10)$ and $(-2, 10)$ to

the formula $\sqrt{(y_2 - y_1)^2 + (x_1 - x_2)^2}$ yields

$$\sqrt{(10 - 10)^2 + (-2 - 2)^2} = 4$$

4 would therefore be the radius.

Plugging in the coordinates of the center and the radius to the standard equation yields $(x + 2)^2 + (y - 10)^2 = 16$.

Distractor Explanations: Choices A, C, and D are incorrect and may result due to conceptual errors such as identifying the center from the equation of the circle.

14. **Level:** Medium | **Domain:** ALGEBRA
Skill/Knowledge: Linear functions | **Testing point:** Finding the value of a composite function

Key Explanation: Choice C is correct. To solve this, calculate for $g(2)$ first.

Substituting 2 to $g(x)$ yields $g(2) = 2(2) + 3$ or $g(2) = 4 + 3$.

Combining like terms yields $g(2) = 7$.

Since $g(2) = 7$, then $f(g(2)) = f(7)$.

Substituting 7 yields $f(7) = 7 + 2$ or $f(7) = 9$.

Distractor Explanations: Choice A is incorrect because this is the value of $g(2)$. Choice B is incorrect because this is the value of $f(2)$. Choice D is incorrect because this would be the value of $g(f(2))$.

15. **Level:** Medium | **Domain:** ADVANCED MATH
Skill/Knowledge: Nonlinear functions | **Testing point:** Solving for the y -intercept in a nonlinear function

Key Explanation: The y -intercept is when $x = 0$. Substituting 0 for x in the given equation yields $y = 300^0 + 5$.

Any number raised to the power of 0 is equal to 1.

The equation becomes, $y = 1 + 5$ or $y = 6$.

Therefore, the y -intercept is 6.

16. **Level:** Easy | **Domain:** ALGEBRA
Skill/Knowledge: Linear inequalities in one or two variables | **Testing point:** Finding the equation of an inequality from its graph

Key Explanation: Choice B is correct. The solutions to the inequality are above the line which would mean that the y values are greater. This means that the equation will be in the form of $y > mx + b$. Hence, the possible answer is either choice A or B. Since the dash line falls down from left to right, the value of the $slope(m)$ is negative. Between Choices A and B, only Choice A has a negative slope. Therefore, the graph represents the inequality $y > -2x + 3$.

Distractor Explanations: Choice A is incorrect because it has a positive slope. Choices C and D are incorrect because they both use less than symbols for the inequalities.

17. **Level:** Easy | **Domain:** ADVANCED MATH
Skill/Knowledge: Nonlinear functions | **Testing point:** Finding exponential functions from graphs

Key Explanation: Choice C is correct. Since the graph rises from left to right, it is an exponential growth function in the form of $f(x) = a(1 + r)^x$ where a is the initial amount, r is the growth rate,

and x is the number of time intervals. Since the graph represents an exponential growth function, $(1 + r) > 1$. Hence, the possible answers are

Choices A or C because $1.03 > 1$. To determine the correct answer between **Choice A** and **C**, find the value of a . Looking at the graph, it intersects at $(0, 180)$ which means that the y -intercept is 180. Thus, the initial amount is 180 or $a = 180$. Therefore, the correct answer is **Choice C**.

Distractor Explanations: **Choices A and D** are incorrect. They both have y -intercepts greater than 180. **Choice B** is incorrect. It represents a decaying exponential function.

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

Skill/Knowledge: Linear equations in two variables | **Testing point:** Matching coefficients

Key Explanation: **Choice D** is correct. To solve this, use the distributive property to simplify the left side of the equation.

This yields $3x + 2x + 8y = ax + by$.

Combining like terms yields $5x + 8y = ax + by$.

Matching the coefficients yields $a = 5$.

Distractor Explanations: **Choices A, B, and C** are incorrect and may result from a conceptual or calculation error.

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

Skill/Knowledge: Linear inequalities in one or two variables | **Testing point:** Writing the solution of an inequality in interval notation

Key Explanation: To solve for this inequality, divide both sides by -3 which yields $\frac{-3y}{-3} > \frac{-15}{-3}$ or $y < 5$. Since y can be any number less than 5, its value approaches negative infinity. Therefore, the interval notation is $(-\infty, 5)$.

20. **Level:** Easy | **Domain:** GEOMETRY AND TRIGONOMETRY

Skill/Knowledge: Right triangles and trigonometry | **Testing point:** Using trigonometric identities

Key Explanation: **Choice B** is correct. Since $\sin(3x) = \cos(x + 10)$, the two angles $(3x)$ and $(x + 10)$ are complementary and add up to 90° . Therefore, $(3x) + (x + 10) = 90$.

Combining like terms yields $4x + 10 = 90$.

Subtracting 10 from both sides of the equation yields $4x = 80$.

Dividing both sides of the equation by 4 yields $x = 20^\circ$.

Distractor Explanations: **Choice A** is incorrect and may result from a conceptual or calculation error. **Choice C** is incorrect and may result from solving the value of $(x + 10)$. **Choice D** is incorrect and may result from solving the value of $3x$.

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

Skill/Knowledge: Nonlinear functions | **Testing point:** Determining the type of equation from data given

Key Explanation: **Choice A** is correct. Since Amanda doubles the amount of money she will save every week, the amount that she puts in every week grows exponentially. This exponential growth can be represented by the model $s = \$10(2)^t$, where t is time in weeks and s is the amount that she will save in the given week.

Distractor Explanation: **Choices B and D** are incorrect. The function is exponential and not linear. **Choice C** is incorrect. The amount she saves per week increases exponentially and does not decrease.

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

Skill/Knowledge: Linear equations in one variable

Testing point: Solving for x in a linear equation

Key Explanation: Choice B is correct. The value of x can be solved by subtracting 8 from both sides which yields $4x + 8 - 8 = 24 - 8$ or $4x = 16$.

Dividing both sides of the equation by 4 yields $x = 4$.

Distractor Explanations: Choices A, C, and D are incorrect and may result from a conceptual or calculation error.