

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

Key Explanation: Choice C is correct. Quadratic equations can be solved either by using the quadratic formula or by solving using the factor method.

Using the factor method, first find the product of the highest degree term and the constant which will be $3x^2 \times 6 = 18x^2$.

The factors of $18x^2$ that will add up to be equal to the middle term $-19x$ are $-x$ and $-18x$.

Splitting the middle term yields $3x^2 - x - 18x + 6 = 0$.

Grouping the equation yields $(3x^2 - x) - (18x - 6) = 0$.

Factoring the equation yields $x(3x - 1) - 6(3x - 1) = 0$.

Factoring out $(3x - 1)$ yields $(3x - 1)(x - 6) = 0$.

Equating $(x - 6)$ to zero yields $x - 6 = 0$ or $x = 6$.

Equating $(3x - 1)$ to zero yields $3x - 1 = 0$ or $x =$

$$\frac{1}{3}.$$

Since $\frac{1}{3}$ is in the options, then **Choice C** is the

correct answer.

Distractor Explanations: **Choice A** is incorrect.

This is the negative value of the solution $x = 6$.

Choice B is incorrect. This is the value of the

products of the solutions/roots which is $\frac{c}{a}$.

Choice D is incorrect. This is the negative value of the solution $x = \frac{1}{3}$.

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

Skill/Knowledge: Circles | **Testing point:**

Completing the square and using the equation of a circle

Key Explanation: **Choice B** is correct. Diameter is twice the radius. To find the radius of the circle, rewrite the given equation in standard form $(x - h)^2 + (y - k)^2 = r^2$ where (h, k) is the center of the circle and r is its radius. Completing the squares

$$\text{yields } (x - 4)^2 - \left(\frac{-8}{2}\right)^2 + (y + 5)^2 - \left(\frac{10}{2}\right)^2 = 8 \text{ or}$$

$$(x - 4)^2 - 16 + (y + 5)^2 - 25 = 8. \text{ Adding 25 and 16 to both sides of the equation yields } (x - 4)^2 + (y + 5)^2 = 8 + 25 + 16 \text{ or } (x - 4)^2 + (y + 5)^2 = 49.$$

Since $r^2 = 49$, then $r = 7$.

The diameter would then be $2(7) = 14$.

Distractor Explanations: **Choice A** is incorrect.

This is the value of the radius of the circle given above.

Choice C is incorrect. This assumes that 8 is the radius of the circle and that the diameter

would be $2(8) = 16$. **Choice D** is incorrect. This can be a result of not getting the square root of the constant in the equation.

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

Skill/Knowledge: Linear functions | **Testing point:** Solving for the absolute value of a linear function $f(x)$, given x

Key Explanation: To find $f(2)$, substitute 2 in place of x in the equation which yields $f(2) = -2(2) - 6$.

Simplifying the equation yields $f(2) = -4 - 6$ or $f(2) = -10$.

$|f(2)|$ is the absolute value of $f(2)$.

Therefore, $|-10| = 10$.

4. **Level:** Hard | **Domain:** GEOMETRY AND TRIGONOMETRY

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

Key Explanation: **Choice B** is correct. Converting the tangent function to sine and cosine functions

yields $\tan(90 - x)^\circ = \frac{\sin(90 - x)^\circ}{\cos(90 - x)^\circ}$. Since the

sine of an angle is equal to the cosine of its complementary angle and vice versa,

$\sin x = \cos(90 - x)$ and $\cos x = \sin(90 - x)$.

Substituting the equivalent identities yields

$\tan(90 - x) = \frac{\cos x}{\sin x}$. Therefore, the correct answer

is **Choice B**.

Distractor Explanations: **Choices A and C**

are incorrect and may result from solving the

equivalent identity of $\tan x$ and $\frac{1}{\tan x}$ respectively.

Choice D is incorrect and may result from solving the equivalent identity of $\tan(-x)$.

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

Skill/Knowledge: Linear functions | **Testing**

point: Meaning in context in linear equation

Key Explanation: **Choice C** is correct. Alina earns an interest monthly based on her deposit. This makes the model equation for her savings account linear. 7.684 in this context, is the amount of interest she earns monthly which can be obtained by multiplying the interest rate with the principal amount. This yields $(6.8\% \times 113) = 7.684$. Thus making option C correct.

Distractor Explanations: **Choice A** is incorrect.

The amount of interest earned after t months would be represented by $7.684t$. **Choice B** is incorrect. The total amount in the account after t months would be represented by the function $A(t)$. **Choice D** is incorrect. The interest earned per year is \$92.208.

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

Skill/Knowledge: Systems of two linear equations in two variables | **Testing point:** Finding equation that makes system have no solutions

Key Explanation: **Choice B** is correct. A system of equations with no solution are systems that have parallel lines and therefore have the same slope and different y -intercepts. To find the slope and y -intercept of the given equation, the equation has to be in the slope-intercept form $y = mx + c$.

Subtracting $-6x$ from the equation yields

$-3y = -6x + 2$. Dividing -3 from both sides of the

equation yields $y = 2x - \frac{2}{3}$. The slope is 2 and the

y -intercept is $-\frac{2}{3}$.

Rewriting **Choice C** in slope intercept form

yields $y = 2x + 4$. Since it has the same slope and different y -intercept with the given line, both lines are parallel and will have no solutions.

Distractor Explanations: **Choice A** is incorrect.

The line has a different slope of $\frac{2}{3}$, which makes

the system have one solution. **Choices C and D** are incorrect. Both lines have a slope of 2 and y -

intercept is $-\frac{2}{3}$ which is the same as the given line.

Hence, both lines are collinear which makes the system have infinite solutions.

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

Skill/Knowledge: Nonlinear functions | **Testing**

point: Solving for $p(x)$ given x in a quadratic function

Key Explanation: To find $p(2)$, substitute 2 in place of x . This yields $p(2) = 2(2)^2 - 6(2) + 5$.

Simplifying the equation yields $p(2) = 8 - 12 + 5$ or $p(2) = 1$.

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

Skill/Knowledge: Linear equations in two

variables | **Testing point:** Finding the equation of the line given two points

Key Explanation: Choice B is correct. To find the equation of the line, first find the slope of the line. Substituting (6, 5) and (0, 0) to the slope formula

$$m = \frac{y_2 - y_1}{x_2 - x_1} \text{ yields } m = \frac{0 - 5}{0 - 6} = \frac{5}{6}.$$

Substituting the slope to the slope-intercept form $y = mx + b$ yields

$$y = \frac{5}{6}x + b.$$

Since the line passes through the origin, the y -intercept is zero which means $b = 0$.

$$\text{Hence, the equation of the line is } y = \frac{5}{6}x \text{ or}$$

$$6y = 5x, \text{ which makes B the correct option.}$$

Distractor Explanations: Choice A is incorrect and may result from finding the equation of the line that passes through the origin and point (5, 6). Choices C and D are incorrect. These lines do not pass through the origin and point (6, 5).

9. **Level:** Easy | **Domain:** ADVANCED MATH
Skill/Knowledge: Nonlinear functions | **Testing point:** Determining a quadratic equation from its graph

Key Explanation: Choice D is correct. The graph opens downwards and this makes a (the coefficient of x^2) negative. Hence, the possible answer is either choice C or D. To determine which is correct between choice C and choice D, check the

value of h for each equation using the formula $\frac{-b}{2a}$

where b is the coefficient of x . Since the vertex of the graph is in the first quadrant, then h must be

positive. Solving h in Choice C yields $\frac{-(-6)}{2(-2)}$ or

$$-\frac{3}{2}.$$

Hence, Choice C is incorrect. Solving h in choice D yields $\frac{-(-6)}{2(-2)}$ or $\frac{3}{2}$. Therefore, Choice D is the correct answer.

Distractor Explanations: Choices A and B are incorrect. The graph of these equations opens upwards since the coefficient of x^2 is positive. Choice C is incorrect because the value of h is negative.

10. **Level:** Easy | **Domain:** GEOMETRY AND TRIGONOMETRY
Skill/Knowledge: Lines, angles and triangles | **Testing point:** Using the sum of the interior angles of a polygon formula

Key Explanation: A quadrilateral is a four sided figure. The sum of the interior angles can be found by $180(n - 2)$ where n is the number of sides. Substituting 4 yields $180(4 - 2) = 360^\circ$.

Adding the given angles yields

$$x + x + 40 + x + 50 + x - 10 = 360.$$

Combining like terms yields $4x + 80 = 360$.

Subtracting 80 from both sides of the equation yields $4x + 80 - 80 = 360 - 80$ or $4x = 280$.

Dividing both sides of the equation by 4 yields $x = 70^\circ$.

11. **Level:** Medium | **Domain:** GEOMETRY AND TRIGONOMETRY
Skill/Knowledge: Right triangles and trigonometry | **Testing point:** Using SOHCAHTOA in similar right triangles

Key Explanation: Choice A is correct. Triangle ABD and Triangle ACD are similar right triangles. This makes angle CAD and angle DBA equal. Therefore, $\sin CAD = \sin DBA$.

$$\text{Since } \sin DBA = \frac{O}{H} = \frac{AD}{BD}, \text{ then } \sin CAD = \frac{AD}{BD}$$

BD is the hypotenuse for triangle ABD which can be calculated using Pythagorean Theorem $a^2 + b^2 = c^2$, where a and b are the legs and c is the hypotenuse of the right triangle. Applying

this to triangle ABD yields $AB^2 + AD^2 = BD^2$. Substituting the values of AB and AD yields $10^2 + 24^2 = BD^2$. Simplifying the left side of the equation yields $676 = BD^2$. Getting the square root of both sides of the equation yields $\sqrt{676} = BD$ or $26 = BD$. Substituting the value of AD and BD

to $\sin CAD = \frac{AD}{BD}$ yields $\sin CAD = \frac{24}{26}$ or $\sin$

$$CAD = \frac{12}{13}.$$

Distractor Explanations: Choice B is incorrect.

This option is the value of $\tan CAD$. Choice C is incorrect. This option is the value of $\cos CAD$.

Choice D is incorrect. This option is the value of $\tan CDA$.

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

Skill/Knowledge: Equivalent expressions |

Testing point: Using the distributive property

Key Explanation: Choice B is correct. Using distributive property yields $7wp(2w) + 7wp(5)$. Simplifying the expression yields $14w^2p + 35wp$.

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

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

Skill/Knowledge: Area and volume | **Testing point:** Using volumes of similar shapes

Key Explanation: The ratio of volume of sphere A and sphere B is $27 : 1$. The ratio of the radius would be $\sqrt[3]{27} : \sqrt[3]{1} = 3 : 1$.

Sphere B has a radius of 4 cm.

Applying the ratio of $3 : 1$, this would make the radius of sphere A $3 \times 4 = 12$.

14. **Level:** Hard | **Domain:** PROBLEM-SOLVING AND DATA ANALYSIS

Skill/Knowledge: Probability and conditional probability | **Testing point:** Calculating probabilities

Key Explanation: Choice C is correct.

	Rain	No rain
Monday	43%	57%
Thursday	86%	14%

Probability is equal to one or 100% (if in percentage form), therefore the chance that it won't rain on Monday will be $100\% - 43\% = 57\%$. Since it is twice as likely to rain on Thursday than on Monday, the chance that it will rain on Thursday will be $2(43\%) = 86\%$. Hence, the chance that it would not rain on Thursday is $100\% - 86\% = 14\%$ or 0.14.

Distractor Explanations: Choice A is incorrect.

This is the value of the probability that it would rain on Monday. Choice B is incorrect as this is the chance that it would not rain on Monday.

Choice D is incorrect as this is the chance that it would rain on Thursday.

15. **Level:** Hard | **Domain:** ADVANCED MATH

Skill/Knowledge: Nonlinear equations in one variable and systems of equations in two variables

Testing point: Solving nonlinear inequalities

Key Explanation: Choice B is correct. To solve the following system, the bases have to be the same. Since 16 and 4 are multiples of 2, 16^x becomes 2^{4x} and 4^x becomes 2^{2x} . This yields

$$\frac{2^{4x}}{2^{2x}} > 2.$$

Since the terms on the left side of the inequality are divided, their exponents will be subtracted which will yield $2^{4x-2x} > 2^6$ or $2^{2x} > 2^6$. Since the bases are the same, then $2x > 6$. Dividing both sides of the inequality by 2 yields $x > 3$. 4 is the next integer greater than 3.

Distractor Explanations: Choices A, C, and D are incorrect as they are all less than 3 or equal to 3.

16. **Level :** Hard | **Domain:** ADVANCED MATH

Skill/Knowledge: Equivalent expressions |

Testing point: Matching coefficients and solving systems of equations

Key Explanation: Using distributive property yields $3ax - 3b + 4bx - 4a = x - 6$.

Grouping like terms yields $(3a + 4b)x + (-3b - 4a) = x - 6$. Matching the coefficients of x and the constants to make two equations yields $3a + 4b = 1$ and $-4a - 3b = -6$. Using the elimination method to find the value of a and b , multiply the 1st equation by 4 and the 2nd equation by 3. This yields $4(3a + 4b = 1)$ or $12a + 16b = 4$ and $3(-4a - 3b = -6)$ or $-12a - 9b = -18$. Adding the two equations yields $7b = -14$. Dividing both sides of the equation by 7 yields $b = -2$. Substituting the value of b to the 1st equation yields $3a + 4(-2) = 1$ or $3a - 8 = 1$. Adding 8 to both sides of the equation yields $3a = 9$. Dividing both sides of the equation by 3 yields $a = 3$.

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

Skill/Knowledge: Area and volume | **Testing point:** Finding the volume of a cone

Key Explanation: Choice B is correct. The volume

of a cone is given by the formula $\left(\frac{1}{3}\pi r^2 h\right)$

where r is the radius and h is the height. Since the height is 6 more than the radius, $h = 12 + 6 = 8$. Substituting the values to the formula yields

$$\frac{1}{3}\pi(12)^2(18) = 864\pi.$$

Distractor Explanations: Choice A is incorrect because this gives the volume of a cylinder with the given parameters. Choices C and D are incorrect. These options may result from miscalculation or by using the wrong formula.

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

Skill/Knowledge: Linear equations in two

variables | **Testing point:** Finding the slope of a line from an equation

Key Explanation: Choice A is correct. To find the slope of the line, rewrite the equation in slope intercept form $y = mx + c$, where m is the slope and c is the y -intercept. Adding $3y$ and subtracting 6 from both sides of the equation yields $4x - 6 = 3y$. Dividing both sides of the equation by 3 yields

$$\frac{4}{3}x - 2 = y \text{ or } y = \frac{4}{3}x - 2. \text{ Therefore, the slope of the line is } \frac{4}{3}.$$

Distractor Explanations: Choice B is incorrect because this is the coefficient of x when the equation of the line is in general form. Choices C and D are incorrect and may result from a conceptual or calculation error.

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

Skill/Knowledge: Circles | **Testing point:** Calculating angle measure given arc length

Key Explanation: The arc length is a fraction of the circumference. The arc would therefore be

$$\frac{3\pi}{20\pi} = \frac{3}{20}.$$

Multiplying it to the full angle of a circle yields

$$\frac{3}{20} \times 360^\circ = 54^\circ.$$

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

Skill/Knowledge: Ratios, rates, proportional relationships, and units | **Testing point:** Using inverse proportions

Key Explanation: Choice B is correct. The

price per student would be $\frac{p}{30}$. If 28 students paid before the day of the trip, then this can be represented by $\frac{p}{30} \times 28 = \frac{28p}{30}$ or $\frac{14}{15}p$.

Distractor Explanations: Choices A and C are incorrect and may result from assuming that p is the price per student. Choice D is incorrect and may result from solving the price per student.

21. **Level:** Hard | **Domain:** GEOMETRY AND TRIGONOMETRY

Skill/Knowledge: Circles | **Testing point:** Finding the equation of a circle

Key Explanation: Choice C is correct.

The standard form of the equation of a circle is $(x - h)^2 + (y - k)^2 = r^2$, where (h, k) is the center of the circle and r is the radius. Substituting the given data yields $(x + 3)^2 + (y - 5)^2 = 6^2$.

Expanding the equation yields

$$x^2 + 6x + 9 + y^2 - 10y + 25 = 36.$$

Subtracting 36 from both sides of the equation yields $x^2 + 6x + y^2 - 10y + 34 - 36 = 0$.

Matching the constant in $x^2 + 6x + y^2 - 10y - 2 = ax^2 + bx + cy^2 + dy + e$ yields $e = -2$.

Distractor Explanations: Choices A and D are incorrect. These options may result from conceptual errors. Choice B is incorrect. This is the value of $r^2 = 6^2 = 36$, however it is not the value of e .

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

Skill/Knowledge: Linear inequalities in one or two variables | **Testing point:** Solving for a linear inequality

Key Explanation: Choice D is correct. Using distributive property yields $-3x - 6 < 2x - 16$. Adding 6 and subtracting $2x$ from both sides of the inequality yields $-3x - 6 - 2x + 6 < 2x - 16 + 6 - 2x - 5x < -10$. Dividing both sides of the inequality by -5 yields $x > 2$. Since 3 is greater than 2, it is the correct answer.

Distractor Explanations: Choices A, B and C are incorrect. These values are less than or equal to 2.