

Math

Module 1

(27 questions)

QUESTION 1

Choice A is correct. The given absolute value equation can be rewritten as two linear equations: $x + 45 = 48$ and $-(x + 45) = 48$, or $x + 45 = -48$. Subtracting 45 from both sides of the equation $x + 45 = 48$ yields $x = 3$. Subtracting 45 from both sides of the equation $x + 45 = -48$ yields $x = -93$. Thus, the given equation has two possible solutions, 3 and -93 . Therefore, the positive solution to the given equation is 3.

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

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

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

QUESTION 2

Choice A is correct. The first equation in the given system of equations is $x = 4$. Substituting 4 for x in the second equation in the given system of equations yields $y = 5 - 4$, or $y = 1$.

Choice B is incorrect. This is the value of x in the solution to the given system of equations, not the value of y . *Choice C* is incorrect and may result from conceptual or calculation errors. *Choice D* is incorrect and may result from conceptual or calculation errors.

QUESTION 3

Choice C is correct. Let d represent the mass, in grams, of vitamin D in the mixture, and let c represent the mass, in grams, of calcium in the mixture. It's given that the mixture consists of only vitamin D and calcium and that the total mass of the mixture is 150 grams. Therefore, the equation $d + c = 150$ represents this situation. It's also given that the mass of vitamin D in the mixture is 50 grams. Substituting 50 for d in the equation $d + c = 150$ yields $50 + c = 150$. Subtracting

50 from both sides of this equation yields $c = 100$. Therefore, the mass of calcium in the mixture is 100 grams.

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

Choice B is incorrect. This is the total mass, in grams, of the mixture, not the mass, in grams, of calcium in the mixture. *Choice D* is incorrect. This is the mass, in grams, of vitamin D in the mixture, not the mass, in grams, of calcium in the mixture.

QUESTION 4

Choice C is correct. It's given that this service contract requires a monthly cost of \$23. A monthly cost of \$23 for t months results in a cost of $\$23t$. It's also given that this service contract requires a onetime activation cost of \$35. Adding the onetime activation cost to the monthly cost of the service contract for t months yields the total cost c , in dollars, of this service contract for t months. Therefore, this situation can be represented by the equation $c = 23t + 35$.

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

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

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

QUESTION 5

Choice B is correct. It's given that the function f is defined by $f(x) = 3x - 8$. The value of $f(7)$ is the value of $f(x)$ when $x = 7$. Substituting 7 for x in the given equation yields $f(7) = 3(7) - 8$, which is equivalent to $f(7) = 21 - 8$, or $f(7) = 13$.

Choice A is incorrect. This is the value of $f(7)$ when $f(x) = 3x + 8$, rather than $f(x) = 3x - 8$. *Choice C* is incorrect. This is the value of $f(1)$, rather than $f(7)$.

Choice D is incorrect. This is the value of $f(-7)$, rather than $f(7)$.

QUESTION 6

The correct answer is 40. The y -intercept of a graph in the xy -plane is the point (x, y) on the graph where $x = 0$. The y -intercept of the graph shown is $(0, 40)$. Therefore, the value of y is 40.

QUESTION 7

The correct answer is 130. It's given that $8x - 7x + 130 = 260$. Combining like terms on the left-hand side of this equation yields $x + 130 = 260$. Subtracting 130 from each side of this equation yields $x = 130$. Therefore, the value of x that's the solution to the given equation is 130.

QUESTION 8

Choice C is correct. It's given that the geologist has already collected 63 samples from the volcano. Let x represent the number of additional samples the geologist needs to collect. After collecting x additional samples, the geologist will have collected a total of $63 + x$ samples. It's given that the geologist needs to collect

at least 67 samples. Therefore, $63 + x \geq 67$. Subtracting 63 from each side of this inequality yields the inequality $x \geq 4$. Thus, the geologist needs to collect a minimum of 4 additional samples.

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

Choice B is incorrect. This is the number of samples the geologist has already collected, rather than the minimum number of additional samples the geologist needs to collect. *Choice D* is incorrect. If the geologist collects 0 additional samples, the geologist will have collected a total of 63 samples, which is less than 67 samples.

QUESTION 9

Choice A is correct. If one of the gemstones is selected at random, the probability of selecting a gemstone of color Y is equal to the number of gemstones of color Y divided by the total number of gemstones. According to the table, there are 3 gemstones of color Y, and it's given that the total number of gemstones is 157. Therefore, if one of the gemstones is selected at random, the probability of selecting a gemstone of color Y is $\frac{3}{157}$.

Choice B is incorrect. This is the probability of selecting a gemstone of color Z.

Choice C is incorrect. This is the probability of selecting a gemstone of color X.

Choice D is incorrect. This is the probability of selecting a gemstone that's not of color Y.

QUESTION 10

Choice A is correct. The equation for the line representing the boundary of the shaded region can be written in slope-intercept form $y = mx + b$, where m is the slope and $(0, b)$ is the y -intercept of the line. For the graph shown, the boundary line passes through the points $(0, -6)$ and $(9, 0)$. Given two points on a line, (x_1, y_1) and (x_2, y_2) , the slope of the line can be calculated using the equation $m = \frac{y_2 - y_1}{x_2 - x_1}$. Substituting the points $(0, -6)$ and $(9, 0)$ for (x_1, y_1) and (x_2, y_2) , respectively, in this equation yields $m = \frac{0 - (-6)}{9 - 0}$, which is equivalent to $m = \frac{6}{9}$, or $m = \frac{2}{3}$. Since the point $(0, -6)$ represents the y -intercept, it follows that $b = -6$. Substituting $\frac{2}{3}$ for m and -6 for b in the equation $y = mx + b$ yields $y = \frac{2}{3}x - 6$ as the equation of the boundary line. Since the shaded region represents all the points on and above this boundary line, it follows that the shaded region shown represents the solutions to the inequality $y \geq \frac{2}{3}x - 6$.

Choice B is incorrect. This inequality represents a region whose boundary line has a y -intercept of $(0, 6)$, not $(0, -6)$. *Choice C* is incorrect. This inequality represents a region whose boundary line has a y -intercept of $(0, -9)$, not $(0, -6)$. *Choice D* is incorrect. This inequality represents a region whose boundary line has a y -intercept of $(0, 9)$, not $(0, -6)$.

QUESTION 11

Choice A is correct. In an equilateral triangle, all three sides have the same length. It's given that in triangle ABC , $AB = 4,680$ mm and $BC = 4,680$ mm. Therefore, if $AC = 4,680$ mm, then all three sides of triangle ABC have the same length, so triangle ABC is equilateral. Therefore, $AC = 4,680$ mm is sufficient to prove that triangle ABC is equilateral.

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

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

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

QUESTION 12

Choice C is correct. The function P gives the predicted population, in millions, of a certain country for the period from 1984 to 2018, where t is the number of years after 1984. Since the value of $P(8)$ is the value of $P(t)$ when $t = 8$, it follows that " $P(8)$ is approximately equal to 32.91" means that the value of $P(t)$ is approximately equal to 32.91 when $t = 8$. Therefore, the best interpretation of the statement " $P(8)$ is approximately equal to 32.91" is that 8 years after 1984, the predicted population of this country was approximately 32.91 million.

Choice A is incorrect. In 1984, the predicted population of this country was 24.8 million, not approximately 8 million. **Choice B** is incorrect. In 1984, the predicted population of this country was 24.8 million, not approximately 32.91 million. **Choice D** is incorrect. 32.91 years after 1984, the predicted population of this country was $24.8(1.036)^{32.91}$ million, or approximately 79.42 million, not approximately 8 million.

QUESTION 13

The correct answer is 29. The volume, V , of a right circular cylinder is given by the formula $V = \pi r^2 h$, where r is the radius of the base of the cylinder and h is the height of the cylinder. Since the base of the cylinder is a circle with radius r , the area of the base of the cylinder is πr^2 . It's given that a right circular cylinder has a volume of 377 cubic centimeters; therefore, $V = 377$. It's also given that the area of the base of the cylinder is 13 square centimeters; therefore, $\pi r^2 = 13$.

Substituting 377 for V and 13 for πr^2 in the formula $V = \pi r^2 h$ yields $377 = 13h$. Dividing both sides of this equation by 13 yields $29 = h$. Therefore, the height of the cylinder, in centimeters, is 29.

QUESTION 14

The correct answer is 3,630. The mean of a data set is the sum of the values in the data set divided by the number of values in the data set. The sum of the masses, in grams, of these alpine marmots is $4,010 + 4,010 + 3,030 + 4,050 + 3,050$, or 18,150 grams. The number of alpine marmots in the data set is 5. Therefore, the mean mass, in grams, of these 5 alpine marmots is $\frac{18,150}{5}$, or 3,630.

QUESTION 15

Choice A is correct. The first equation in the given system of equations is $x = 3$. Substituting 3 for x in the second equation in the given system of equations yields $y = (15 - 3)^2$, or $y = 144$. Substituting 3 for x and 144 for y in the expression xy yields $(3)(144)$, or 432. Therefore, the value of xy is 432.

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

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

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

QUESTION 16

Choice B is correct. The cosine of an acute angle in a right triangle is defined as the ratio of the length of the leg adjacent to the angle to the length of the hypotenuse. In the triangle shown, the length of the leg adjacent to angle A is 41, and the length of the hypotenuse is 42. Therefore, $\cos A = \frac{41}{42}$.

Choice A is incorrect. This is the value of $\frac{1}{\cos A}$. *Choice C* is incorrect and may result from conceptual or calculation errors. *Choice D* is incorrect and may result from conceptual or calculation errors.

QUESTION 17

Choice D is correct. The area, A , of a circle is given by the formula $A = \pi r^2$, where r is the radius of the circle. It's given that the circle has a radius of 43 meters. Substituting 43 for r in the formula $A = \pi r^2$ yields $A = \pi(43)^2$, or $A = 1,849\pi$. Therefore, the area, in square meters, of the circle is $1,849\pi$.

Choice A is incorrect. This is the area, in square meters, of a circle with a radius of $\sqrt{\frac{43}{2}}$ meters. *Choice B* is incorrect. This is the area, in square meters, of a circle with a radius of $\sqrt{43}$ meters. *Choice C* is incorrect. This is the circumference, in meters, of the circle.

QUESTION 18

Choice A is correct. It's given that the object has a mass of 168 grams and a volume of 24 cubic centimeters. Dividing the mass, in grams, of the object by the volume, in cubic centimeters, of the object gives the density, in grams per cubic centimeter, of the object. It follows that the density of the object is

$\frac{168 \text{ grams}}{24 \text{ cubic centimeters}}$, which is equivalent to $\frac{168}{24}$ grams per cubic centimeter, or

7 grams per cubic centimeter.

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

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

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

QUESTION 19

Choice B is correct. It's given that in January 2018, there were 1,300 customers subscribed to a company's newsletter and for the next 24 months after January 2018, the total number of customers subscribed to the newsletter each month was 7% greater than the total number subscribed the previous month. It follows that this situation can be represented by the equation $c = a\left(1 + \frac{r}{100}\right)^m$, where c is the total number of customers subscribed to the company's newsletter m months after January 2018, a is the number of customers subscribed to the newsletter in January 2018, and the total number of customers subscribed to the newsletter each month was $r\%$ greater than the total number subscribed the previous month. Substituting 1,300 for a and 7 for r in this equation yields $c = 1,300\left(1 + \frac{7}{100}\right)^m$, or $c = 1,300(1.07)^m$.

Choice A is incorrect. This equation represents a situation where the total number of customers subscribed each month was 93% less, not 7% greater, than the total number subscribed the previous month. **Choice C** is incorrect. This equation represents a situation where the total number of customers subscribed each month was 70%, not 7%, greater than the total number subscribed the previous month. **Choice D** is incorrect. This equation represents a situation where the total number of customers subscribed each month was 600%, not 7%, greater than the total number subscribed the previous month.

QUESTION 20

The correct answer is 6. The line of best fit predicts a greater y -value than the actual y -value for any data point that's located below the line of best fit. For the scatterplot shown, 6 of the data points are below the line of best fit. Therefore, the line of best fit predicts a greater y -value than the actual y -value for 6 of the data points.

QUESTION 21

The correct answer is 156. In the figure shown, the sum of the measures of angle UVS and angle RVS is 180° . It's given that the measure of angle RVS is 41° . Therefore, the measure of angle UVS is $(180 - 41)^\circ$, or 139° . The sum of the measures of the interior angles of a triangle is 180° . In triangle UVS , the measure of angle UVS is 139° and it's given that the measure of angle VST is 29° . Thus, the measure of angle VUS is $(180 - 139 - 29)^\circ$, or 12° . It's given that $RT = TU$. Therefore, triangle TUR is an isosceles triangle and the measure of VUS is equal to the measure of angle TRU . In triangle TUR , the measure of angle VUS is 12° and the measure of angle TRU is 12° . Thus, the measure of angle UTR is $(180 - 12 - 12)^\circ$, or 156° . The figure shows that the measure of angle UTR is x° , so the value of x is 156.

QUESTION 22

Choice D is correct. A system of two linear equations in two variables, x and y , has zero solutions if the lines representing the equations in the xy -plane are distinct and parallel. Two lines are distinct and parallel if they have the same slope

but different y -intercepts. Each equation in the given system can be written in slope-intercept form $y = mx + b$, where m is the slope of the line representing the equation in the xy -plane and $(0, b)$ is the y -intercept. Adding $12x$ to both sides of the first equation in the given system of equations, $-12x + 14y = 36$, yields

$14y = 12x + 36$. Dividing both sides of this equation by 14 yields $y = \frac{6}{7}x + \frac{18}{7}$. It follows that the first equation in the given system of equations has a slope of $\frac{6}{7}$ and a y -intercept of $(0, \frac{18}{7})$. Adding $6x$ to both sides of the second equation in the given system of equations, $-6x + 7y = -18$, yields $7y = 6x - 18$. Dividing both sides of this equation by 7 yields $y = \frac{6}{7}x - \frac{18}{7}$. It follows that the second equation in the given system of equations has a slope of $\frac{6}{7}$ and a y -intercept of $(0, -\frac{18}{7})$. Since the slopes of these lines are the same and the y -intercepts are different, it follows that the given system of equations has zero solutions.

Alternate approach: To solve the system by elimination, multiplying the second equation in the given system of equations, $-6x + 7y = -18$, by -2 yields $12x - 14y = 36$. Adding this equation to the first equation in the given system of equations, $-12x + 14y = 36$, yields $(-12x + 12x) + (-14y + 14y) = 36 + 36$, or $0 = 72$. Since this equation isn't true, the given system of equations has zero solutions.

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

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

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

QUESTION 23

Choice D is correct. Let $n\%$ represent the percent by which the positive quantity x is decreased to result in $0.35x$. The value of n can be found by solving the equation $x - (\frac{n}{100})x = 0.35x$. Since x is a common factor of each of the terms on the left-hand side of this equation, the equation can be rewritten as

$x(1 - \frac{n}{100}) = 0.35x$. Dividing each side of this equation by x yields $1 - \frac{n}{100} = 0.35$.

Multiplying each side of this equation by 100 yields $100 - n = 35$. Subtracting 100 from each side of this equation yields $-n = -65$. Dividing each side of this equation by -1 yields $n = 65$. Therefore, the expression $0.35x$ represents the result of decreasing the positive quantity x by 65%.

Choice A is incorrect. Decreasing the quantity x by 3.5% yields $x - 0.035x$, or $0.965x$, not $0.35x$. *Choice B* is incorrect. Decreasing the quantity x by 35% yields $x - 0.35x$, or $0.65x$, not $0.35x$. *Choice C* is incorrect. Decreasing the quantity x by 6.5% yields $x - 0.065x$, or $0.935x$, not $0.35x$.

QUESTION 24

Choice B is correct. It's given that object R travels a distance of $4x$ inches in y seconds. This speed can be written as $\frac{4x \text{ inches}}{y \text{ seconds}}$. It's given that the speed of object R is half the speed of object S. It follows that the speed of object S is twice the speed of object R, which is $2(\frac{4x \text{ inches}}{y \text{ seconds}})$, or $\frac{8x \text{ inches}}{y \text{ seconds}}$. Let n represent the time,

in seconds, it takes object S to travel a distance of $24x$ inches. The value of n can be found by solving the equation $\frac{8x \text{ inches}}{y \text{ seconds}} = \frac{24x \text{ inches}}{n \text{ seconds}}$, which can be written as $\frac{8x}{y} = \frac{24x}{n}$. Multiplying each side of this equation by ny yields $8xn = 24xy$. Dividing each side of this equation by $8x$ yields $n = 3y$. Therefore, the expression $3y$ represents the time, in seconds, it takes object S to travel a distance of $24x$ inches.

Choice A is incorrect. This expression represents the time, in seconds, it would take object S to travel a distance of $24x$ inches if the speed of object R were twice, not half, the speed of object S. *Choice C* is incorrect. This expression represents the time, in seconds, it takes object S to travel a distance of $128x$ inches, not $24x$ inches. *Choice D* is incorrect. This expression represents the time, in seconds, it takes object R, not object S, to travel a distance of $24x$ inches.

QUESTION 25

Choice C is correct. The equation representing the linear relationship shown can be written in slope-intercept form $y = mx + b$, where m is the slope and $(0, b)$ is the y -intercept of the line. The line shown passes through the points $(0, 6)$ and $(2, 0)$. Given two points on a line, (x_1, y_1) and (x_2, y_2) , the slope of the line can be calculated using the equation $m = \frac{y_2 - y_1}{x_2 - x_1}$. Substituting $(0, 6)$ and $(2, 0)$ for (x_1, y_1) and (x_2, y_2) , respectively, in this equation yields $m = \frac{0 - 6}{2 - 0}$, which is equivalent to $m = -\frac{6}{2}$, or $m = -3$. Since $(0, 6)$ is the y -intercept, it follows that $b = 6$.

Substituting -3 for m and 6 for b in the equation $y = mx + b$ yields $y = -3x + 6$. Adding $3x$ to both sides of this equation yields $3x + y = 6$. Multiplying this equation by 6 yields $18x + 6y = 36$. It follows that the equation $18x + Ry = 36$, where R is a positive constant, represents this relationship.

Choice A is incorrect. The graph of this relationship passes through the point $(0, 2)$, not $(0, 6)$. *Choice B* is incorrect. The graph of this relationship passes through the point $(0, 2)$, not $(0, 6)$. *Choice D* is incorrect. The graph of this relationship passes through the point $(-2, 0)$, not $(2, 0)$.

QUESTION 26

Choice B is correct. Let x represent the total mass, in grams, of the first piece, and let y represent the total mass, in grams, of the second piece. It's given that the sample has a total mass of 50.0 grams. Therefore, the equation $x + y = 50.0$ represents this situation. It's also given that the sample is 50.0% silicon by mass. Therefore, the total mass of the silicon in the sample is $0.500(50.0)$, or 25.0 , grams. It's also given that the first piece was 30.0% silicon by mass and the second piece was 80.0% silicon by mass. Therefore, the masses, in grams, of the silicon in the first and second pieces can be represented by the expressions $0.300x$ and $0.800y$, respectively. Since the sample was created by combining the first and second pieces, and the total mass of the silicon in the sample is 25.0 grams, the equation $0.300x + 0.800y = 25.0$ represents this situation.

Subtracting y from both sides of the equation $x + y = 50.0$ yields $x = 50.0 - y$. Substituting $50.0 - y$ for x in the equation $0.300x + 0.800y = 25.0$ yields $0.300(50.0 - y) + 0.800y = 25.0$. Distributing 0.300 on the left-hand side of this equation yields $15.0 - 0.300y + 0.800y = 25.0$. Combining like terms on the left-hand side of this equation yields $15.0 + 0.500y = 25.0$. Subtracting 15.0 from both sides of this equation yields $0.500y = 10.0$. Dividing both sides of this equation by 0.500 yields $y = 20.0$. Substituting 20.0 for y in the expression representing the mass, in grams, of the silicon in the second piece, $0.800y$, yields $0.800(20.0)$, or 16.0 . Therefore, the mass, in grams, of the silicon in the second piece is 16.0 .

Choice A is incorrect. This is the mass, in grams, of the silicon in the first piece, not the second piece. *Choice C* is incorrect. This is the total mass, in grams, of the second piece, not the mass, in grams, of the silicon in the second piece. *Choice D* is incorrect. This is the total mass, in grams, of the first piece, not the mass, in grams, of the silicon in the second piece.

QUESTION 27

The correct answer is 14. Let x represent the first integer and y represent the second integer. If the first integer is 5 greater than twice the second integer, then $x = 2y + 5$. It's given that the product of the two integers is 462; therefore $xy = 462$. Substituting $2y + 5$ for x in this equation yields $(2y + 5)(y) = 462$, which can be written as $2y^2 + 5y = 462$. Subtracting 462 from each side of this equation yields $2y^2 + 5y - 462 = 0$. The left-hand side of this equation can be factored by finding two values whose product is $2(-462)$, or -924 , and whose sum is 5. The two values whose product is -924 and whose sum is 5 are 33 and -28 . Thus, the equation $2y^2 + 5y - 462 = 0$ can be rewritten as $2y^2 - 28y + 33y - 462 = 0$, which is equivalent to $2y(y - 14) + 33(y - 14) = 0$, or $(2y + 33)(y - 14) = 0$. By the zero product property, it follows that $2y + 33 = 0$ or $y - 14 = 0$. Subtracting 33 from both sides of the equation $2y + 33 = 0$ yields $2y = -33$. Dividing both sides of this equation by 2 yields $y = -\frac{33}{2}$. Since y is a positive integer, the value of y isn't $-\frac{33}{2}$. Adding 14 to both sides of the equation $y - 14 = 0$ yields $y = 14$.

Substituting 14 for y in the equation $xy = 462$ yields $x(14) = 462$. Dividing both sides of this equation by 14 yields $x = 33$. Therefore, the two integers are 14 and 33, so the smaller of the two integers is 14.