Algebra

(13-15 questions, about 35%)

Topics: linear equations (functions) with one or two variables, System of linear equations, and Linear inequalities one or two variables. Meaning of numbers or variables in the context.

- **Linear equations**: Standard form $ax + by = c$
  Slope-intercept form $y = mx + b$,
  Point-slope form $y - y_1 = m(x - x_1)$.

(Practice problems for algebra)

1) In the XY-plane, line l is perpendicular to line $2x - 3y = 1$. If the line l passes through a point (2, 1), which of the following is an equation of line l?

   A) $3x + 2y = 8$
   B) $2x - 3y = -8$
   C) $y = -\frac{2}{3}x + 4$
   D) $y = -\frac{2}{3}x + \frac{7}{3}$

x	y
-2	-4
1/3	3
1	5
3	11

2) From the table above, four pairs of XY-coordinate points in a line are shown. If a line $ax + by = -4$, where a and b are constants, represents the relationship in the line, what is the value of a?

3) A construction contractor uses the function h defined by $h(x) = 5{,}000 + 250x$, where x is the area of floor in square feet to estimate the cost of labor, in dollars, to build a wooden floor in a certain area. If the contractor gives the estimate of labor cost to build a wooden floor of a house in that area is \$15,000, what is the area of the wooden floor, in square feet, of the house?

CONTINUE

- **The system of equations**:
  (Ways to solve system of equations)
  1) Linear combination method (match the coefficients of one variable and eliminate it)
  2) Substitution method (isolate one variable and substitute it into the other equation)

Standard form: $\begin{cases} a_1x + b_1y = c_1 \\ a_2x + b_2y = c_2 \end{cases}$ Point-slope form: $\begin{cases} y = m_1x + b_1 \\ y = m_2x + b_2 \end{cases}$

Standard form	Types of solutions	Point-slope form
$\frac{a_1}{a_2} = \frac{b_1}{b_2} \neq \frac{c_1}{c_2}$	No solution	$m_1 = m_2$ *and* $b_1 \neq b_2$
$\frac{a_1}{a_2} = \frac{b_1}{b_2} = \frac{c_1}{c_2}$	Infinitely many solutions	$m_1 = m_2$ *and* $b_1 = b_2$
$\frac{a_1}{a_2} \neq \frac{b_1}{b_2}$	One solution	$m_1 \neq m_2$

$$4u + 5v = a$$
$$-12u - \frac{v}{b} = 2$$

4) In the given system of equation above, a *and* b are constants. If the system has infinitely many solutions, what is the absolute value of $a - b$?

5) Adrian plans to work out every morning. He runs at 8 miles per hour and swims at 4 miles per hour. His goal is to practice both exercises at least a total of 15 miles in no more than 2 hours a day. If he spends k hours in running and m hours in swimming, which of the following system of inequalities represent Adrian's goal?

A) $\begin{cases} k + m \leq 2 \\ \frac{8}{k} + \frac{4}{m} \geq 15 \end{cases}$

B) $\begin{cases} k + m \leq 2 \\ \frac{k}{8} + \frac{m}{4} \geq 15 \end{cases}$

C) $\begin{cases} 8k + 4m \geq 15 \\ k + m \geq 2 \end{cases}$

D) $\begin{cases} 8k + 4m \geq 15 \\ k + m \leq 2 \end{cases}$

CONTINUE

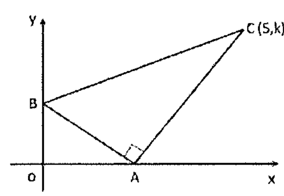
6) Janet purchased a blouse and a purse at a local store. The store offered a special discount on certain items. She spent a total of $215.20 for both items. If the store offered no tax on the blouse and 10% sales tax on the purse she purchased and the sum of the prices before tax was $198, what was the price, in dollars, of the purse?

- Properties of parallel and perpendicular lines (in the point-slope forms)

Parallel lines	$m_1 = m_2$ *and* $b_1 \neq b_2$
Perpendicular lines	$m_1 = -\frac{1}{m_2}$ or $m_1 \cdot m_2 = -1$

- Distance, midpoint, and slope formula between two points $A(x_1, y_1)$ *and* $B(x_2, y_2)$

Distance $= \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$ Midpoint $\left(\frac{x_1+x_2}{2}, \frac{y_1+y_2}{2}\right)$ Slope $= \frac{y_2-y_1}{x_2-x_1}$



7) In the XY-plane above, the coordinates of points B and C are (0, 2) and (5, k), respectively. If $\overline{AB}$ is perpendicular to $\overline{AC}$ and the slope of $\overline{AB}$ is $-\frac{3}{5}$, what is the value of k?

8) The distance between two points $A(2, a)$ *and* $B(-1, b)$ is 5. What is the value of $\frac{1}{2}|b - a|$?

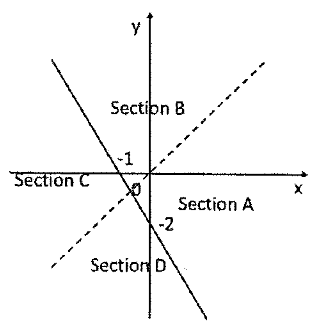
CONTINUE

9) The end points of a line segment AB are A(2, 12) and B(-4, -9), respectively. If points M is on $\overline{AB}$ such that $AM: MB = 1: 2$, what are the coordinates of point M?

A) $(0, 8)$
B) $(-1, 4)$
C) $(0, 5)$
D) $(-1, 2)$

10) Which of the following equations represent a line parallel to the graph of the equation $\frac{1}{5}x + \frac{1}{3}y = -2$?

A) $5x + 3y = 1$
B) $5x - 3y = -4$
C) $3x - 5y = 9$
D) $3x + 5y - 2 = 0$



$$\begin{cases} y - x > 0 \\ -2x - y \leq 2 \end{cases}$$

11) A system of inequalities and a graph are shown in the XY-plane above, which section of the graph could represent all of the solutions to the system?

A) Section A B) Section B C) Section C D) Section D

12) Elliott scored 85, 89, 95, and 80 on his exams before his last exam. If all exams weigh equally, which of the following inequalities could get him all the possible scores of the fifth exam, m that he would result in a mean score on all five exams at least 90?

A) $85 + 89 + 95 + 80 + m \leq 450$
B) $85 + 89 + 95 + 80 + m \geq 360$
C) $\frac{85+89+95+80+m}{5} \leq 90$
D) $85 + 89 + 95 + 80 \geq 450 - m$

CONTINUE