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VCE Mathematical Methods ½
Linear & Coordinate Geometry [1.1]
Test Solutions

17 Marks. 1 Minute Reading. 17 Minutes Writing.

Results:

Test Questions	_____ / 17
Extension	_____ / 4

Section A: Test Questions (17 Marks)

INSTRUCTION: 17 Marks. 17 Minutes Writing.

Question 1 (4 marks)

Tick whether the following statements are **true** or **false.**

Question	True	False
a. The inequality $3x + 5 \leq 9$ has a unique solution.		✓
b. Midpoint of the two points is always the average of the x and y-values.	✓	
c. Distance between two points is derived from Pythagoras theorem.	✓	
d. Reflecting a point around the $y = 4$ line changes the x-value.		✓
e. The vertical distance between two points is the difference in their x-values.		✓
f. The angle measured clockwise between the line and the x-axis is given by $\tan(\theta)$.		✓
g. For two lines to have infinite solutions, their gradient and y-intercept have to be the same measured clockwise.		✓
h. The simultaneous equations $2x - 4y = 4$ and $-4x + 8y = -8$ have infinitely many solutions.	✓	

Space for Personal Notes

Question 2 (5 marks)

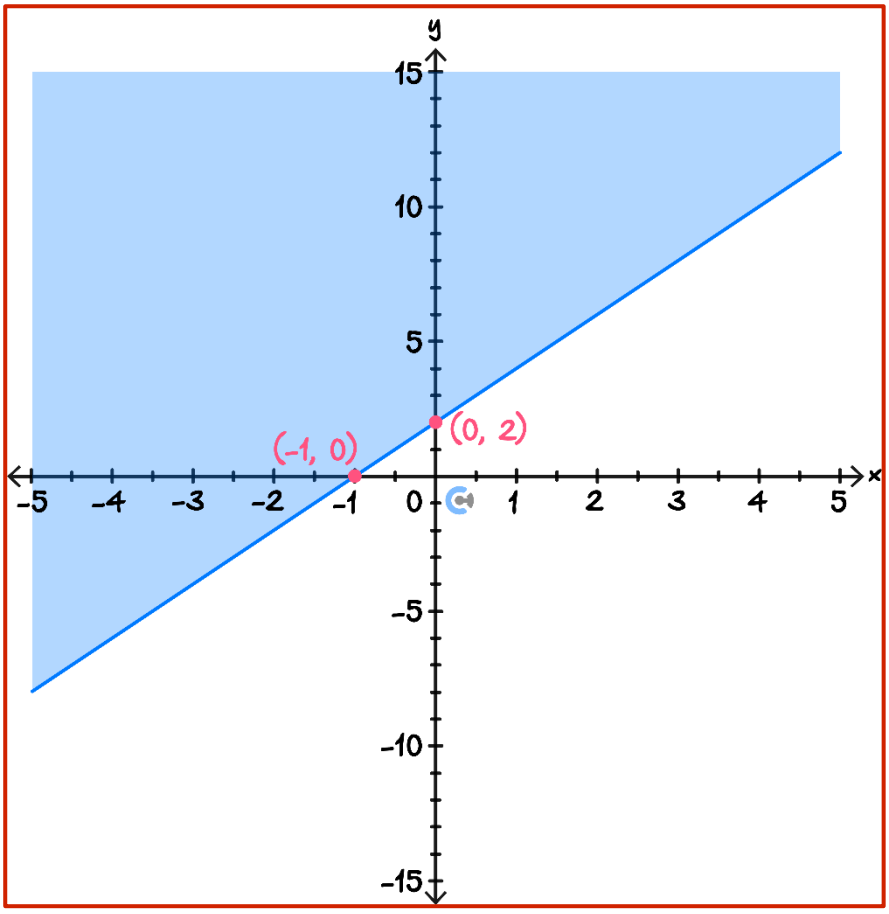
a. Solve the equation $2x - 3 = 5x + 6$ for x. (1 mark)

$3x = -9 \implies x = -3$

b. Solve the inequality $5 - 2x > 3x - 12$ for x. (1 mark)

$17 > 5x \implies x < \frac{17}{5}.$

c. Sketch line governed by the equation $2y - 4x = 4$ on the axis below. Label all axes intercepts. (2 marks)



d. Shade the region described by $2y \geq 4x + 4$ on the axis above. (1 mark)

Question 3 (3 marks)

Given that the distance between point A $(2,1)$ and point B $(k, 4)$ is 5.0 units, find the possible values of k.

```
Solve[ √((k - 2)^2 + (4 - 1)^2 == 5, k]
{{k → -2}, {k → 6}}
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Question 4 (5 marks)

Consider the simultaneous linear equations:

$$\frac{3m}{8}x + 2y = m - 1$$

$$3x + my = 6$$

Where m is a real constant.

a. Find the values of m for which there is a unique solution to the simultaneous equations. (2 marks)

Gradients are ratios of co-efficients of x & $y \rightarrow \begin{cases} kx - 3y = k + 3 \\ 4x + (k = 7)y = 1 \end{cases}$

Constants are co-efficients of = RHS

expand(solve($\frac{3 \cdot m}{8} \cdot x + 2 \cdot y = m - 1, y$))

$$y = \frac{-3 \cdot m \cdot x}{16} + \frac{m}{2} - \frac{1}{2}$$

expand(solve($3 \cdot x + m \cdot y = 6, y$))

$$y = \frac{6}{m} - \frac{3 \cdot x}{m}$$

$m \neq -4,4$

b. Find the value of m for which there are infinitely many solutions. (2 marks)

$m_1 = m_2$

solve($\frac{-3 \cdot m}{16} = \frac{-3}{m}, m$) $m = -4$ or $m = 4$

$m = -4,4$

$c_1 = c_2$

solve($\frac{m}{2} - \frac{1}{2} = \frac{6}{m}, m$) $m = -3$ or $m = 4$

$m = -3,4$

$m = 4$

c. Find the value of m for which there are no solutions. (1 mark)

$m_1 = m_2$ $\cap$ $c_1 \neq c_2$

$m = -4,4$ $\cap$ $m \neq -3,4$

$m = -4$

$m = -4$

Space for Personal Notes

Section B: Extension Test Questions (4 Marks)

INSTRUCTION: 4 Marks. 6 Minutes Writing.

Question 5 (4 marks)

Sam is standing at point $A(3,5)$ and needs to get to a walking path described by the line $y = 3x - 2$. To minimize his effort, he wants to travel the shortest possible distance to the path. What is the shortest distance Sam needs to travel?

a. Find the line perpendicular to $y = 3x - 2$ that passes through $A(3,5)$. (2 marks)

Line had gradient $-\frac{1}{3}$ and through point $(3,5)$. Therefore,

$$y - 5 = -\frac{1}{3}(x - 3)$$
$$y = -\frac{1}{3}x + 6$$

b. Find the intersection of the line $y = 3x - 2$ and the line from **part a**. (1 mark)

$-\frac{1}{3}x + 6 = 3x - 2 \implies \frac{10}{3}x = 8 \implies x = \frac{12}{5}$. Therefore point is

$$\left(\frac{12}{5}, \frac{26}{5}\right)$$

c. Hence, find the shortest distance Sam can travel to reach the walking path. (1 mark)

We want the distance between $A(3,5)$ and $\left(\frac{12}{5}, \frac{26}{5}\right)$.

$$d = \sqrt{\left(\frac{3}{5}\right)^2 + \left(\frac{1}{5}\right)^2} = \sqrt{\frac{10}{25}} = \frac{\sqrt{10}}{5}.$$

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