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VCE Mathematical Methods ¾

Coordinate Geometry [1.5]

Test Solutions

26.5 Marks. 33 Minutes Writing.

Results:

Test Questions	_____ / 20.5
Extension Test Questions	_____ / 6

Section A: Test Questions (20.5 Marks)

Question 1 (3.5 marks)

State if the following statements are true or false.

	True	False
a. Midpoint of two points is always the average of the x- and y-values.	✓	
b. Distance between two points is derived from the Pythagoras theorem.	✓	
c. Reflecting a point around the $y = 4$ line changes the x-value.		✓
d. Vertical distance between two points is the difference in their x-values.		✓
e. Angle measured clockwise between the line and the x-axis is given by the relationship, $\tan\theta = m$.		✓
f. For two lines to have infinite solutions, their gradient and y-intercept has to be the same.	✓	
g. Addition of ordinates is a graphing technique which involves adding the x-values of two graphs. It adds the y-values instead.		✓

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Question 2 (3 marks)

Given that the distance between point $A(2,5)$ and point $B(m,-4)$ is 15.0 units, find the possible values of m.

$(6-9, -2-6)$

Question 3 (3 marks)

Given that the distance between point A (2,5) and point B $(m,-4)$ is 15.0 units, find the possible values of m.

$\sqrt{(2-m)^2+(5--4)^2} = 15$

$m^2-4m+4+81 = 225$

$m^2-4m-140=0$

$(m+10)(m-14)=0$

$m=-10, 14.$

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Question 3 (3 marks)

Find the equation of the perpendicular bisector of the line segment that joins $(5, -8)$ and $(-12,3)$. Express your answer in the form, $ax + by + c = 0$.

Hint: Perpendicular bisector cuts a line by the middle and makes 90 degrees.

Question 4 (3 marks)

Find the equation of the perpendicular bisector of the line segment that joins $(5, -8)$ and $(-12,3)$. Express your answer in the form $ax + by + c = 0$.

$m = \frac{3 - -8}{-12 - 5} = \frac{-11}{17}$

$y = \frac{17}{11}x + c$

sub $(\frac{-7}{2}, \frac{-5}{2})$

$11y = 17x + d$

sub $(\frac{-7}{2}, \frac{-5}{2})$

$11 \times \frac{-5}{2} = 17 \times \frac{-7}{2} + d$

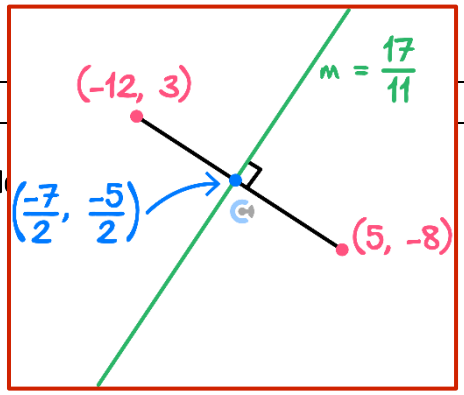
$-55 = -119 + 2d$

$64 = 2d$

$32 = d$

$\therefore 11y = 17x + 32$

$-17x + 11y - 32 = 0$



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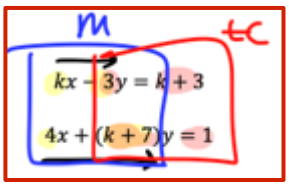
Question 4 (5 marks)

Consider the simultaneous linear equations:

$$kx - 3y = k + 3$$

$$4x + (k + 7)y = 1$$



where, k is a real constant.

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

$m_1 \neq m_2$ $\quad (k+3)(k+4) \neq 0$

$\frac{k}{-3} \neq \frac{4}{k+7}$ $\quad k \neq -3, -4$

$k(k+7) \neq -12$ $\quad \therefore k \in R \setminus \{-3, -4\}$

$k^2 + 7k + 12 \neq 0$

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

$C_1 = C_2$ $\quad -3 = k^2 + 10k + 21$ $\quad m_1 = m_2$

$\frac{-3}{k+3} = \frac{k+7}{1}$ $\quad 0 = k^2 + 10k + 24$ $\quad k = -3, -4$

$-3 = (k+7)(k+3)$ $\quad 0 = (k+6)(k+4)$

$k = -4, -6$ $\quad k = -4$

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

$m_1 = m_2$ $\quad C_1 \neq C_2$

$k = -3, -4$ & $k \neq -4, -6$

$\therefore k = -3$

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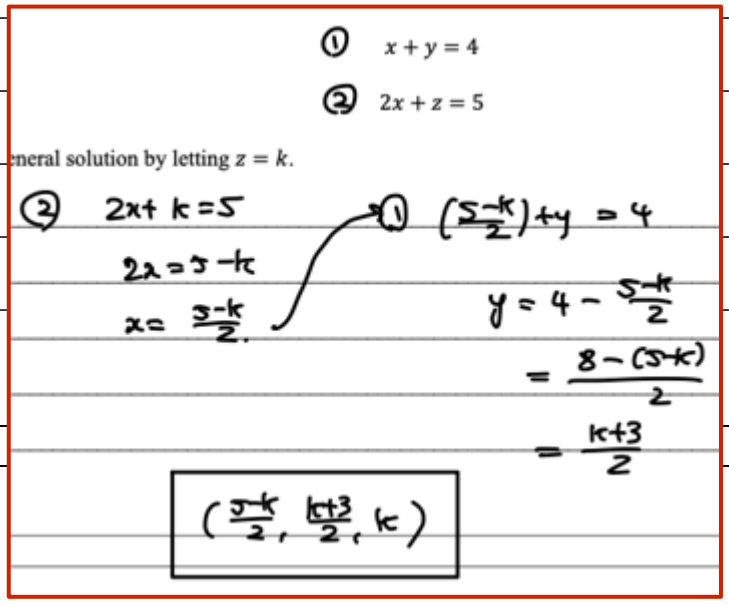
Question 5 (2 marks)

Consider the simultaneous linear equations:

$$x + y = 4$$

$$2x + z = 5$$

Find the general solution by letting $z = k$.



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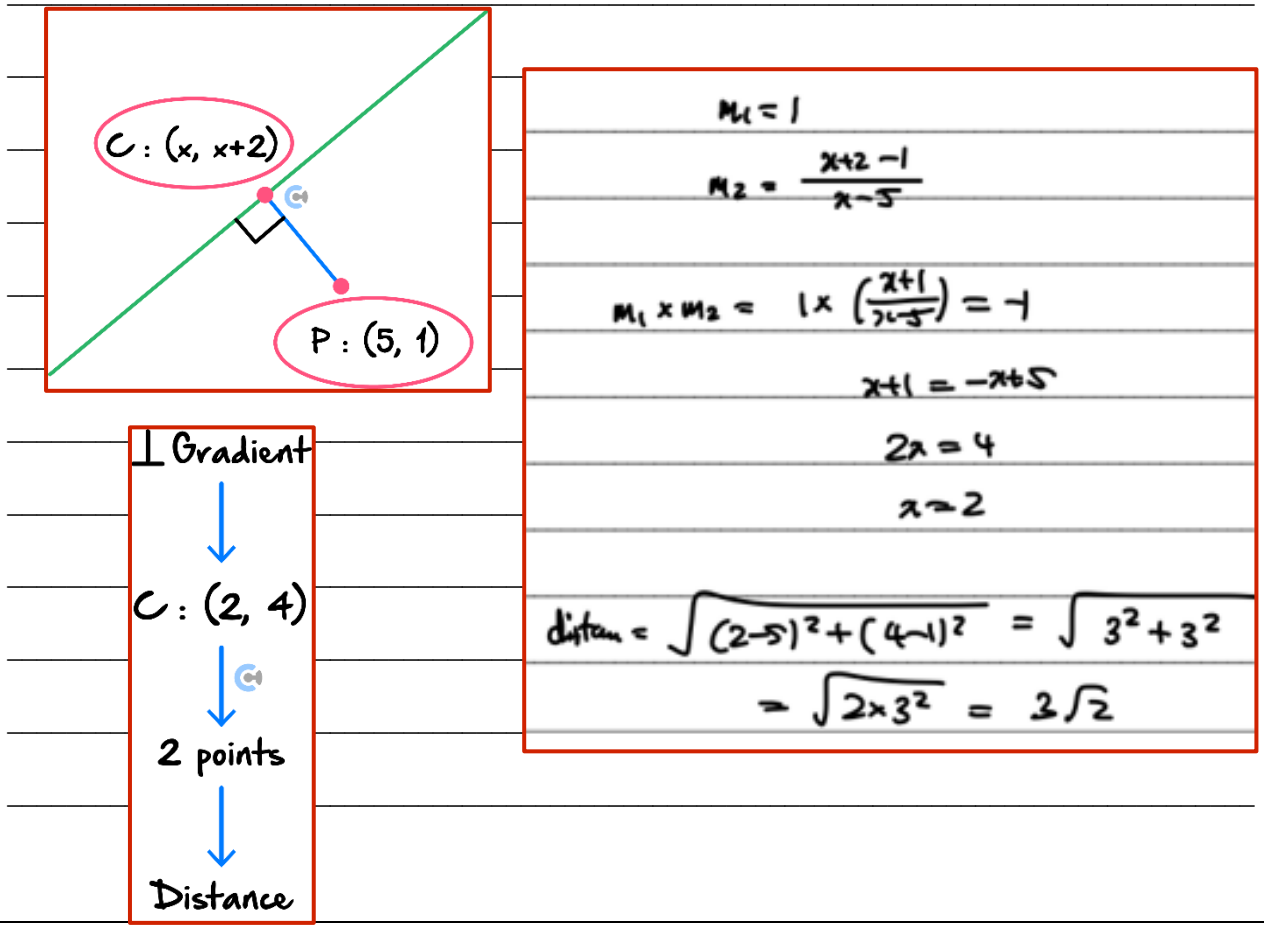
Question 6 (4 marks)

James is standing at point $P(5,1)$ and wants to walk to the road, which is described by $y = x + 2$. But James wants to reach the road by covering the least amount of steps possible. Find the shortest distance he can travel to reach the road.



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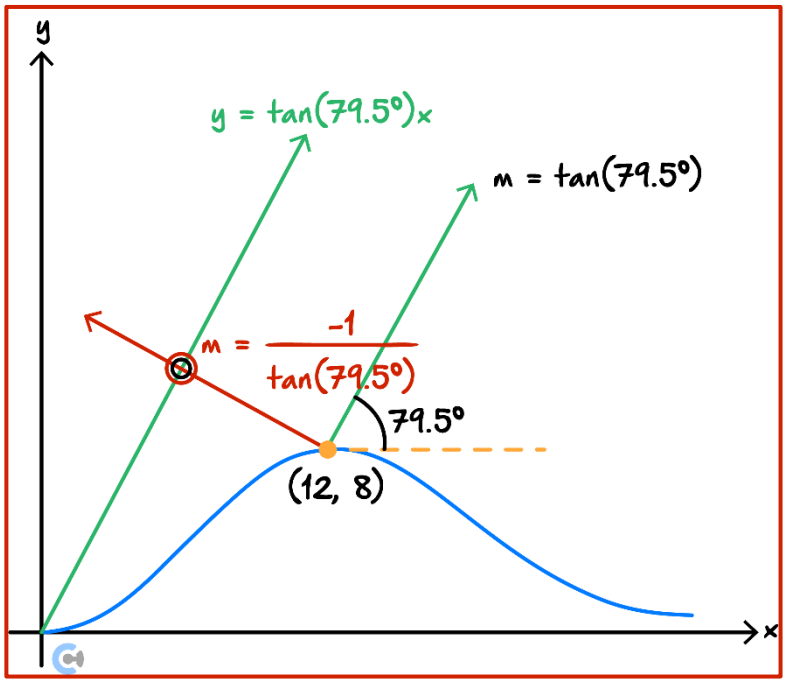
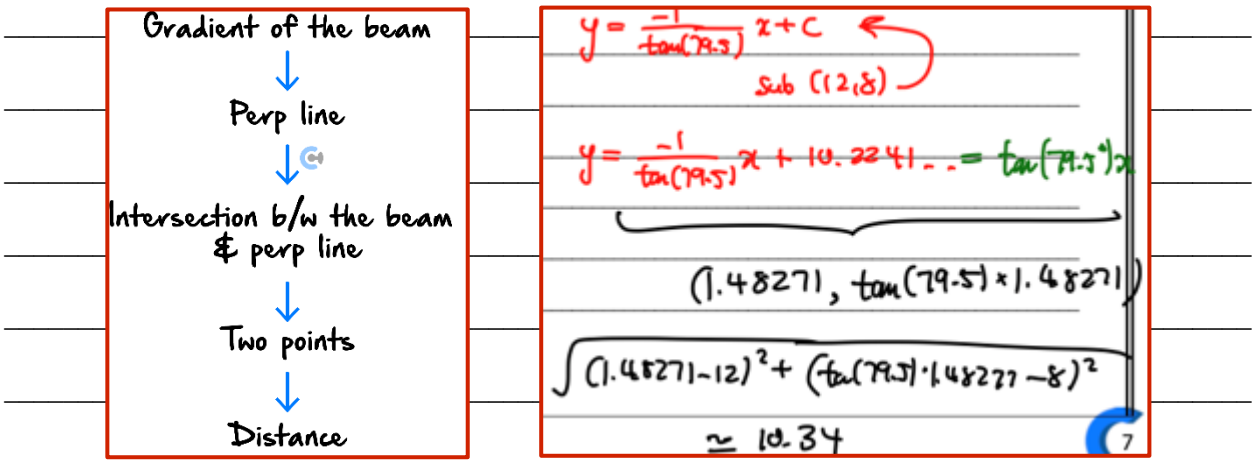
Section B: Extension Test Questions (6 Marks)

Question 7 (6 marks) **Tech-Active.**

Rohan is on a rollercoaster, which starts from the origin as shown in the diagram. When he is at the point $(12, 8)$, he launches a UV beam at an angle of $\alpha = 79.5°$ above the horizontal. Sometime before, another UV beam was launched parallel to Rohan's, such that they both travel together through space.

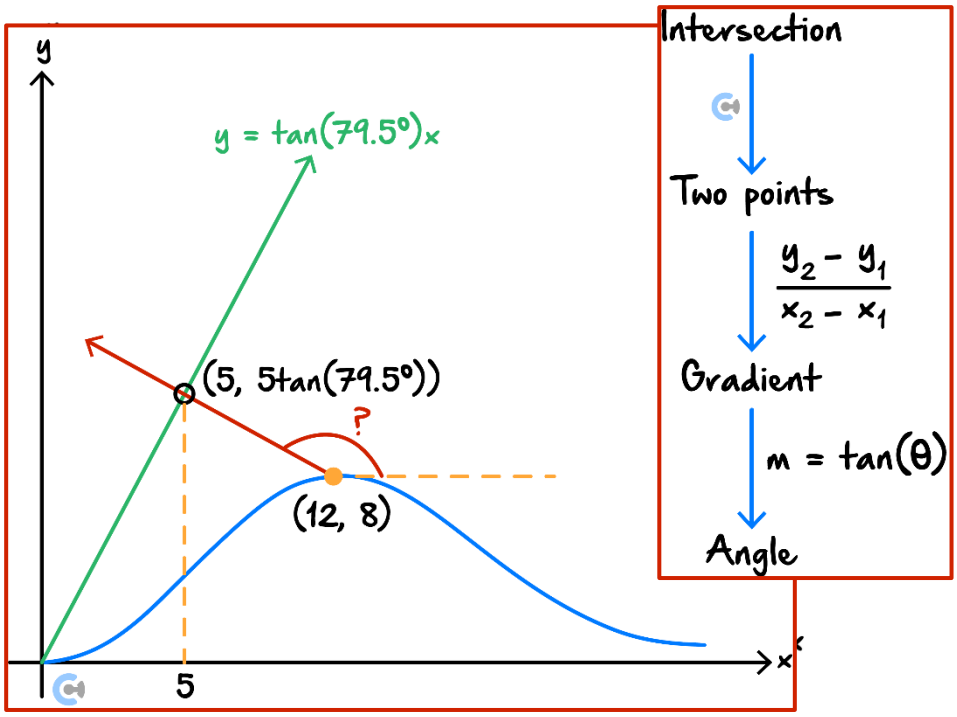


a. Find the shortest distance between the UV beam paths. Give your answer correct to two decimal places. (3 marks)



b. At what angle, should Rohan have launched his beam instead, such that the paths of the two beams would intersect at $x = 5$?

Find the coordinates of this intersection, giving your answer correct to two decimal places. (3 marks)



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