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VCE Mathematical Methods ¾
Coordinate Geometry [1.5]
Homework

Homework Outline:

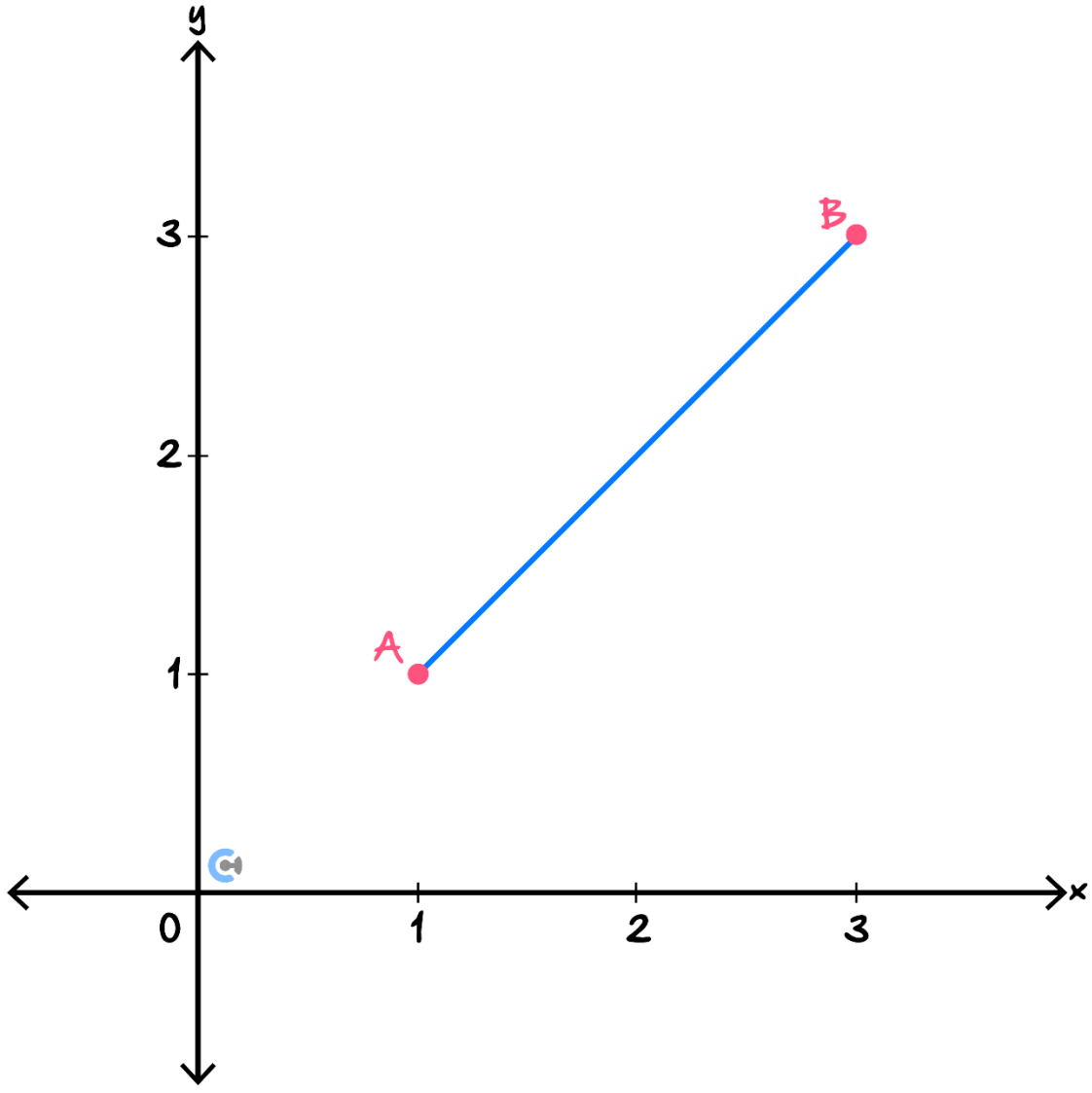
Homework Questions	Pg 2 – Pg 25

Section A: Homework Questions

Sub-Section [1.5.1]: Finding the Midpoint and Distance Between Points and Functions

Question 1

The line segment AB is shown on the axis below. Draw the midpoint, M of AB.



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Question 2

Find the midpoints of the following points.

a. $A(3, 7)$ and $B(5, 9)$.

b. $C(-2, -3)$ and $D(6, 4)$.

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Question 3

The midpoint of points A and B is $M(2, 2)$.

a. If the coordinates of A are $(6, -4)$, find the coordinates of B.

Consider the points $C(c, 5)$ and $D(-3, d)$. The midpoint of the line CD is the origin.

b. Find the values of c and d.

c. Find the midpoint of $E(x_1, y_1)$ and $F(x_2, y_2)$ in terms of x_1, x_2, y_1, and y_2.

d. The graph of $y = x^2 + k$ and the line $y = 1$ has a minimum vertical distance of 4. Find the value of k.

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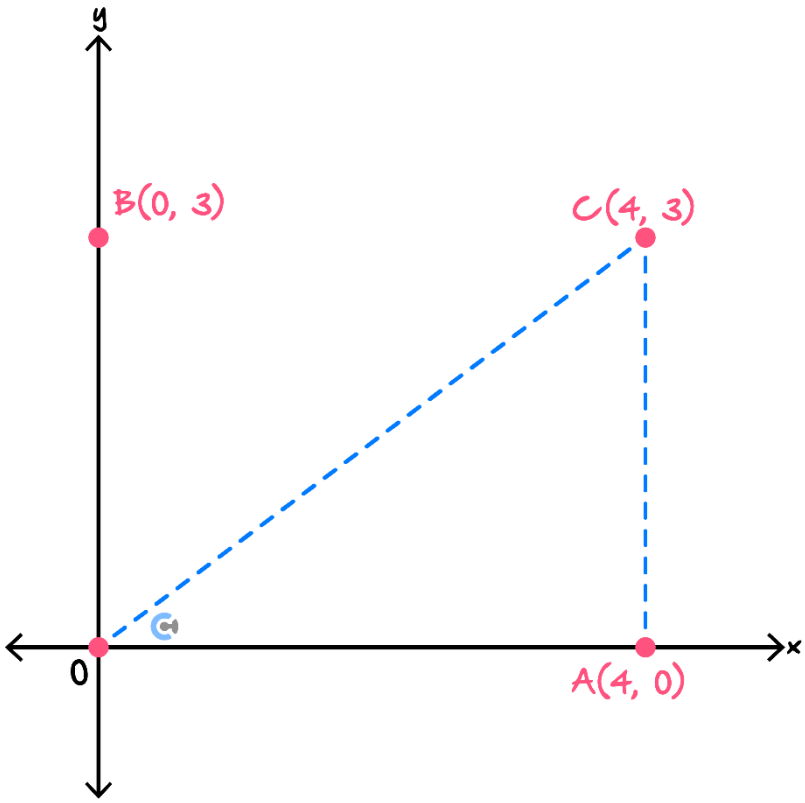
Sub-Section [1.5.2]: Finding Distances Between Points

Question 4

Consider the points, A, B, C as well as the origin drawn below.



a. Find the distance between the origin and point A.

b. Find the distance between the origin and point B.

c. Use Pythagoras' theorem to find the distance between the origin and point C.

Question 5

Find the distance between the following pairs of points.

a. $A(2, 5)$ and $B(-2, 2)$.

b. $C(-1, -7)$ and $D(4, 5)$.

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Question 6

A point $P(u, v)$ lies on the line $y = 3 - x$.

a. Express the distance between P and the origin in terms of u only.

Consider the points $A(-1, -1), B(5, 7)$ and $C(x, y)$.

The length of AC is equal to the length of BC which is equal to halve the length of AB.

b. Find the coordinates of C.

c. **Tech-Active.** The distance between the point $P(u, v)$ is 3 units away from the origin and 4 units away from the point $Q(1, 4)$. Find the coordinates of P.

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Sub-Section [1.5.3]: Finding Parallel and Perpendicular Lines

Question 7

State whether the following lines are parallel or perpendicular to each other.

a. $y = 2x + 1$ and $y = 2x + 5$.

b. $y = 3x + 2$ and $y = -\frac{1}{3}x - 2$.

c. $2x + 3y = 5$ and $4x + 6y = 12$.

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Question 8

A line l_1 goes through the points $(2, 3)$ and $(3, 5)$.

a. Find the gradient of l_1.

b. Find the equation of l_1.

The line l_2 is perpendicular to l_1 and goes through the point $(2, 3)$.

c. Find the gradient of l_2.

d. Find the equation of l_2.

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Question 9

The line l_1 is parallel to the line $l_2 = \{(x, y) \in \mathbb{R}^2 : 2y + 3x = 5\}$ and goes through the origin.

a. Find the equation of l_1.

b. Find the equation of the line that is perpendicular to the line with the equation $y = -5x + 7$ and passes through the point $(2, -5)$.

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Question 10

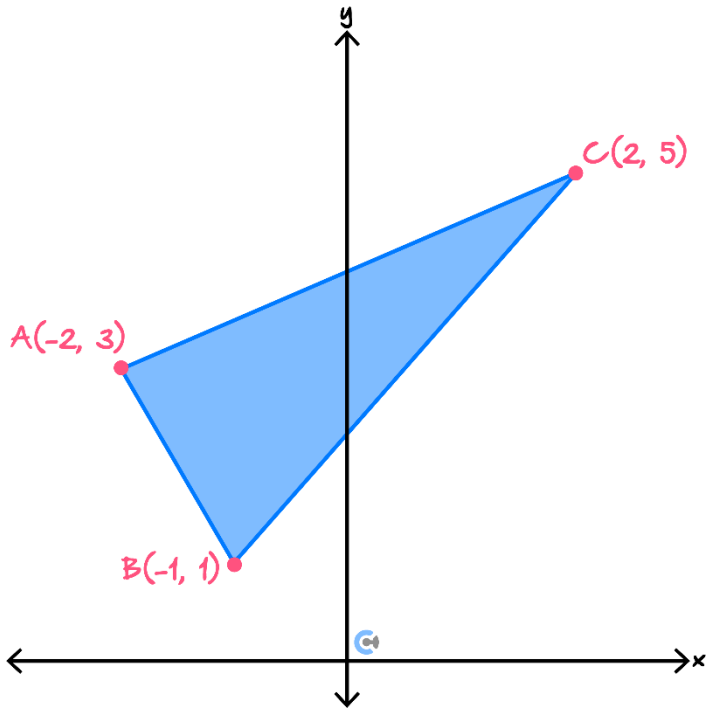
a. Find the perpendicular bisector of the points $A(2, 3)$ and $B(4, 9)$.

b. A point $P(u, v)$ lies on the line $y = 2x$.

Find the value of u and v for which the distance between P and the point $Q(0, 1)$ is minimum.

Hint: The line PQ is perpendicular to the line $y = 2x$.

c. Consider the triangle ABC drawn below.



i. Show that the line AB is perpendicular to the line AC.

ii. Hence, find the area of the triangle ABC.

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Sub-Section [1.5.4]: Angles Between Lines

Question 11

a. Find the angle of the line $y = x + 1$ makes with the positive direction of the x-axis.

b. Find the equation of the line that passes through the origin and makes an angle of 30 degrees with the positive direction of the x-axis.

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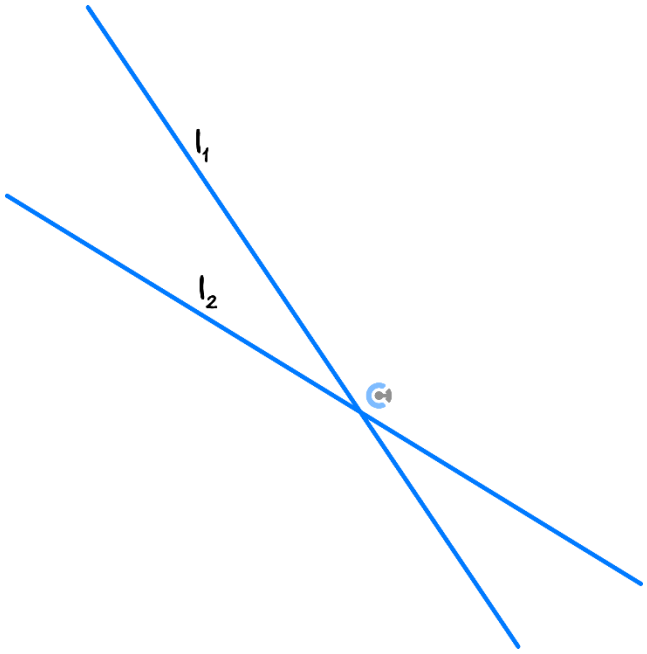
Question 12

a. Find the acute angle between the lines $y = \frac{1}{\sqrt{3}}x + 2$ and $y = \frac{-1}{\sqrt{3}}x$.

b. **Tech-Active.** Consider the line l_1, with the equation $2y + 3x = 5$.

The line l_2 intersects l_1 at an acute angle 25°. Both l_1 and l_2 are drawn below.



Find the slope of l_2 correct to 2 decimal places.

c. **Tech-Active.** Find the acute angle of intersection between the lines $y = 3x + 5$ and $-2x + 3y = 7$.

Give your answer in degrees correct to the nearest degree.

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Question 13

The line l intersects the positive y-axis at $30°$

a. Find the gradient, m of l if $m < 0$.

b. **Tech-Active.** Find the acute angle of intersection between the lines $y = 2x + 3$ and $3x + 5y = -4$.

Give your answer in degrees correct to the nearest degree.

c. Find the equation of all lines that intersect the line $y = x + 3$ at the point $(1, 4)$ at an acute angle of $15°$.

Sub-Section [1.5.5]: Simultaneous Equations

Question 14

Solve the following equations simultaneously.

a. $3x + 4y = 7$ and $5x - 2y = 3$.

b. $y = 5x + 3$ and $3y + 4x = 8$.

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Question 15

a. Find the point of intersection between the lines $y = 3x + 7$ and $2x + 5y = 1$.

b. Explain why the equations $2x + 4y = 6$ and $3x + 6y = 5$ have no solutions.

c. **Tech-Active.** For each pair of simultaneous equations, state whether they have, no solution, a unique solution or infinitely many solutions.

i. $2x + 5y = 7$ and $3x + 2y = 8$.

ii. $y = -3x + 6$ and $2y + 6x = 6$.

iii. $6x + y = 2$ and $y = -6x + 2$.

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Question 16

a. Consider the following pair of simultaneous equations,

$$kx - y = 6$$
$$7x + (k - 8)y = 4$$

For what value(s) of k do they have:

i. A unique solution.

ii. No solution.

b. Consider the following pair of simultaneous equations,

$$ax + 3y = 6$$
$$x + (4 - a)y = 2$$

For what value(s) of a do they have:

i. No solution.

ii. Infinitely many solutions.

iii. A unique solution.

c. **Tech-Active.** Consider the following pair of simultaneous equations,

$$3x + (1 - a)y = 2$$
$$ax - 2y = b$$

Find all pairs (a, b) such that the equations have infinitely many solutions.

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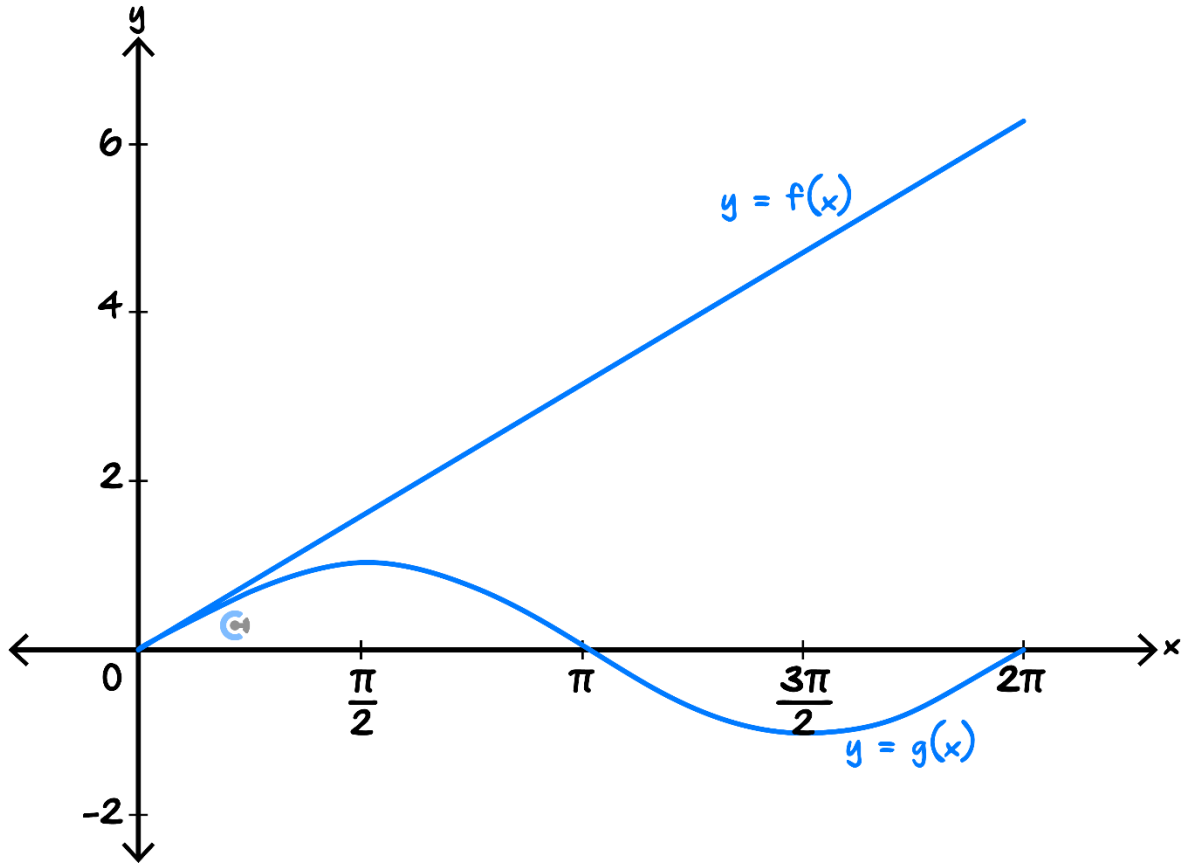
Sub-Section [1.5.6]: Addition of Ordinates

Question 17

The graphs of $f : [0, 2\pi] \longrightarrow \mathbb{R}, f(x) = x$, and $g : [0, 2\pi] \longrightarrow \mathbb{R}, g(x) = \sin(x)$ are drawn below.

Sketch the graph of $h(x) = f(x) + g(x)$ on the axis below, labelling all points of intersection between f and h with their co-ordinates.



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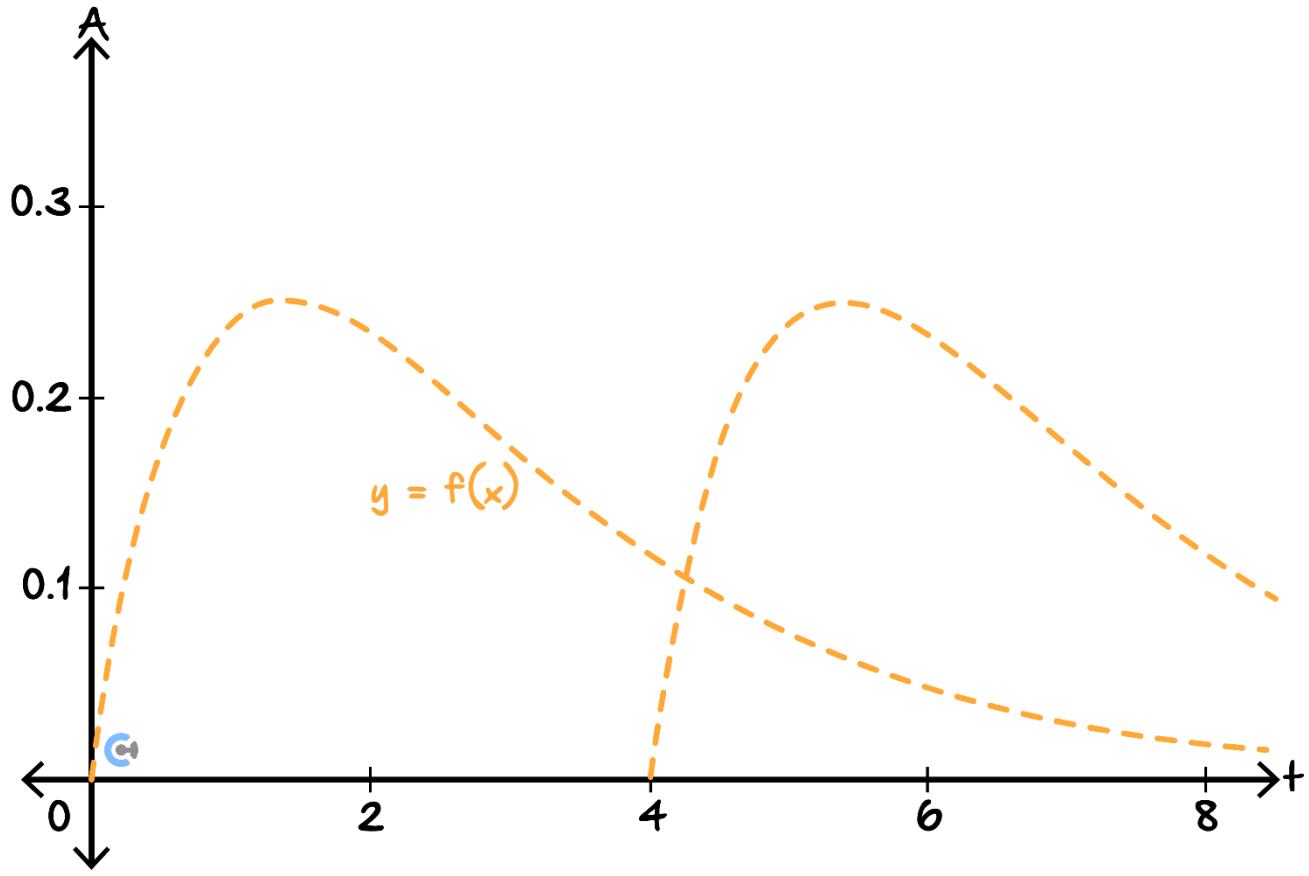
Question 18

t hours after taking a mystery pill, the concentration of dopamine in a patient's bloodstream is $A = f(t)$ milligrams per litre. The graph of f is shown below.

4 hours after taking one mystery pill, the patient takes another mystery pill.

On the axis below, sketch the concentration of dopamine in the patient's bloodstream during the first 8 hours after they take the first mystery pill.



Question 19 Tech-Active.

Let $f(x) = e^x - e^{-2x}$ and $g(x) = e^{x-x^2}$.

How many solutions does the equation $f(x) + g(x) = 0$ have?

Sub-Section [1.5.7]: Boss Question

Question 20

Consider the points $A(1, 0)$ and $B(4, 3)$.

a. Find the equation of the line segment AB.

b. There is another point C, such that A is the midpoint of the line segment CB. Find the coordinates of C.

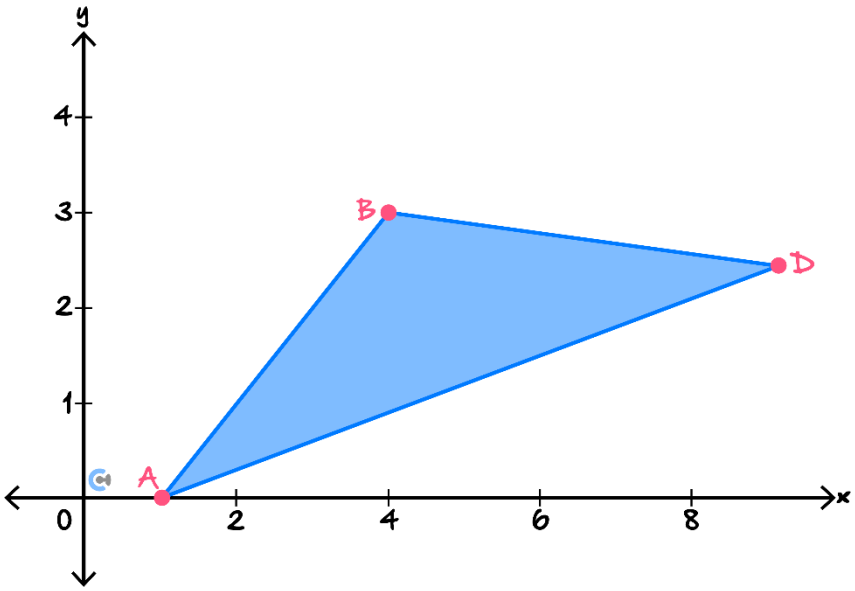
c. Hence or otherwise, find the length of BC.

d. Another point $D(u, v)$ has the following properties,

- The length of AD is equal to twice the length of AB.
- The angle between AD and AB is 30°.
- The gradient of AB is larger than the gradient of AD.
- Both u and v are positive.

Find the values of u and v correct to 3 decimal places.

e. The triangle ABD is drawn below.



i. Find the equation of the line, l perpendicular to AD that goes through B.

ii. Hence or otherwise, find the area of ABD correct to the nearest integer.

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