Further Pure Maths: Rectangular Cartesian Coordinates

Total Marks

EDEXCEL 4PM1 · Calculator allowed · about 65 minutes

Name: _____ Date: ____ / ____ / _____

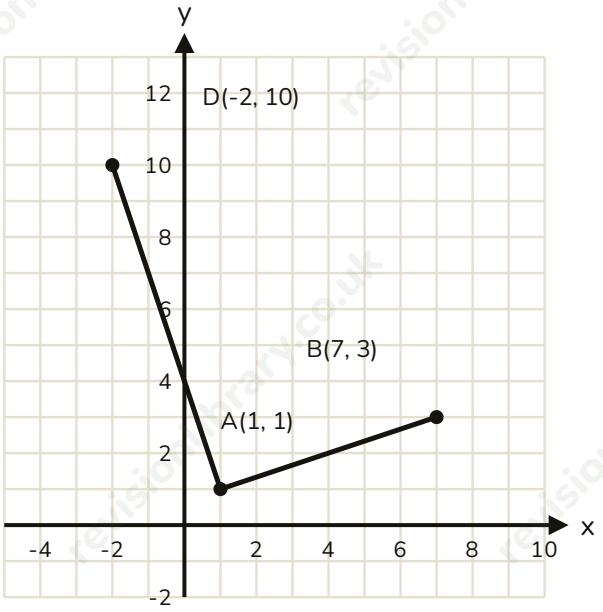
Show your working. Give exact answers unless stated otherwise. Coordinates use the same unit on both axes.

1 A(-4, -1) and B(2, 7) are fixed points. Find an equation of the perpendicular bisector of AB. Hence find the point on $x + y = 4$ that is equidistant from A and B.

(Total for Question 1 is 5 marks)

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2 A quadrilateral has consecutive vertices A(1, 1), B(7, 3), C and D(-2, 10). It is a parallelogram. Find C, show using gradients that the parallelogram is a rectangle, and calculate its area.



(Total for Question 2 is 6 marks)

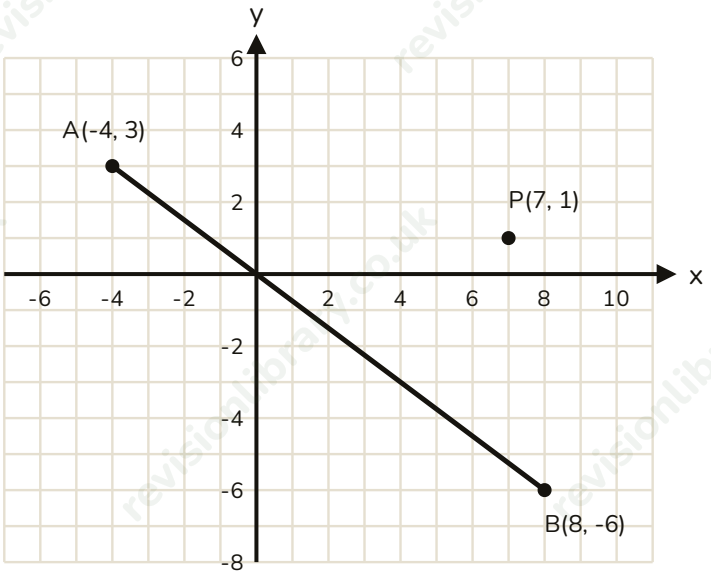
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3 A(-3, 4), B(5, -2) and P lie on a straight line in that order. AP:PB = 3:1. Find P. The line through P perpendicular to AB meets the x-axis at X. Find X.

(Total for Question 3 is 5 marks)

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4 A straight path is the segment joining A(-4, 3) to B(8, -6). A marker is at P(7, 1). Let H be the foot of the perpendicular from P to the infinite line through A and B. Find H, show that H lies on the path by finding AH:HB, and calculate the shortest distance from the marker to the path.



(Total for Question 4 is 6 marks)

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5 M is the midpoint of C(-7, 6) and D(3, -4). Find the coordinates of M.

(Total for Question 5 is 2 marks)

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6 The line l passes through (2, -5) and (8, 4). Find an equation of the line through (-2, 3) parallel to l.

(Total for Question 6 is 3 marks)

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7 Find an equation of the line through (4, -1) perpendicular to 2*x + 5*y = 17.

(Total for Question 7 is 3 marks)

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8 A line passes through (3, -2) and is perpendicular to x = -4. Find its equation.

(Total for Question 8 is 2 marks)

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9 A(-2, 1), B(4, 10) and C(k, 16) are collinear. Find k.

(Total for Question 9 is 3 marks)

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10 A(-6, 5) and B are endpoints of a segment. P(0, 1) divides the segment internally, with AP:PB = 3:2. Find B.

(Total for Question 10 is 3 marks)

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11 The line l has equation y = -2*x + 9. The line m passes through (1, -3) and is perpendicular to l. Find the coordinates where l and m meet.

(Total for Question 11 is 5 marks)

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Mark scheme · Further Pure Maths: Rectangular Cartesian Coordinates

Question 1

Midpoint = (-1, 3). **B1**

Perpendicular gradient = -3/4. **B1**

Perpendicular bisector 3*x + 4*y = 9, or equivalent. **A1**

Solve the bisector equation simultaneously with x + y = 4. **M1**

(7, -3); accept any valid method for the corresponding marks. **A1**

Answer: 3*x + 4*y = 9; (7, -3)

Question 2

Use C = B + (D - A), or equivalent parallel-side displacements. **M1**

C = (4, 12). **A1**

Calculate gradients AB = 1/3 and AD = -3. **M1**

Their product is -1, so adjacent sides are perpendicular; a parallelogram with a right angle is a rectangle. **A1**

Use area = $\sqrt{40}$*$\sqrt{90}$, or another valid coordinate area calculation. **M1**

Area = 60 square units. Accept any valid method for the corresponding marks. **A1**

Answer: C = (4, 12); rectangle; area = 60

Question 3

Use PB = AB/2, since AP = AB + BP and AP = 3*BP. **M1**

P = (9, -5). **A1**

Perpendicular gradient = 4/3. **B1**

Use y + 5 = (4/3)*(x - 9) and set y = 0. **M1**

X = (51/4, 0); accept equivalent exact forms and any valid method for the corresponding marks. **A1**

Answer: P = (9, -5); X = (51/4, 0)

Question 4

Obtain an equation of AB, for example 3*x + 4*y = 0. **M1**

Obtain the perpendicular through P, for example y - 1 = (4/3)*(x - 7). **M1**

H = (4, -3) by solving the line equations. **A1**

Compare AH = (8, -6) and HB = (4, -3), or the corresponding positive lengths. **M1**

AH:HB = 2:1; H lies between A and B, so the perpendicular meets the path. **A1**

Shortest distance = PH = $\sqrt{(7 - 4)^2 + (1 + 3)^2}$ = 5 units. Accept any valid method for the corresponding marks. **A1**

Answer: H = (4, -3); AH:HB = 2:1; shortest distance = 5

Question 5

Average the two x-coordinates and the two y-coordinates. **M1**

M = (-2, 1); accept any valid method for the corresponding marks. **A1**

Answer: (-2, 1)

Question 6

Calculate the gradient of l as (4 + 5)/(8 - 2). **M1**

Use y - 3 = (3/2)*(x + 2), or substitute (-2, 3) into a line with their gradient. **M1**

3*x - 2*y + 12 = 0 or any equivalent equation. Accept any valid method for the corresponding marks. **A1**

Answer: 3*x - 2*y + 12 = 0

Question 7

Identify the perpendicular gradient as 5/2. **B1**

Use y + 1 = (5/2)*(x - 4), or determine the intercept using the given point. **M1**

5*x - 2*y = 22 or any equivalent equation. Accept any valid method for the corresponding marks. **A1**

Answer: 5*x - 2*y = 22

Question 8

Identify that the required line is horizontal. **B1**

y = -2. Accept a correct equation alone for both marks. **B1**

Answer: y = -2

Question 9

Calculate gradient AB = 3/2, or use the displacement ratio. **M1**

Set 15/(k + 2) = 3/2, or 6/(k - 4) = 3/2, or equivalent. **M1**

k = 8; accept any valid method for the corresponding marks. **A1**

Answer: k = 8

Question 10

Use PB = (2/3)*AP, or use P = (2*A + 3*B)/5. **M1**

The x-coordinate of B is 4. **A1**

The y-coordinate of B is -5/3; accept equivalent forms and any valid method for the corresponding marks. **A1**

Answer: (4, -5/3)

Question 11

Perpendicular gradient = 1/2. **B1**

Use the point to obtain y + 3 = (x - 1)/2. **M1**

Solve the two line equations simultaneously. **M1**

x = 5. **A1**

y = -1, giving intersection (5, -1). Accept any valid method for the corresponding marks. **A1**

Answer: (5, -1)

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