5.21 Vectors: 1-hour Pack

EDEXCEL 1MA1 · Calculator allowed · about 60 minutes

Total Marks

Name: _____ Date: ____ / ____ / _____

Answer ALL questions. Show all your working.

1 Point X has position vector (0, 0). Point Y has position vector (0, 6). Point Z has position vector (8, 6).

Work out the vector ZX and state its components. (3 marks)

(Total for Question 1 is 3 marks)

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2 Column vectors are written in the form (x, y), where x is the top (horizontal) number and y is the bottom (vertical) number. a = (5, -2) and b = (-3, 4).

(a) Write down 2a as a column vector. **(1)**

.....

(b) Work out a + b as a column vector. **(1)**

.....

(c) Work out a - b as a column vector. **(1)**

.....

(Total for Question 2 is 3 marks)

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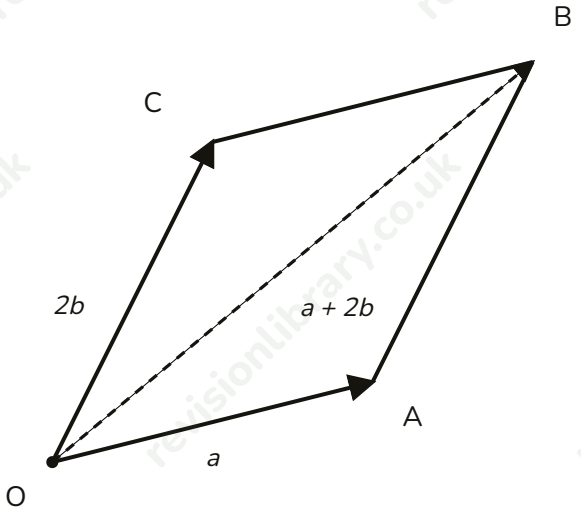
3 a + b = (7, 2). a = (3, -5). Find b as a column vector.

(Total for Question 3 is 2 marks)

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4 O is the origin. OABC has position vectors OA = a, OB = a + 2b and OC = 2b. Show that OABC is a parallelogram.

Diagram NOT accurately drawn



(Total for Question 4 is 3 marks)

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5 u = (3, -1), v = (-5, 4) and w = (2, 6).

(a) Work out u + v + w as a column vector. **(1)**

.....

(b) Calculate the magnitude of u + v + w. **(2)**

.....

(Total for Question 5 is 3 marks)

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6 M is the midpoint of AB, where OA = p and OB = q. Find OM in terms of p and q.

(Total for Question 6 is 2 marks)

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7 a = (3, -6) and b = (2, -2) are column vectors (top number first). Work out 2a + 4b as a column vector.

(Total for Question 7 is 2 marks)

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8 Simplify fully 5(a + 2b) - 3(2a - b).

(Total for Question 8 is 3 marks)

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9 p and q are column vectors.

(a) p = (6, 8). Calculate the magnitude of p, |p|. **(2)**

(b) q = (-5, 12). Calculate the magnitude of q, |q|. **(2)**

(Total for Question 9 is 4 marks)

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10 r = (3, -1).

(a) s = (-9, 3). Show that s is parallel to r. **(1)**

(b) w = (12, -4). Determine, showing your working, whether w is parallel to r. **(2)**

(Total for Question 10 is 3 marks)

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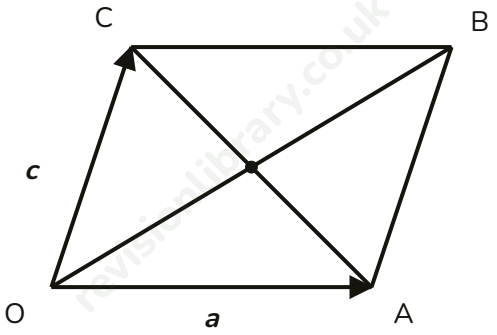
11 Given vectors a = (3, 1) and b = (-2, 4), calculate 2a - 3b and give your answer as a column vector.

(Total for Question 11 is 3 marks)

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12 OABC is a parallelogram. OA = a and OC = c. Prove, using vectors, that the diagonals OB and AC bisect each other.

Diagram NOT accurately drawn



(Total for Question 12 is 4 marks)

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13 On a diagram, A, B and C are points with position vectors relative to origin O: OA = (2, 1), OB = (-1, 3), OC = (5, 4).

(a) Find the vector AB. **(2)**

(b) Show that A, B and C are not collinear by using vectors. **(3)**

(Total for Question 13 is 5 marks)

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14 Vectors a and b satisfy 3a - 2b = (7, 1) and a + b = (3, 2).

(a) Solve for a and b. **(4)**

(b) Hence find 2a - b. **(3)**

(Total for Question 14 is 7 marks)

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Mark scheme · 5.21 Vectors: 1-hour Pack

Question 1

use ZX = X - Z or show correct subtraction of components **M1**

compute components: (0 - 8, 0 - 6) or shown method **M1**

(-8, -6) cao **A1**

Answer: (-8, -6)

Question 2

(a) (10, -4) cao **B1**

(a) Answer: (10, -4)

(b) (2, 2) cao **B1**

(b) Answer: (2, 2)

(c) (8, -6) cao **B1**

(c) Answer: (8, -6)

Question 3

b = (7, 2) - (3, -5) **M1**

(4, 7) cao **A1**

Answer: (4, 7)

Question 4

finds AB = OB - OA = 2b **M1**

compares AB with OC = 2b **M1**

cso: AB = OC, so AB is parallel and equal to OC, so OABC is a parallelogram **A1**

Answer: AB = OC = 2b, so OABC is a parallelogram

Question 5

(a) (0, 9) cao **B1**

(a) Answer: (0, 9)

(b) $\sqrt{0^2 + 9^2}$ ft from (a) **M1**

(b) 9 cao **A1**

(b) Answer: 9

Question 6

uses a correct route, e.g. via O **M1**

(p + q)/2 oe **A1**

Answer: (p + q)/2

Question 7

multiplies one vector correctly **M1**

(14, -20) cao **A1**

Answer: (14, -20)

Question 8

expands both brackets: 5a + 10b - 6a + 3b oe **M1**

collects a terms and b terms correctly (dependent on at least one bracket expanded) **M1**

-a + 13b oe, e.g. 13b - a **A1**

Answer: -a + 13b

Question 9

(a) $\sqrt{6^2 + 8^2}$ oe **M1**

(a) 10 cao **A1**

(a) Answer: 10

(b) $\sqrt{(-5)^2 + 12^2}$ oe **M1**

(b) 13 cao **A1**

(b) Answer: 13

Question 10

(a) cso: s = -3r (or r = -(1/3)s), a scalar multiple of r, so s is parallel to r **B1**

(a) Answer: s = -3r, so s is parallel to r

(b) attempts to write w as a scalar multiple of r, e.g. compares 12/3 and -4/-1 **M1**

(b) cso: w = 4r, so w is parallel to r (and in the same direction, since the scalar is positive) **A1**

(b) Answer: w = 4r, so w is parallel to r

Question 11

Multiply vectors and form 2a and 3b components: 2a = (6,2), 3b = (-6,12) **M1**

Subtract components: (6 - (-6), 2 - 12) or show (6+6, -10) **M1**

(12, -10) cao as a column vector **A1**

Answer: [12; -10]

Question 12

OB = a + c, so the midpoint of OB has position vector (1/2)(a + c) **M1**

midpoint of AC has position vector a + (1/2)(c - a) **M1**

simplifies midpoint of AC to (1/2)(a + c) **A1**

cso: both diagonals have the same midpoint, (1/2)(a+c), so the diagonals bisect each other **A1**

Answer: Midpoint of OB = midpoint of AC = (1/2)(a + c), so the diagonals bisect each other

Question 13

(a) Use AB = OB - OA **M1**

(a) AB = (-3, 2) cao **A1**

(a) Answer: (-3, 2)

(b) Compute AC = OC - OA = (3, 3) and note AB = (-3, 2) **M1**

(b) Attempt to find scalar t with AB = t*AC or AC = t*AB and show no single t fits both components **M1**

(b) Conclude not collinear since components would need same ratio but -3/3 ≠ 2/3 **A1**

(b) Answer: AC = (3, 3), AB = (-3, 2); no scalar t satisfies AB = t AC since -3/3 ≠ 2/3, so points are not collinear.

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Question 14

(a) Use system: from a + b = (3,2) get a = (3,2) - b and substitute into 3a - 2b **M1**

(a) Substitute: 3[(3,2) - b] - 2b = (7,1) => (9,6) - 3b - 2b = (7,1) **M1**

(a) Combine -5b = (7,1) - (9,6) = (-2, -5) so b = ((-2)/ -5, (-5)/ -5) **M1**

(a) b = (2/5, 1) and then a = (3,2) - b = (13/5,1) cao **A1**

(a) Answer: a = (13/5, 1), b = (2/5, 1)

(b) Substitute a and b: 2a - b = 2(13/5,1) - (2/5,1) **M1**

(b) Compute components: (26/5 - 2/5, 2 - 1) = (24/5,1) **M1**

(b) 2a - b = (24/5, 1) cao **A1**

(b) Answer: (24/5, 1)

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