5.21 Vectors: Test Pack

EDEXCEL 1MA1 · Calculator allowed · about 65 minutes

Total Marks

Name: _____ Date: ____ / ____ / _____

Answer ALL questions. Show all your working.

1 Calculate 3 times the vector (1, -2).

(Total for Question 1 is 1 mark)

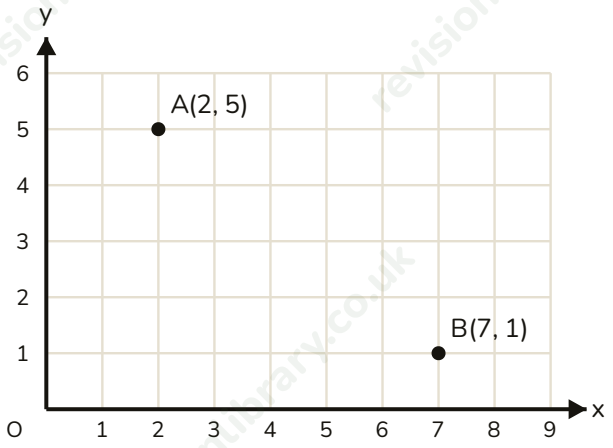
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2 Vector u = (2, 5). Vector v = (6, -1). Work out 2u - v.

(Total for Question 2 is 2 marks)

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3 On a centimetre grid, point A is at (2, 5) and point B is at (7, 1).



(a) Write the vector AB as a column vector. **(1)**

(b) Write the vector BA as a column vector. **(1)**

(Total for Question 3 is 2 marks)

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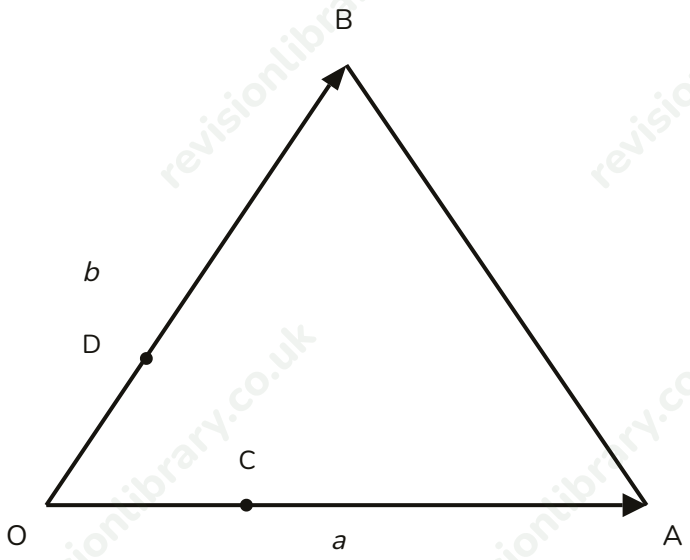
4 v is the column vector (9, 12). Calculate the magnitude of v, |v|.

(Total for Question 4 is 2 marks)

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5 In triangle OAB, OA = a and OB = b. C is the point on OA such that OC = (1/3)a. D is the point on OB such that OD = (1/3)b.

Diagram NOT accurately drawn



(a) Find the vector CD in terms of a and b. **(2)**

(b) Hence show that CD is parallel to AB, and give the ratio CD : AB. **(2)**

(Total for Question 5 is 4 marks)

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6 Which of the following column vectors has a magnitude of exactly 10?

- ☐ A) (6, 8)
- ☐ B) (5, 5)
- ☐ C) (7, 7)
- ☐ D) (3, 9)

(Total for Question 6 is 1 mark)

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7 w is the column vector (5, 11). Work out |w|, giving your answer correct to 1 decimal place.

(Total for Question 7 is 2 marks)

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8 p = 6a - 9b and q = 4a - 6b.

(a) Show that p and q are parallel. **(2)**

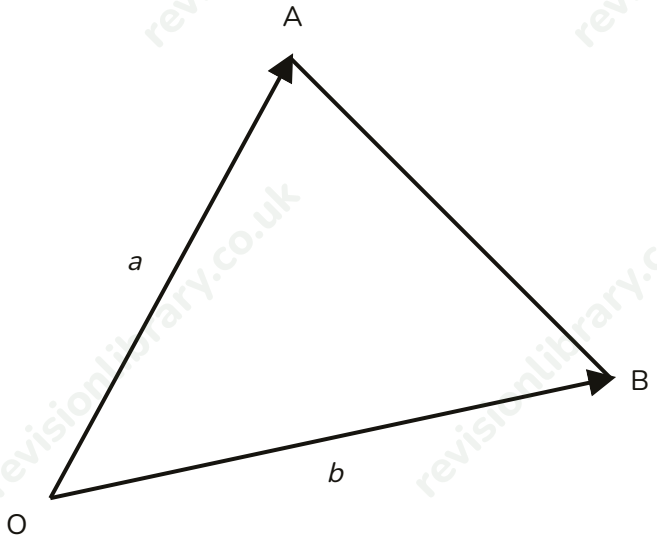
(b) Write down the ratio of the length of p to the length of q. **(1)**

(Total for Question 8 is 3 marks)

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9 In triangle OAB, O is the origin. OA = a and OB = b.

Diagram NOT accurately drawn



(a) Find the vector AB in terms of a and b. **(1)**

(b) Find the vector BA in terms of a and b. **(1)**

(Total for Question 9 is 2 marks)

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10 Points A, B and C have position vectors a = (1, 0), b = (4, 0) and c = (7, 0).

(a) Write down AB and BC. **(2)**

(b) Show that B is the midpoint of AC by using vectors. Give clear working. **(3)**

(c) Hence or otherwise, write AC as a multiple of AB. **(4)**

(Total for Question 10 is 9 marks)

11 Vectors p and q are shown on a grid. p = (4, 0) and q = (1, 3).

(a) Write down p + q. **(2)**

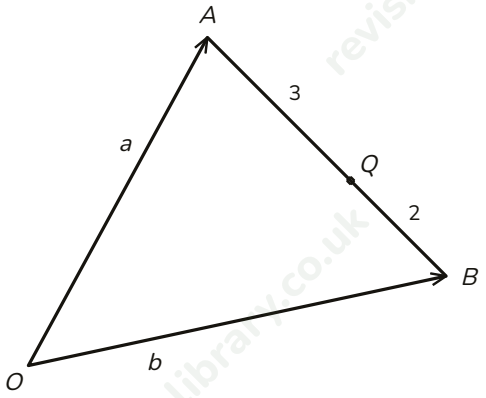
(b) Find a scalar k such that kq = (4, 12). **(2)**

(Total for Question 11 is 4 marks)

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12 In triangle OAB, O is the origin. OA = a and OB = b. Q is the point on AB such that AQ : QB = 3 : 2. Find OQ in terms of a and b.

Diagram NOT accurately drawn



(Total for Question 12 is 3 marks)

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13 Points A and B have position vectors OA = (2, -1) and OB = (8, 5). A point X lies on AB such that AX : XB = 2 : 1.

(a) Find the position vector of X. **(3)**

(b) Verify by vector calculation that X divides AB in the ratio 2 : 1. **(3)**

(Total for Question 13 is 6 marks)

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14 Show that the vectors (2, -1), (5, 2) and (7, 1) are coplanar in R^2 and then determine whether they are linearly dependent by finding constants x, y, z, not all zero, such that x(2, -1) + y(5, 2) + z(7, 1) = (0, 0). Give one nontrivial solution.

(Total for Question 14 is 8 marks)

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Mark scheme · 5.21 Vectors: Test Pack

Question 1

3(1, -2) = (3, -6) cao **B1**

Answer: (3, -6)

Question 2

calculate 2u = (4, 10) and subtract v or show component method **M1**

(-2, 11) cao **A1**

Answer: (-2, 11)

Question 3

(a) (5, -4) cao **B1**

(a) Answer: (5, -4)

(b) (-5, 4) ft from (a) **B1**

(b) Answer: (-5, 4)

Question 4

$\sqrt{9^2 + 12^2}$ oe **M1**

15 cao **A1**

Answer: 15

Question 5

(a) CD = OD - OC = (1/3)b - (1/3)a **M1**

(a) (1/3)(b - a) oe, e.g. (b-a)/3 **A1**

(a) Answer: CD = (1/3)(b - a)

(b) states AB = b - a **M1**

(b) cso: CD = (1/3)AB so CD is parallel to AB, ratio CD : AB = 1 : 3 **A1**

(b) Answer: CD is parallel to AB; CD : AB = 1 : 3

Question 6

A cao **B1**

Answer: A) (6, 8)

Question 7

$\sqrt{5^2 + 11^2}$ oe **M1**

awrt 12.1 **A1**

Answer: 12.1

Question 8

(a) writes p or q as a scalar multiple of the other, e.g. p = 1.5 x q oe **M1**

(a) cso: states p = (3/2)q (or q = (2/3)p), so p and q are parallel **A1**

(a) Answer: p = (3/2)q so p and q are parallel

(b) 3 : 2 oe (ft from the scalar in (a)) **B1**

(b) Answer: 3 : 2

Question 9

(a) b - a cao **B1**

(a) Answer: AB = b - a

(b) a - b ft from (a), the negative of their AB **B1**

(b) Answer: BA = a - b

Question 10

(a) AB = b - a = (3, 0) or BC = c - b = (3, 0) shown **M1**

(a) AB = (3, 0) and BC = (3, 0) cao **A1**

(a) Answer: AB = (3, 0), BC = (3, 0)

(b) show AC = c - a = (6, 0) or equivalent **M1**

(b) show that AB = 1/2 AC or that A + 1/2 AC = B **M1**

(b) state B is midpoint cao **A1**

(b) Answer: AC = (6, 0), AB = (3, 0) = 1/2 AC so B is midpoint

(c) relate AC and AB using components or scalar k with AC = k AB **M1**

(c) substitute numbers to get (6,0) = k(3,0) or equivalent **M1**

(c) k = 2 cao **A1**

(c) AC = 2 AB cao **A1**

(c) Answer: AC = 2 AB

Question 11

(a) Add components: (4+1, 0+3) **M1**

(a) (5, 3) cao **A1**

(a) Answer: (5, 3)

(b) Set k*(1,3) = (4,12) and compare components **M1**

(b) k = 4 cao **A1**

(b) Answer: 4

Question 12

AB = b - a **M1**

OQ = a + (3/5)(b - a), correct method for the ratio **M1**

(2/5)a + (3/5)b oe, e.g. (2a + 3b)/5 **A1**

Answer: OQ = (2a + 3b)/5

Question 13

(a) Use section formula: X = OA + (2/3)AB since AX is 2/3 of AB **M1**

(a) Compute AB = OB - OA = (6,6) **M1**

(a) OX = (2, -1) + (2/3)(6,6) = (2, -1) + (4,4) = (6,3) cao **A1**

(a) Answer: (6, 3)

(b) Compute AX = OX - OA = (6,3) - (2,-1) = (4,4) and XB = OB - OX = (8,5) - (6,3) = (2,2) **M1**

(b) Compare components to show AX = 2*XB in each component **M1**

(b) Conclude AX : XB = 2 : 1 cao **A1**

(b) Answer: AX = (4,4), XB = (2,2); AX = 2 XB so ratio 2 : 1.

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Question 14

Note that in R^2 any three vectors are coplanar; state this or show they lie in R^2	**M1**
Set up equations for linear dependence: 2x + 5y + 7z = 0 and -x + 2y + z = 0	**M1**
Solve system: eliminate x using x = 2y + z from second equation or solve by elimination	**M1**
Substitute x = 2y + z into first: 2(2y+z) + 5y + 7z = 0 => 4y + 2z + 5y + 7z = 0	**M1**
Combine to get 9y + 9z = 0 so y = -z	**M1**
Choose z = 1 then y = -1 and x = 2y + z = 2(-1) + 1 = -1	**M1**
Provide nontrivial solution x = -1, y = -1, z = 1 and conclude vectors are linearly dependent	**A1**
State that the vectors are coplanar (in R^2) and linearly dependent since a nonzero solution exists	**A1**

Answer: Coplanar in R^2. One nontrivial solution is x = -1, y = -1, z = 1 since -1*(2,-1) + -1*(5,2) + 1*(7,1) = (0,0).

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