1.10 Pure: Vectors: 1-hour Pack

EDEXCEL 9MA0 · Calculator allowed · about 60 minutes

Total Marks

Name: _____ Date: ____ / ____ / _____

Answer ALL questions. Show all your working.

1 b = 8i + 6j. Find |b|.

(Total for Question 1 is 1 mark)

2 Find the unit vector in the direction of 6i - 8j.

(Total for Question 2 is 1 mark)

3 Relative to a fixed origin O, OA = 2i + 3j and OB = 7i - 9j. Find the vector AB.

(Total for Question 3 is 1 mark)

4 Relative to a fixed origin O, points P and Q have position vectors p = 2i + 3j and q = 8i - 3j. The point R lies on PQ such that PR : RQ = 2 : 1.

(a) Find the position vector of R. **(4)**

(b) A further point S has position vector s = 12i + 5j. Find the vector RS, and hence find a unit vector in the direction of RS. **(4)**

(Total for Question 4 is 8 marks)

5 a = 3i - 2j + 6k. Find |a|, and hence find the unit vector in the direction of a.

(Total for Question 5 is 2 marks)

6 p = 2i - 5j. q = ti + 15j, where t is a constant. Given that p and q are parallel, find the value of t.

(Total for Question 6 is 2 marks)

7 Relative to a fixed origin O, OA = 2i - 3j and OB = 8i + 7j. M is the midpoint of AB. Find the position vector of M.

(Total for Question 7 is 2 marks)

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8 Relative to a fixed origin O, the points A and B have position vectors OA = 3i + j - 2k and OB = 7i - 3j + 6k. Find the vector AB, and hence find |AB|, giving your answer as an exact simplified surd.

(Total for Question 8 is 3 marks)

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9 Relative to a fixed origin O, points P and Q have position vectors OP = i + 4j - 3k and OQ = 9i - 4j + 5k. The point R lies on PQ such that PR : RQ = 3 : 1. Find the position vector of R.

(Total for Question 9 is 4 marks)

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10 In triangle OAB, OA = a and OB = b. The point P lies on AB such that AP : PB = 1 : 2. The point Q lies on OP such that OQ : QP = 4 : 1.

(a) Find AB in terms of a and b, and hence find OP in terms of a and b. **(3)**

(b) Find OQ in terms of a and b. **(2)**

(c) Find AQ in terms of a and b, giving your answer in its simplest form. **(2)**

(Total for Question 10 is 7 marks)

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11 Relative to a fixed origin O, the points A and B have position vectors OA = -3i + 2j + k and OB = i - j + 4k.

(a) Find the vector AB and the exact length |AB|. **(4)**

(b) Find the position vector of the midpoint M of AB. **(2)**

(c) The point C lies on the line AB, with AC = 2 AB. Find the position vector of C. **(2)**

(d) The point D has position vector 9i - 7j + 10k. Show that D lies on the line AB and find the ratio AD : AB. **(3)**

(Total for Question 11 is 11 marks)

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12 Three forces F1 = (3i + 2j) N, F2 = (-i + 5j) N and F3 = (π + qj) N act on a particle which is in equilibrium.

(a) Find the values of p and q. **(3)**

(b) Find the magnitude of F3, giving your answer in newtons to 3 significant figures. **(2)**

(c) A fourth force F4 is now applied so that the resultant of all four forces is 10i N. Find F4. **(2)**

(Total for Question 12 is 7 marks)

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13 In triangle OAB, OA = a and OB = b. The point P lies on OA such that OP = (2/5)a, and the point Q lies on AB such that AQ = (3/4)AB.

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

(b) Show that PQ = (3/20)(5b - a), fully simplified. **(4)**

(c) A point R lies on OB such that OR = (1/4)b. Determine, showing full working, whether P, Q and R are collinear. **(4)**

(Total for Question 13 is 9 marks)

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Mark scheme · 1.10 Pure: Vectors: 1-hour Pack

Question 1

|b| = 10 cao **B1**

Answer: 10

Question 2

0.6i - 0.8j oe, using |6i-8j| = 10 **B1**

Answer: 0.6i - 0.8j

Question 3

AB = 5i - 12j cao **B1**

Answer: 5i - 12j

Question 4

(a) find PQ = q - p **M1**

(a) PQ = 6i - 6j **A1**

(a) r = p + (2/3)PQ **M1**

(a) r = 6i - j cao **A1**

(a) Answer: r = 6i - j

(b) RS = s - r **M1**

(b) RS = 6i + 6j **A1**

(b) find |RS| = $6\sqrt{2}$ and divide RS by |RS| **M1**

(b) unit vector = $(\sqrt{2}/2)$i + $(\sqrt{2}/2)$j oe (awrt 0.707i + 0.707j) **A1**

(b) Answer: RS = 6i + 6j; unit vector = $(\sqrt{2}/2)$i + $(\sqrt{2}/2)$j

Question 5

|a| = $\sqrt{9+4+36}$ = 7 **M1**

unit vector = (3/7)i - (2/7)j + (6/7)k oe **A1**

Answer: |a| = 7; unit vector = (3/7)i - (2/7)j + (6/7)k

Question 6

sets up t/2 = 15/(-5) oe from the parallel condition **M1**

t = -6 cao **A1**

Answer: t = -6

Question 7

M = (OA + OB)/2 **M1**

OM = 5i + 2j cao **A1**

Answer: OM = 5i + 2j

Question 8

OB - OA **M1**

AB = 4i - 4j + 8k cao **A1**

|AB| = $\sqrt{16+16+64}$ = $\sqrt{96}$ = $4\sqrt{6}$ cao (exact) **A1**

Answer: AB = 4i - 4j + 8k, |AB| = $4\sqrt{6}$

Question 9

find PQ = OQ - OP **M1**

PQ = 8i - 8j + 8k **A1**

r = OP + (3/4)PQ **M1**

OR = 7i - 2j + 3k cao **A1**

Answer: OR = 7i - 2j + 3k

Question 10

(a) AB = b - a **B1**

(a) AP = (1/3) AB and OP = OA + AP **M1**

(a) OP = (2/3)a + (1/3)b **A1**

(a) Answer: AB = b - a, OP = (2/3)a + (1/3)b

(b) OQ = (4/5) OP **M1**

(b) (8/15)a + (4/15)b **A1**

(b) Answer: (8/15)a + (4/15)b

(c) AQ = AO + OQ = -a + OQ **M1**

(c) -(7/15)a + (4/15)b **A1**

(c) Answer: -(7/15)a + (4/15)b

Question 11

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

(a) AB = 4i - 3j + 3k **A1**

(a) uses Pythagoras in three dimensions **M1**

(a) |AB| = $\sqrt{34}$ **A1**

(a) Answer: AB = 4i - 3j + 3k, |AB| = $\sqrt{34}$

(b) (1/2)(OA + OB) **M1**

(b) -i + (1/2)j + (5/2)k **A1**

(b) Answer: -i + (1/2)j + (5/2)k

(c) OC = OA + 2 AB **M1**

(c) 5i - 4j + 7k **A1**

(c) Answer: 5i - 4j + 7k

(d) finds AD = OD - OA **M1**

(d) AD = 12i - 9j + 9k = 3 AB, a multiple of AB, so D lies on the line AB **A1**

(d) AD : AB = 3 : 1 **B1**

(d) Answer: AD = 3 AB, so AD : AB = 3 : 1

Question 12

(a) set sum of i- and j-components equal to zero (equilibrium) **M1**

(a) p = -2 **A1**

(a) q = -7 **A1**

(a) Answer: p = -2, q = -7

(b) $\sqrt{p^2+q^2}$ using values from (a) **M1**

(b) awrt 7.28 N **A1**

(b) Answer: awrt 7.28 N

(c) recognise F1+F2+F3 = 0 from part (a), so F4 alone equals the new resultant **M1**

(c) F4 = 10i N (+0j) cao ft **A1**

(c) Answer: F4 = 10i N

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Question 13

(a) AB = b - a oe **B1**

(a) Answer: AB = b - a

(b) find OQ = a + (3/4)(b-a) **M1**

(b) OQ = (1/4)a + (3/4)b **A1**

(b) PQ = OQ - OP **M1**

(b) cso: PQ = (3/20)(5b - a) fully simplified as printed **A1**

(b) Answer: PQ = (3/20)(5b - a)

(c) find PR = OR - OP **M1**

(c) PR = (1/4)b - (2/5)a **A1**

(c) attempt to compare PR with PQ as a scalar multiple (compare coefficients of a and b) **M1**

(c) cso: coefficient ratios 1/3 (for b) and 8/3 (for a) are unequal, so PR is not a scalar multiple of PQ, hence P, Q, R are not collinear **A1**

(c) Answer: P, Q and R are not collinear

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