HIGHER

8.10 Vectors Proof Questions: 1-hour Pack

Total Marks

EDEXCEL 1MA1 · Calculator allowed · about 60 minutes

Name: _____ Date: ____ / ____ / _____

Answer ALL questions. Show all your working.

1 OA = <2, 1>, OC = <-4, 7>. Show that B, with OB = <-1, 4>, is the midpoint of AC.

(Total for Question 1 is 2 marks)

2 OA = <2, 1>, OB = <12, 11>. Point P divides AB internally so that AP:PB = 3:2. Find the position vector OP and show working.

(Total for Question 2 is 3 marks)

3 OA = <0, 0>, OB = <2, 1>, OC = <3, 4>. Show that A, B and C are not collinear.

(Total for Question 3 is 2 marks)

4 OA = <2, 3>, OB = <8, 7>, OC = <-4, -1>.
Show that A is the midpoint of BC.

(Total for Question 4 is 3 marks)

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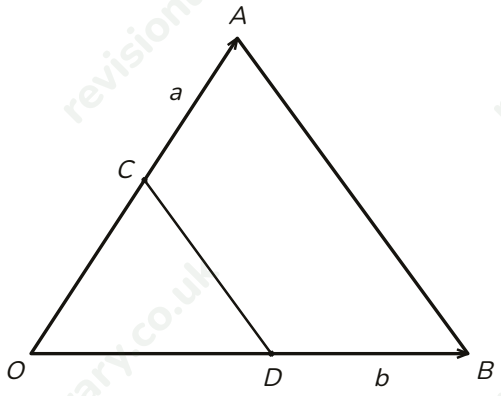
5 Let OA = a and OB = b. Point C has position vector OC = (1/3)a + (2/3)b.
Show that C lies on AB and find AC:CB.

(Total for Question 5 is 3 marks)

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6 OAB is a triangle with OA = a and OB = b. C is the point on OA such that OC = k*a, and D is the point on OB such that OD = k*b, where 0 < k < 1.

Diagram NOT accurately drawn



(a) Find CD in terms of a, b and k. **(2)**

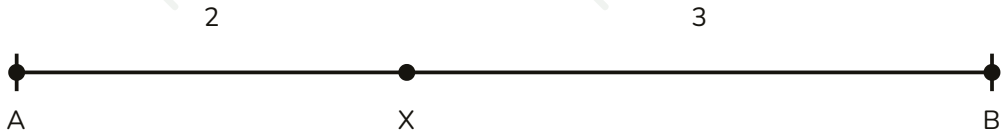
(b) Show that CD is parallel to AB for all values of k. **(2)**

(Total for Question 6 is 4 marks)

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7 X is the point on the line segment AB such that AX:XB = 2:3. O is the origin, with OA = a and OB = b.

Diagram NOT accurately drawn



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

.....

(b) Hence find OX in terms of a and b, giving your answer in the form OX = (1/5) (p*a + q*b), where p and q are integers. **(2)**

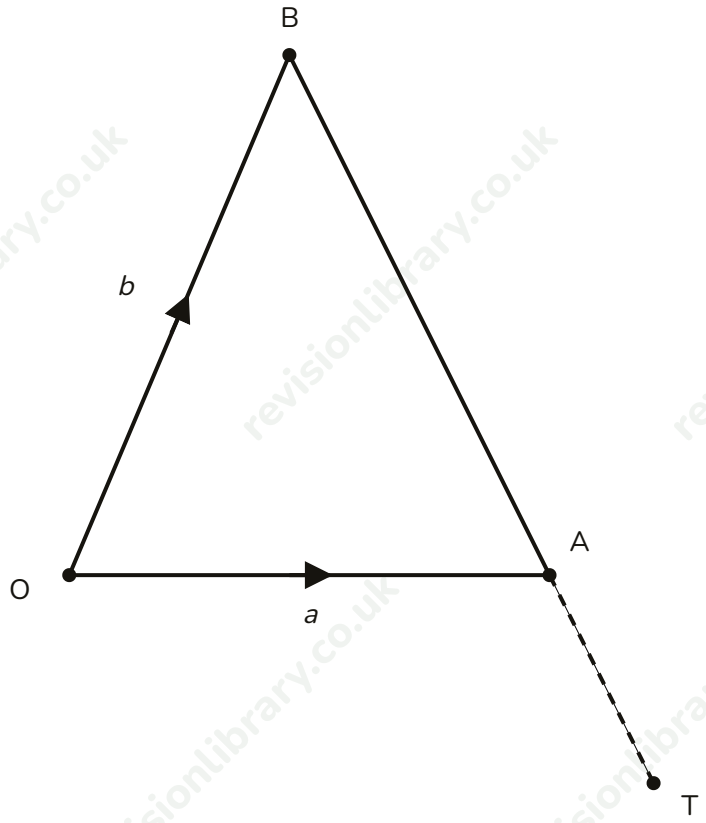
.....

(Total for Question 7 is 4 marks)

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8 OAB is a triangle with OA = a and OB = b. T is the point on the line BA extended, beyond A, such that AT = (2/5)AB.

Diagram NOT accurately drawn



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

.....

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

.....

(Total for Question 8 is 3 marks)

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9 OABC is a parallelogram. OA = a and OC = b. M is the point on AB such that AM:MB = 4:1. Find CM in terms of a and b.

(Total for Question 9 is 3 marks)

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10 OAB is a triangle. OA = a and OB = b. P is the point on AB such that AP:PB = 4:5. Find OP in terms of a and b. Give your answer in its simplest form.

(Total for Question 10 is 3 marks)

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11 OP = 3a + 4b, OQ = a + 4b and OR = -5a + 4b. Show that P, Q and R lie on a straight line.

(Total for Question 11 is 4 marks)

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12 OAB is a triangle. OA = a and OB = b. M is the midpoint of AB. N is the point on OB such that ON:NB = 1:3. Find MN in terms of a and b.

(Total for Question 12 is 3 marks)

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13 OAB is a triangle. OA = a and OB = b. P is the point on OA such that OP:PA = 2:5 and Q is the point on OB such that OQ:QB = 2:5. Show that PQ is parallel to AB and state the value of k in PQ = k AB.

(Total for Question 13 is 4 marks)

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14 OABC is a parallelogram. OA = a and OC = b. M is the point on AB such that AM:MB = 2:3. Find CM in terms of a and b.

(Total for Question 14 is 3 marks)

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15 OAB is a triangle. OA = a and OB = b. P is the point on OA such that OP:PA = 2:3. Q is the point on OB such that OQ:QB = 1:2. Find PQ in terms of a and b.

(Total for Question 15 is 2 marks)

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Mark scheme · 8.10 Vectors Proof Questions: 1-hour Pack

Question 1

calculate (OA + OC)/2 = (<2,1> + <-4,7>)/2 = <-1,4> oe **M1**

state OB = (OA + OC)/2 so B is midpoint of AC cao **A1**

Answer: B is the midpoint of AC because OB = (OA + OC)/2 = <-1, 4>.

Question 2

use OP = (n*OA + m*OB)/(m+n) with AP:PB = m:n so OP = (2*OA + 3*OB)/5 oe **M1**

calculate (2<2,1> + 3<12,11>)/5 = <8,7> oe **M1**

final OP = <8, 7> cao **A1**

Answer: OP = <8, 7>. (Using OP = (2*OA + 3*OB)/5 gives <8,7>.)

Question 3

calculate AB = <2,1> and AC = <3,4> and show there is no scalar k with <3,4> = k<2,1> (3/2 ≠ 4/1) oe **M1**

state A, B and C are not collinear cao **A1**

Answer: Not collinear because AC is not a scalar multiple of AB (3/2 ≠ 4/1).

Question 4

calculate (OB + OC)/2 = (<8,7> + <-4,-1>)/2 = <2,3> oe **M1**

recognise this equals OA so OA = (OB + OC)/2 oe **M1**

state A is midpoint of BC cao **A1**

Answer: A is midpoint of BC because OA = (OB + OC)/2 = <2,3>.

Question 5

calculate OC - OA = -2/3 a + 2/3 b = 2/3 (b - a) oe **M1**

identify k = 2/3 so AC = (2/3) AB oe **M1**

AC:CB = 2:1 cao **A1**

Answer: C lies on AB and AC:CB = 2:1 (since OC - OA = 2/3(b - a)).

Question 6

(a) CD = OD - OC = k*b - k*a **M1**

(a) k*(b - a) (oe) (cao) **A1**

(a) Answer: CD = k*(b - a)

(b) AB = OB - OA = b - a (ft their part (a)) **M1**

(b) CD = k x AB, and since k is a scalar for any value of k with 0 < k < 1, CD is a scalar multiple of AB, so CD is parallel to AB for all such k (cso) **A1**

(b) Answer: CD = k*AB, parallel to AB for all values of k

Question 7

(a) AB = OB - OA = b - a, and AX = (2/5)AB **M1**

(a) (2/5)(b - a) (oe) (cao) **A1**

(a) Answer: AX = (2/5)(b - a)

(b) OX = OA + AX = a + (2/5)(b - a) (ft their part (a)) **M1**

(b) OX = (1/5)(3a + 2b); p = 3, q = 2 (cao) **A1**

(b) Answer: OX = (1/5)(3a + 2b); p = 3, q = 2

Question 8

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

(a) Answer: AB = b - a

(b) recognises T is beyond A away from B, so AT = -(2/5)(b - a), and OT = OA + AT (ft their part (a)) **M1**

(b) (7/5)a - (2/5)b (oe) (cao) **A1**

(b) Answer: OT = (7/5)a - (2/5)b

Question 9

AB = OC = b so OB = a + b or OM = a + AM **M1**

AM = 4/5b and CM = OM - OC **M1**

CM = a - (1/5)b oe **A1**

Answer: CM = a - (1/5)b

Question 10

AB = -a + b **M1**

AP = 4/9 of AB **M1**

OP = (5/9)a + (4/9)b oe **A1**

Answer: OP = (5/9)a + (4/9)b

Question 11

PQ = OQ - OP = -2a **M1**

PR = OR - OP = -8a **M1**

PR = 4PQ **A1**

common point P and conclusion that P, Q and R are collinear **B1**

Answer: PR = 4PQ, so P, Q and R are collinear

Question 12

OM = 1/2(a + b) **M1**

ON = 1/4b **M1**

MN = -(1/2)a - (1/4)b oe **A1**

Answer: MN = -(1/2)a - (1/4)b

Question 13

OP = 2/7a and OQ = 2/7b **M1**

PQ = 2/7b - 2/7a = 2/7(b - a) **M1**

AB = b - a **M1**

PQ = (2/7)AB, so PQ is parallel to AB **A1**

Answer: PQ = (2/7)AB, so PQ is parallel to AB

Question 14

AB = OC = b so OB = a + b or OM = a + AM **M1**

AM = 2/5b and CM = OM - OC **M1**

CM = a - (3/5)b oe **A1**

Answer: CM = a - (3/5)b

Question 15

PQ = PO + OQ or OQ - OP **M1**

-(2/5)a + (1/3)b oe **A1**

Answer: PQ = -(2/5)a + (1/3)b

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