HIGHER

8.10D Vectors Proof Questions: Fluency and Exam Drill

Total Marks

EDEXCEL Edexcel 1MA1 · Calculator allowed · about 50 minutes

Name: _____ Date: ____ / ____ / _____

Answer ALL questions. Show all your working.

1 Vectors OA = <3, 2> and OB = <-1, 4>. Work out the vector AB.

(Total for Question 1 is 1 mark)

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2 OA = <1, 2>, OB = <4, 5>. Point P has position vector OP = (2/3)OA + (1/3)OB.
Show that P lies on the line AB and find the ratio AP:PB.

(Total for Question 2 is 3 marks)

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3 OA = <1, 0>, OB = <4, 3>, OC = <7, 6>. Show that A, B and C are collinear.

(Total for Question 3 is 2 marks)

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

(Total for Question 4 is 2 marks)

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5 OA = <2, 0>, OB = <8, 6>, OC = <5, 3>. Prove that A, B and C are collinear.

(Total for Question 5 is 2 marks)

6 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 6 is 3 marks)

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7 OA = <1, 2>, OB = <4, 3>, OC = <7, 4>. Prove that A, B and C are collinear by showing AC is a multiple of AB.

(Total for Question 7 is 2 marks)

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

(Total for Question 8 is 2 marks)

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9 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 9 is 3 marks)

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

(Total for Question 10 is 3 marks)

11 Let OA = a, OB = b and OC = 5a - 4b. Show that A, B and C are collinear and state where C lies in relation to A and B.

(Total for Question 11 is 3 marks)

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12 OA = a and OB = b. D is a point on AB such that AD = 2 DB. Show that OD = (1/3) a + (2/3) b.

(Total for Question 12 is 3 marks)

Mark scheme · 8.10D Vectors Proof Questions: Fluency and Exam Drill

Question 1

- **B1** AB = <-4, 2> cao
- **Answer: AB = OB - OA = <-4, 2>.**

Question 2

- **M1** calculate OP = (2/3)<1,2> + (1/3)<4,5> = <2,3> oe
- **M1** write OP = OA + t(OB - OA) and solve 1 + 3t = 2, 2 + 3t = 3 to get t = 1/3 oe
- **A1** AP:PB = 1:2 cao
- **Answer: P lies on AB with AP:PB = 1:2. (OP = <2,3>, t = 1/3 so AP = 1/3 AB.)**

Question 3

- **M1** calculate OC - OA = <6,6> and OB - OA = <3,3> and show OC - OA = 2(OB - OA) oe
- **A1** state A, B and C are collinear cao
- **Answer: Collinear, since OC - OA = 2(OB - OA).**

Question 4

- **M1** calculate (OA + OC)/2 = (<2,1> + <-4,7>)/2 = <-1,4> oe
- **A1** state OB = (OA + OC)/2 so B is midpoint of AC cao
- **Answer: B is the midpoint of AC because OB = (OA + OC)/2 = <-1, 4>.**

Question 5

- **M1** calculate AB = <6,6> and AC = <3,3> and show AC = 1/2 AB oe
- **A1** state A, B and C are collinear cao
- **Answer: Collinear, since AC = 1/2 AB.**

Question 6

- **M1** 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
- **A1** final OP = <8, 7> cao
- **Answer: OP = <8, 7>. (Using OP = (2*OA + 3*OB)/5 gives <8,7>.)**

Question 7

- **M1** calculate AB = <3,1>, AC = <6,2> and show AC = 2 AB oe
- **A1** state A, B and C are collinear cao
- **Answer: Collinear because AC = 2 AB.**

Question 8

- **M1** 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
- **A1** state A, B and C are not collinear cao
- **Answer: Not collinear because AC is not a scalar multiple of AB (3/2 ≠ 4/1).**

Question 9

- **M1** 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
- **A1** AC:CB = 2:1 cao
- **Answer: C lies on AB and AC:CB = 2:1 (since OC - OA = 2/3(b - a)).**

Question 10

- **M1** calculate (OB + OC)/2 = (<8,7> + <-4,-1>)/2 = <2,3> oe
- **M1** recognise this equals OA so OA = (OB + OC)/2 oe
- **A1** state A is midpoint of BC cao
- **Answer: A is midpoint of BC because OA = (OB + OC)/2 = <2,3>.**

Question 11

- **M1** compute OC - OA = 4a - 4b = 4(a - b) = -4(b - a) oe
- **A1** state A, B and C are collinear with OC - OA = -4(OB - OA) cao
- **A1** state C lies on the line AB produced beyond A (k = -4) cao
- **Answer: Collinear; OC - OA = -4(OB - OA) so C is on line AB produced beyond A (scalar k = -4).**

Question 12

- **M1** use AD = 2/3 AB so vector AD = 2/3(b - a) oe
- **M1** write OD = OA + AD = a + 2/3(b - a) and simplify oe
- **A1** OD = 1/3 a + 2/3 b cso
- **Answer: OD = 1/3 a + 2/3 b. (Using AD = 2/3 AB gives OD = a + 2/3(b - a) = 1/3 a + 2/3 b.)**