HIGHER

3.1 Vector Geometry: Proof and Ratio Problems: 1-hour Pack

Total Marks

EDEXCEL 4MA1 · Calculator allowed · about 60 minutes

Name: _____ Date: ____ / ____ / _____

Answer ALL questions. Show all your working.

1 OABC is a parallelogram. OA = a and OC = b.
X is the midpoint of OB. Find XA and XC in terms of a and b, and show that X is also the midpoint of AC.

(Total for Question 1 is 4 marks)

2 OAB is a triangle. OA = a and OB = b. The point P lies on AB such that AP : PB = 3 : 4.
Find BP in terms of a and b.

(Total for Question 2 is 4 marks)

3 OA = a and OB = b. The points P, Q and R have position vectors OP = -3a - b, OQ = 2a + b and OR = -8a - 3b relative to O.
Show whether P, Q and R lie on a straight line. Give a reason.

(Total for Question 3 is 5 marks)

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4 OAB is a triangle. OA = a and OB = b. The point M lies on OA such that OM : MA = 2 : 3. The point N lies on OB such that ON : NB = 2 : 3.
Find AN in terms of a and b.

(Total for Question 4 is 3 marks)

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5 OABC is a parallelogram. OA = a and OC = b.
(a) Find OB in terms of a and b.
(b) Find AC in terms of a and b.
(c) M is the midpoint of AC. Find OM and hence show that M is also the midpoint of OB.

(Total for Question 5 is 4 marks)

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6 OAB is a triangle. OA = a and OB = b. The point P lies on AB such that AP : PB = 1 : 3.
Find OP in terms of a and b. Give your answer in its simplest form.

(Total for Question 6 is 4 marks)

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7 OABC is a trapezium with CB parallel to OA. OA = a, OC = b and CB = 1/3a.
Find AB in terms of a and b.

(Total for Question 7 is 2 marks)

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8 OAB is a triangle. OA = a and OB = b. M is the midpoint of AB. The point P lies on OM such that OP : PM = 1 : 1.
Find BP in terms of a and b.

(Total for Question 8 is 4 marks)

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9 OA = a and OB = b. The points P, Q and R have position vectors OP = -2a + 2b, OQ = -3a - 3b and OR = 7b relative to O.
Show whether P, Q and R lie on a straight line. Give a reason.

(Total for Question 9 is 5 marks)

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10 OAB is a triangle. OA = a and OB = b. The point M lies on OA such that OM : MA = 1 : 3. The point N lies on OB such that ON : NB = 1 : 3.
Find AN in terms of a and b.

(Total for Question 10 is 3 marks)

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11 OAB is a triangle. OA = a and OB = b. The point P lies on AB such that AP : PB = 1 : 4.
Find BP in terms of a and b.

(Total for Question 11 is 4 marks)

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Mark scheme · 3.1 Vector Geometry: Proof and Ratio Problems: 1-hour Pack

Question 1

OB = a + b, so OX = (1/2)(a + b)	**M1**
XA = (1/2)a - (1/2)b	**A1**
XC = -(1/2)a + (1/2)b	**A1**
XA = -XC, so X lies on AC and is its midpoint	**B1**

Answer: XA = (1/2)a - (1/2)b; XC = -(1/2)a + (1/2)b; XA = -XC

Question 2

AB = AO + OB = -a + b = -a + b	**M1**
AP = (3/7) AB = -(3/7)a + (3/7)b	**M1**
BP = BO + OP or BP = -(PB) with PB found from the ratio	**M1**
BP = (4/7)a - (4/7)b	**A1**

Answer: (4/7)a - (4/7)b

Question 3

PQ = OQ - OP	**M1**
PQ = 5a + 2b	**A1**
PR = OR - OP	**M1**
PR = -5a - 2b	**A1**
PR is a multiple of PQ and they share the point P, so P, Q and R are collinear	**B1**

Answer: Collinear: PR = -1PQ

Question 4

ON = 2/5b	**M1**
AN = AO + ON	**M1**
AN = -a + (2/5)b	**A1**

Answer: -a + (2/5)b

Question 5

OB = OA + AB = a + b (AB = OC)	**B1**
AC = AO + OC = -a + b	**B1**
OM = OA + (1/2)AC = (1/2)a + (1/2)b	**M1**
OM = (1/2)OB, so M is the midpoint of OB	**A1**

Answer: (a) OB = a + b; (b) AC = -a + b; (c) OM = (1/2)a + (1/2)b = (1/2)OB

Question 6

AB = AO + OB = -a + b = -a + b	**M1**
AP = (1/4) AB = -(1/4)a + (1/4)b	**M1**
OP = OA + AP = a - (1/4)a + (1/4)b	**M1**
OP = (3/4)a + (1/4)b	**A1**

Answer: (3/4)a + (1/4)b

Question 7

AB = AO + OC + CB	**M1**
AB = -(2/3)a + b	**A1**

Answer: -(2/3)a + b

Question 8

OM = OA + (1/2)AB = (1/2)(a + b)	**M1**
OP = (1/2)OM = (1/4)a + (1/4)b	**M1**
BP = BO + OP	**M1**
BP = (1/4)a - (3/4)b	**A1**

Answer: (1/4)a - (3/4)b

Question 9

PQ = OQ - OP	**M1**
PQ = -a - 5b	**A1**
PR = OR - OP	**M1**
PR = 2a + 5b	**A1**
PR is not a scalar multiple of PQ, so the points are not on a straight line	**B1**

Answer: Not collinear: PR is not a multiple of PQ

Question 10

ON = 1/4b	**M1**
AN = AO + ON	**M1**
AN = -a + (1/4)b	**A1**

Answer: -a + (1/4)b

Question 11

AB = AO + OB = -a + b = -a + b	**M1**
AP = (1/5) AB = -(1/5)a + (1/5)b	**M1**
BP = BO + OP or BP = -(PB) with PB found from the ratio	**M1**
BP = (4/5)a - (4/5)b	**A1**

Answer: (4/5)a - (4/5)b

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