HIGHER

6.9 Enlarging with Negative Scale Factors: 2-hour Pack

Total Marks

EDEXCEL 1MA1 · Calculator allowed · about 120 minutes

Name: _____ Date: ____ / ____ / _____

Answer ALL questions. Show all your working.

1 The point P is (0, 7). P is enlarged by scale factor -1/2 with centre (-4, -3). Find the coordinates of the image of P.

(Total for Question 1 is 3 marks)

2 The point P is (6, 10). P is enlarged by scale factor -1/2 with centre (-2, 2). Find the coordinates of the image of P.

(Total for Question 2 is 3 marks)

3 The point P(-7, 6) is mapped to P'(-1, 0) by an enlargement with scale factor -1. Find the coordinates of the centre of enlargement.

(Total for Question 3 is 3 marks)

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4 The point P is (-2, 3). P is enlarged by scale factor -3 with centre (3, -2). Find the coordinates of the image of P.

(Total for Question 4 is 3 marks)

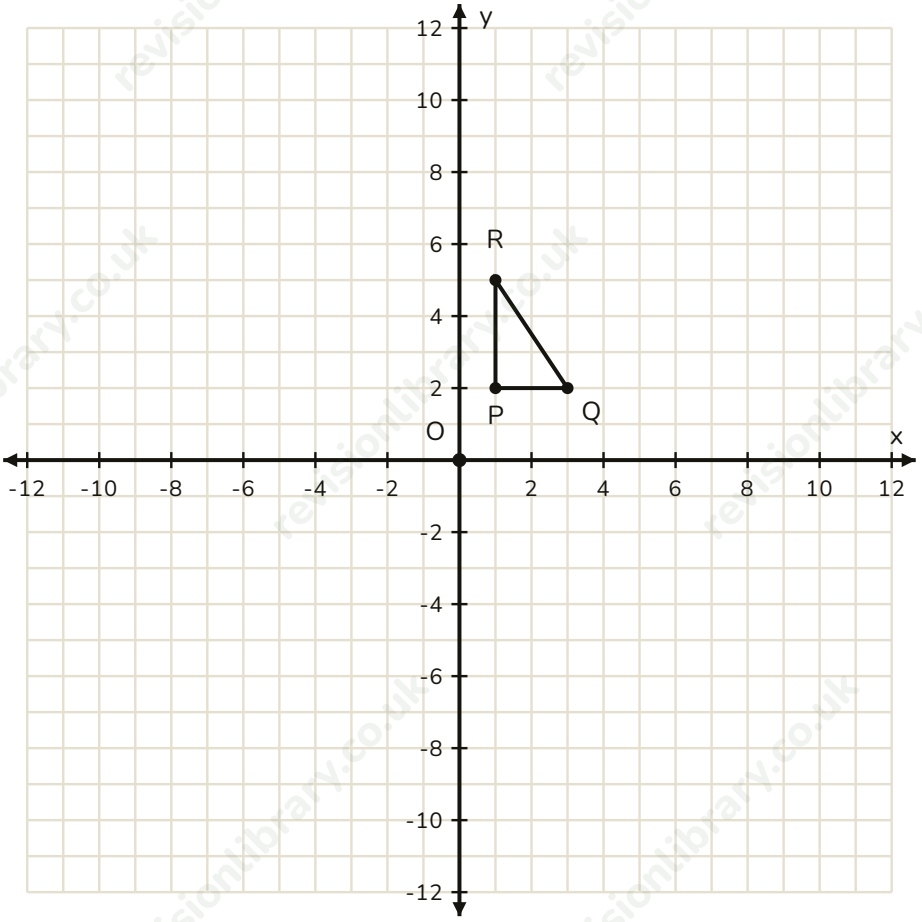
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5 The point P is (13, 11). P is enlarged by scale factor -2/3 with centre (-2, -4). Find the coordinates of the image of P.

(Total for Question 5 is 3 marks)

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6 Triangle PQR has vertices P(1,2), Q(3,2) and R(1,5). It is enlarged by scale factor -2, centre (0,0), to give triangle P'Q'R'. Find the coordinates of P', Q' and R'.



(Total for Question 6 is 3 marks)

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7 The point P is (-4, -3). P is enlarged by scale factor -1 with centre (1, -2). Find the coordinates of the image of P.

(Total for Question 7 is 3 marks)

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8 A shape has area 28 cm². It is enlarged by scale factor -5. Work out the area of the image.

(Total for Question 8 is 2 marks)

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9 The point P is (0, -3). P is enlarged by scale factor -1 with centre (-2, -1). Find the coordinates of the image of P.

(Total for Question 9 is 3 marks)

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10 The point P(-3, 2) is mapped to P'(6, -4) by an enlargement with scale factor -1/2. Find the coordinates of the centre of enlargement.

(Total for Question 10 is 3 marks)

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11 The point P is (-2, 12). P is enlarged by scale factor -2/3 with centre (-2, 0). Find the coordinates of the image of P.

(Total for Question 11 is 3 marks)

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12 A shape has perimeter 12 cm. It is enlarged by scale factor -4. Work out the perimeter of the image.

(Total for Question 12 is 2 marks)

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13 The point P is (-10, 11). P is enlarged by scale factor -2/3 with centre (-1, -1). Find the coordinates of the image of P.

(Total for Question 13 is 3 marks)

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14 Triangle T has a side from A(3, 2) to B(6, 1). Under a single enlargement, A maps to A'(-3, -7) and B maps to B'(-9, -5). Describe fully the enlargement.

(Total for Question 14 is 3 marks)

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15 A shape has perimeter 8 cm. It is enlarged by scale factor -3. Work out the perimeter of the image.

(Total for Question 15 is 2 marks)

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16 The point P(0, -5) is mapped to P'(8, 7) by an enlargement with scale factor -3. Find the coordinates of the centre of enlargement.

(Total for Question 16 is 3 marks)

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17 A shape has perimeter 14 cm. It is enlarged by scale factor -4. Work out the perimeter of the image.

(Total for Question 17 is 2 marks)

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18 The point P(-1, 4) is mapped to P'(-10, -11) by an enlargement with scale factor -2. Find the coordinates of the centre of enlargement.

(Total for Question 18 is 3 marks)

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19 The point P has coordinates (2, 3). P is enlarged by scale factor -1, centre the origin O, to give the image P'. Find the coordinates of P'.

(Total for Question 19 is 2 marks)

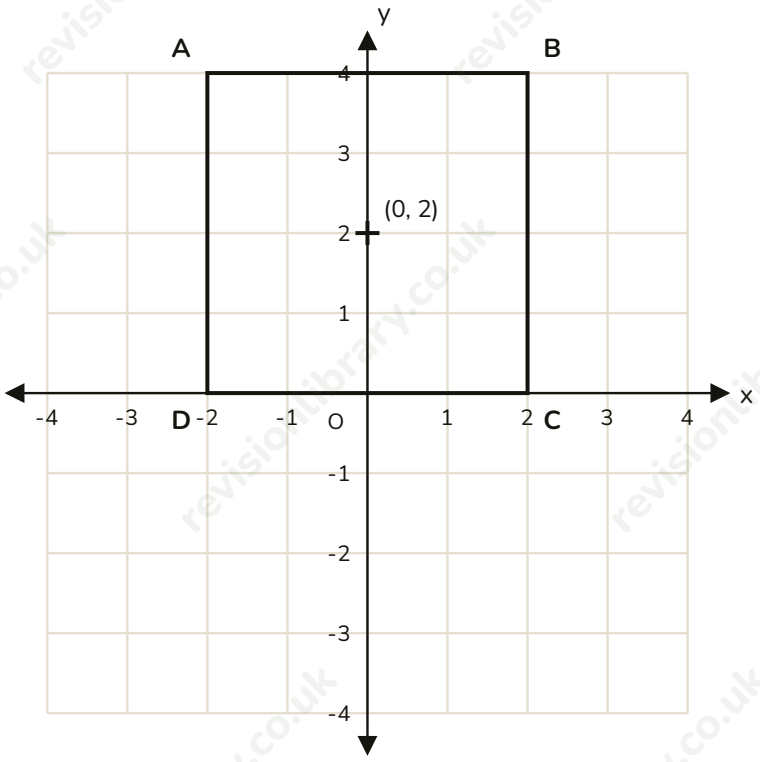
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20 The point Q has coordinates (4, -2). Q is enlarged by scale factor -2, centre the origin O, to give the image Q'. Find the coordinates of Q'.

(Total for Question 20 is 2 marks)

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21 A rectangle ABCD has vertices A(-2,4), B(2,4), C(2,0) and D(-2,0). The rectangle is enlarged by scale factor -1/2, using centre (0,2), to form rectangle A'B'C'D'.



(a) Find the coordinates of A', B', C' and D'. **(4)**

.....

(b) The area of rectangle ABCD is 16 cm². Use the scale factor to calculate the area of rectangle A'B'C'D'. **(2)**

.....

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(c) Find the ratio of the perimeter of ABCD to the perimeter of A'B'C'D', giving your answer in its simplest form. **(2)**

.....

(Total for Question 21 is 8 marks)

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22 Triangle ABC has vertices A(1, 1), B(4, 1) and C(1, 3). After an enlargement, the image has vertices A'(-2, -2), B'(-8, -2) and C'(-2, -6). Find (i) the scale factor of the enlargement (ii) the coordinates of the centre of enlargement.

(Total for Question 22 is 4 marks)

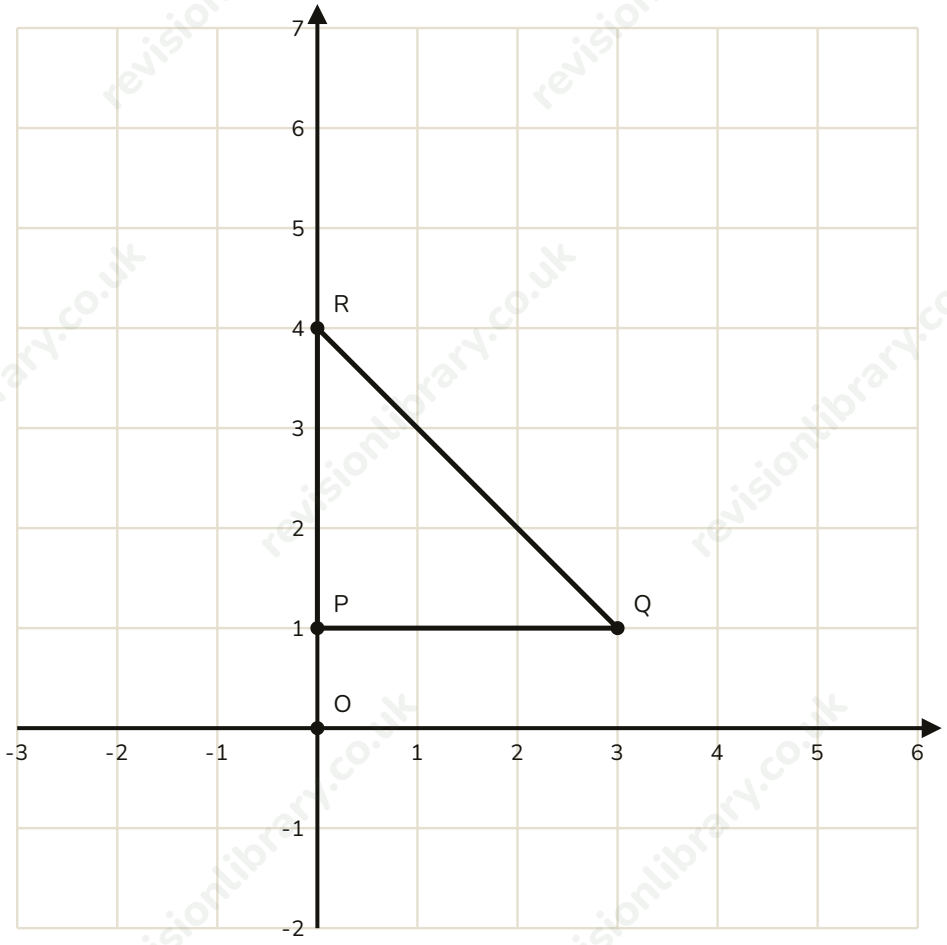
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23 Point S has coordinates (2, 2) and maps to the image point S'(-2, -2) under an enlargement with scale factor -1. Find the coordinates of the centre of enlargement.

(Total for Question 23 is 2 marks)

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24 Triangle PQR has vertices P(0, 1), Q(3, 1) and R(0, 4). The area of triangle PQR is 4.5 cm². Triangle PQR is enlarged by scale factor -2, centre the origin O, to give triangle P'Q'R'.



(a) Find the coordinates of P', Q' and R'. **(2)**

.....

(b) Find the area of triangle P'Q'R'. **(2)**

.....

(Total for Question 24 is 4 marks)

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25 Triangle DEF has vertices D(2, 1), E(5, 1) and F(2, 3). The triangle is enlarged by scale factor -1/2, centre the origin O, to give triangle D'E'F'. Find the coordinates of D', E' and F'.

(Total for Question 25 is 3 marks)

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26 An object has area 6 cm². After an enlargement with a negative scale factor, its image has area 54 cm². Find the scale factor of the enlargement.

(Total for Question 26 is 2 marks)

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27 Triangle LMN has vertices L(2, 3), M(6, 3) and N(2, t), where t is a positive constant. The triangle is enlarged by scale factor -1/2, centre the origin O, to give triangle L'M'N'.

(a) Find the coordinates of L' and M'. **(2)**

(b) Given that N' has coordinates (-1, -4), find the value of t. **(3)**

(Total for Question 27 is 5 marks)

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28 An object has area 12 cm². After an enlargement, the image has area 300 cm². The scale factor of the enlargement is known to be negative. Find the scale factor, showing your working.

(Total for Question 28 is 3 marks)

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29 Declan is investigating how a pinhole camera works for a physics project. Light from an object passes through a small pinhole and forms an inverted image on a screen on the other side of the hole, with the object, the hole and the image point in a straight line. This means the image can be modelled as an enlargement of the object, with the pinhole as the centre of enlargement and a negative scale factor. In Declan's model, the screen is 15 cm from the pinhole, and a toy of height 40 cm stands upright 60 cm from the pinhole on the other side.

(a) Find the scale factor of the enlargement, giving your answer as a fraction. **(2)**

.....

(b) Calculate the height of the image formed on the screen. **(2)**

.....

(c) Declan then moves the toy so that it is 90 cm from the pinhole, keeping the screen 15 cm from the pinhole. Calculate the new height of the image formed on the screen. **(3)**

.....

(Total for Question 29 is 7 marks)

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Mark scheme · 6.9 Enlarging with Negative Scale Factors: 2-hour Pack

Question 1

vector from centre to P = (4, 10)	**M1**
multiplies by -1/2 and adds the centre	**M1**
(-6, -8) cao	**A1**

Answer: (-6, -8)

Question 2

vector from centre to P = (8, 8)	**M1**
multiplies by -1/2 and adds the centre	**M1**
(-6, -2) cao	**A1**

Answer: (-6, -2)

Question 3

sets up an equation, e.g. centre + k x (P - centre) = P'	**M1**
solves for one coordinate of the centre	**M1**
(-4, 3) cao	**A1**

Answer: (-4, 3)

Question 4

vector from centre to P = (-5, 5)	**M1**
multiplies by -3 and adds the centre	**M1**
(18, -17) cao	**A1**

Answer: (18, -17)

Question 5

vector from centre to P = (15, 15)	**M1**
multiplies by -2/3 and adds the centre	**M1**
(-12, -14) cao	**A1**

Answer: (-12, -14)

Question 6

P'(-2,-4)	**B1**
Q'(-6,-4)	**B1**
R'(-2,-10) cao	**B1**

Answer: P'(-2,-4), Q'(-6,-4), R'(-2,-10)

Question 7

vector from centre to P = (-5, -1)	**M1**
multiplies by -1 and adds the centre	**M1**
(6, -1) cao	**A1**

Answer: (6, -1)

Question 8

area scale factor $(-5)^2 = 25$ (the negative sign does not matter for size)	**M1**
700 cm²	**A1**

Answer: 700 cm^2

Question 9

vector from centre to P = (2, -2)	**M1**
multiplies by -1 and adds the centre	**M1**
(-4, 1) cao	**A1**

Answer: (-4, 1)

Question 10

sets up an equation, e.g. centre + k x (P - centre) = P'	**M1**
solves for one coordinate of the centre	**M1**
(3, -2) cao	**A1**

Answer: (3, -2)

Question 11

vector from centre to P = (0, 12)	**M1**
multiplies by -2/3 and adds the centre	**M1**
(-2, -8) cao	**A1**

Answer: (-2, -8)

Question 12

lengths are multiplied by 4 (size of scale factor)	**M1**
48 cm	**A1**

Answer: 48 cm

Question 13

vector from centre to P = (-9, 12)	**M1**
multiplies by -2/3 and adds the centre	**M1**
(5, -9) cao	**A1**

Answer: (5, -9)

Question 14

enlargement	**B1**
scale factor -2	**B1**
centre (1, -1)	**B1**

Answer: Enlargement, scale factor -2, centre (1, -1)

Question 15

lengths are multiplied by 3 (size of scale factor)	**M1**
24 cm	**A1**

Answer: 24 cm

Question 16

sets up an equation, e.g. centre + k x (P - centre) = P'	**M1**
solves for one coordinate of the centre	**M1**
(2, -2) cao	**A1**

Answer: (2, -2)

Question 17

lengths are multiplied by 4 (size of scale factor)	**M1**
56 cm	**A1**

Answer: 56 cm

Question 18

sets up an equation, e.g. centre + k x (P - centre) = P'	**M1**
solves for one coordinate of the centre	**M1**
(-4, -1) cao	**A1**

Answer: (-4, -1)

Question 19

P' = -1 * (2, 3) oe, or correct use of the enlargement formula	**M1**
(-2, -3) cao	**A1**

Answer: (-2, -3)

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Question 20

Q' = -2 * (4, -2) oe	**M1**
(-8, 4) cao	**A1**

Answer: (-8, 4)

Question 21

(a) A'(1,1)	**B1**
(a) B'(-1,1)	**B1**
(a) C'(-1,3)	**B1**
(a) D'(1,3) cao	**B1**

(a) Answer: A'(1,1), B'(-1,1), C'(-1,3), D'(1,3)

(b) area scale factor = $(-1/2)^2 = 1/4$	**M1**
(b) 4 cm² cao	**A1**

(b) Answer: 4 cm^2

(c) perimeter of ABCD = 16, perimeter of A'B'C'D' = 8 (or use scale factor magnitude 1/2 directly)	**M1**
(c) 2 : 1 cao	**A1**

(c) Answer: 2 : 1

Question 22

compares corresponding vectors, e.g. AB = (3,0) and A'B' = (-6,0)	**M1**
scale factor = -2 cao	**A1**
uses a correct method to find the centre, e.g. centre = (A' - kA)/(1-k)	**M1**
centre = (0, 0) cao	**A1**

Answer: scale factor = -2; centre of enlargement = (0, 0)

Question 23

recognises that the centre is the midpoint of S and S' when k = -1 oe	**M1**
(0, 0) cao	**A1**

Answer: (0, 0)

Question 24

(a) multiplies each vertex by -2	**M1**
(a) P'(0,-2), Q'(-6,-2) and R'(0,-8) all correct cao	**A1**

(a) Answer: P' = (0, -2); Q' = (-6, -2); R' = (0, -8)

(b) area scale factor = $(-2)^2 = 4$	**M1**
(b) 18 cm² cao	**A1**

(b) Answer: 18 cm^2

Question 25

correct method applied to at least one vertex, e.g. D' = -1/2 * (2, 1)	**M1**
two of D'(-1,-0.5), E'(-2.5,-0.5), F'(-1,-1.5) correct	**A1**
all three vertices correct cao	**A1**

Answer: D' = (-1, -0.5); E' = (-2.5, -0.5); F' = (-1, -1.5)

Question 26

area scale factor = 54/6 = 9, so $k^2 = 9$ oe	**M1**
k = -3 cao (rejects +3)	**A1**

Answer: -3

Question 27

(a) multiplies each vertex by -1/2	**M1**
(a) L'(-1,-1.5) and M'(-3,-1.5) both correct cao	**A1**

(a) Answer: L' = (-1, -1.5); M' = (-3, -1.5)

(b) sets up N' = -1/2 * (2, t) oe	**M1**
(b) forms the equation -t/2 = -4 oe	**M1**
(b) t = 8 cao	**A1**

(b) Answer: t = 8

Question 28

area scale factor = 300/12 = 25	**M1**
$k^2 = 25$, so k = 5 or k = -5 oe	**M1**
k = -5 cao (since the scale factor is negative, +5 is rejected)	**A1**

Answer: -5

Question 29

(a) scale factor magnitude = 15/60 (= 1/4) oe	**M1**
(a) k = -1/4 cao (negative since the image is inverted)	**A1**

(a) Answer: -1/4

(b) multiplies 40 by 1/4 oe	**M1**
(b) 10 cm cao	**A1**

(b) Answer: 10 cm

(c) new scale factor magnitude = 15/90 (= 1/6) oe	**M1**
(c) multiplies 40 by 1/6 oe	**M1**
(c) 20/3 cm oe, awrt 6.67 cm cao	**A1**

(c) Answer: 20/3 cm (awrt 6.67 cm)

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