AQA Level 2 Further mathematics Coordinate geometry

Points and straight lines

Section test

1. Here are four straight-line equations.

1	$3y = 4x + 5$	2	$4y = 3x - 1$
3	$4y + 3x = 7$	4	$4x + 3y = 2$

Which one of the following statements is true?

(a) Lines 1 and 2 are perpendicular
(b) Lines 1 and 4 are parallel
(c) Lines 2 and 4 are perpendicular
(d) Lines 2 and 3 are parallel
I don't know

Questions 2 – 4 are about the points P (4, -2) and Q (-3, -5).

2. What is the length PQ?

(a) $\sqrt{50}$
(b) $\sqrt{98}$
(c) $\sqrt{40}$
(d) $\sqrt{58}$
(e) I don't know

3. What is the midpoint of PQ?

(a) (3.5, -3.5)
(b) (0.5, -3.5)
(c) (3.5, 1.5)
(d) (-3.5, 1.5)
(e) I don't know

4. The point S lies on PQ and is such that PS:SQ = 3:4. What are the coordinates of S?

(a) (-0.2, -3.8)
(b) (7, 0)
(c) (1.2, -3.2)
(d) (1, 1)
(e) I don't know

5. P is the point (3, 5). Q is the point (-1, 9). R is the midpoint of PQ.
On which one of the following lines does R lie?

(a) $y = x + 6$
(b) $y = x + 8$
(c) $y = x - 6$
(d) $y = x - 8$
(e) I don't know

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6. A is the point (1, 4). B is the point (7, -6). The point C divides AB in the ratio 3:5. What are the coordinates of C?

(a) (4.6, -2)
(b) (2.25, -3.75)
(c) (3.6, -6)
(d) (3.25, 0.25)
(e) I don't know

7. What is the equation of the straight line that is parallel to the line $2y + 3x = 7$ and passes through the point (2, -1)?

(a) $2y + 3x = 1$
(b) $3y - 2x = 8$
(c) $2y + 3x = 4$
(d) $3y - 2x = -1$
(e) I don't know

8. What is the equation of the straight line that is perpendicular to the line $3y = x - 1$ and passes through the point (1, 3)?

(a) $y = -3x + 6$
(b) $3y = x + 8$
(c) $y = 3x$
(d) $3y = -x + 10$
(e) I don't know

9. Point A is (5, -2) and point B is (3, 6).
The equation of the perpendicular bisector of AB is

(a) $4y = -x + 12$
(b) $4y = x + 14$
(c) $4y = x + 4$
(d) $4y = -x + 16$
(e) I don't know

10. A is the point (1, 5), B is the point (4, 7) and C is the point (5, 2).
Triangle ABC is

(a) right-angled
(b) scalene with no right angle
(c) equilateral
(d) isosceles
(e) I don't know

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Solutions to section test

1. The correct answer is (c)

Line 1 can be written as $y = \frac{4}{3}x + \frac{5}{3}$
Line 2 can be written as $y = \frac{3}{4}x - \frac{1}{4}$
Line 3 can be written as $y = -\frac{3}{4}x + \frac{7}{4}$
Line 4 can be written as $y = -\frac{4}{3}x + \frac{2}{3}$

None of the lines are parallel, since they all have different gradients.
Lines 1 and 2 are not perpendicular, since $\frac{4}{3} \times \frac{3}{4} \neq -1$.
Lines 2 and 4 are perpendicular, since $\frac{3}{4} \times -\frac{4}{3} = -1$

2. The correct answer is (d)

$$\text{Length PQ} = \sqrt{(4-(-3))^2 + (-2-(-5))^2}$$
$$= \sqrt{7^2 + 3^3}$$
$$= \sqrt{49 + 9}$$
$$= \sqrt{58}$$

3. The correct answer is (b)

$$\text{The midpoint of PQ is } \left(\frac{4+(-3)}{2}, \frac{-2+(-5)}{2}\right) = (0.5, -3.5)$$

4. The correct answer is (a)

S is $\frac{3}{5}$ of the distance from P to Q
Distance between x-coordinates of P and Q = -3 – 4 = -7
x-coordinate of S $= 4 + \frac{3}{5} \times -7 = 4 - 4.2 = -0.2$
Distance between y-coordinates of P and Q = -5 – (-2) = -3
y-coordinate of S $= -2 + \frac{3}{5} \times -3 = -2 - 1.8 = -3.8$
S is the point (-0.2, -3.8)

5. The correct answer is (a)

$$R = \left(\frac{3+(-1)}{2}, \frac{5+9}{2}\right) = (1, 7)$$
R lies on the line $y = x + 6$.

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6. The correct answer is (d)

Distance in x-direction between A and B = 7 – 1 = 6
x-coordinate of C $= 1 + \frac{3}{8} \times 6 = 1 + 2.25 = 3.25$
Distance in y-direction between A and B = -4 – 4 = -10
y-coordinate of C $= 4 + \frac{3}{8} \times -10 = 4 - 3.75 = 0.25$
The coordinates of C are (3.25, 0.25)

7. The correct answer is (c)

Parallel lines have the same gradient, so line is of the form $2y + 3x = k$.
Line passes through (2, -1), so $2 \times -1 + 3 \times 2 = k$

$$-2 + 6 = k$$

$$k = 4$$

The equation of the line is $2y + 3x = 4$

8. The correct answer is (a)

$3y = x - 1$

$y = \frac{1}{3}x - \frac{1}{3}$

Gradient of line $= \frac{1}{3}$, so gradient of perpendicular line is -3
Equation of line is $y = -3x + c$
Line passes through (1, 3), so $3 = -3 \times 1 + c$

$$3 = -3 + c$$

$$c = 6$$

Equation of line is $y = -3x + 6$

9. The correct answer is (c)

$$\text{Gradient AB} = \frac{6 - (-2)}{3 - 5} = \frac{8}{-2} = -4$$

Gradient of perpendicular bisector $= \frac{1}{4}$

$$\text{Midpoint of AB} = \left(\frac{5 + 3}{2}, \frac{-2 + 6}{2}\right) = (4, 2)$$

Equation of perpendicular bisector is $y - 2 = \frac{1}{4}(x - 4)$

$$4y - 8 = x - 4$$

$$4y = x + 4$$

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10. The correct answer is (b)

Length AB $= \sqrt{(4-1)^2+(7-5)^2} = \sqrt{9+4} = \sqrt{13}$

Length BC $= \sqrt{(4-5)^2+(7-2)^2} = \sqrt{1+25} = \sqrt{26}$

Length AC $= \sqrt{(5-1)^2+(2-5)^2} = \sqrt{16+9} = \sqrt{25}$

The sides are all different lengths.

Gradient AB $= \frac{7-5}{4-1} = \frac{2}{3}$

Gradient BC $= \frac{7-2}{4-5} = \frac{5}{-1} = -5$

Gradient AC $= \frac{2-5}{5-1} = \frac{-3}{4} = -\frac{3}{4}$

None of the lines are perpendicular, so there is no right-angle.

The triangle is scalene with no right-angle.