HIGHER

5.14H Gradient of a Line: Higher Tier Practice

Total Marks

EDEXCEL Edexcel 1MA1 · Calculator allowed · about 70 minutes

Name: _____ Date: ____ / ____ / _____

Answer ALL questions. Show all your working.

1 Work out the gradient of the line joining the points A(2, -1) and B(5, 5).

(a) Show your working and write the gradient of AB. **(2)**

(Total for Question 1 is 2 marks)

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2 A line L has equation y = 3x - 4.
(a) State the gradient of L.
(b) Write down the equation of the line M that is parallel to L and passes through the point (1, 2).

(a) State the gradient of L. **(1)**

(b) Write down the equation of the line M parallel to L through (1, 2). **(1)**

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(Total for Question 2 is 2 marks)

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3 Find the gradient of the line perpendicular to 4x + 2y = 6. Then give the equation of that perpendicular line which passes through (3, -2).

(a) Find the gradient of the line perpendicular to 4x + 2y = 6. **(2)**

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(b) Give the equation of the perpendicular line through (3, -2). **(2)**

(Total for Question 3 is 4 marks)

4 Line p passes through the points (t, 4) and (3, t).
(a) Express the gradient of p in terms of t.
(b) Given that p is horizontal, find t.

(a) Express the gradient of p in terms of t. **(2)**

(b) Given that p is horizontal, find t. **(2)**

(Total for Question 4 is 4 marks)

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5 The graph of $y = kx + 1$ passes through the point (4, 9).
(a) Find k.
(b) A second line $y = mx - 3$ meets the first line at (4, 9). Find m and explain whether the lines are perpendicular, parallel or neither.

(a) Find k. **(1)**

(b) Find m and state whether the two lines are perpendicular, parallel or neither. Give a brief reason. **(4)**

(Total for Question 5 is 5 marks)

6 Show that the line joining the points (2, a) and (a, 8) has gradient 3 when a satisfies an equation. Find the possible values of a.

(a) Show that requiring the gradient to be 3 leads to the equation 8 - a = 3(a - 2). **(2)**

(b) Solve 8 - a = 3(a - 2) and state the possible values of a. Check validity (exclude any value that makes division by zero). **(2)**

(Total for Question 6 is 4 marks)

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7 Line r has equation 2x - y = 5. Line s passes through (1, 4) and has gradient m.
(a) Find the gradient of r and hence the gradient m of the line perpendicular to r.
(b) Find the equation of the line s that is perpendicular to r and passes through (1, 4).
(c) Another line t passes through the intersection point of r and s and has gradient 4. Find the coordinates of the intersection of r and t.

(a) Find the gradient of r and hence the gradient m of the line perpendicular to r. **(2)**

(b) Find the equation of the line s that is perpendicular to r and passes through (1, 4). **(2)**

(c) Another line t passes through the intersection point of r and s and has gradient 4. Find the coordinates of the intersection of r and t. **(2)**

(Total for Question 7 is 6 marks)

8 Consider the family of lines with equation $y = mx + 2$ that meet the parabola $y = x^2$ at exactly one point (i.e. tangent lines).

(a) Write down the equation obtained by equating $mx + 2 = x^2$ and rearranging to a quadratic in x.

(b) For tangency, the quadratic must have exactly one solution. Use the discriminant to find the values of m for which the line is tangent to the parabola. Give your answers in exact form.

(a) Write down the quadratic equation in standard form obtained by equating $mx + 2 = x^2$. **(2)**

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(b) Use the discriminant to find m for which the quadratic has exactly one solution (tangent lines). **(4)**

(Total for Question 8 is 6 marks)

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9 A line passes through (1, k) and (k, 4). The gradient of this line is equal to the gradient of the line joining (0, 2) and (3, 8).

(a) Find the gradient of the line joining (0,2) and (3,8).

(b) Hence find k (give exact value).

(c) For the k you found, write down the equation of the line through (1,k) and (k,4).

(a) Find the gradient of the line joining (0,2) and (3,8). **(1)**

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(b) Hence find k. **(3)**

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(c) For k = 2, write down the equation of the line through (1,k) and (k,4). Give your answer in the form $y = mx + c$. **(3)**

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(Total for Question 9 is 7 marks)

Mark scheme · 5.14H Gradient of a Line: Higher Tier Practice

Question 1

- (a) **M1** difference in y over difference in x: (5 - (-1)) / (5 - 2) or equivalent method
- (a) **A1** 2 cao
- **(a) Answer: 2**

Question 2

- (a) **B1** 3 cao
- **(a) Answer: 3**
- (b) **B1** y = 3x - 1 cao
- **(b) Answer: y = 3x - 1**

Question 3

- (a) **M1** rearrange to y = mx + c to find gradient of given line: 2y = -4x + 6 so gradient = -2
- (a) **A1** 1/2 cao for perpendicular gradient
- **(a) Answer: 1/2**
- (b) **M1** use y = mx + c with m = 1/2 and substitute (3, -2) to find c (method)
- (b) **A1** y = 1/2 x - 7/2 cao
- **(b) Answer: y = 1/2 x - 7/2**

Question 4

- (a) **M1** use (change in y)/(change in x): (t - 4)/(3 - t) or equivalent
- (a) **A1** (t - 4)/(3 - t) cao
- **(a) Answer: (t - 4)/(3 - t)**
- (b) **M1** horizontal line has gradient 0 so set (t - 4)/(3 - t) = 0 and solve
- (b) **A1** t = 4 cao
- **(b) Answer: 4**

Question 5

- (a) **B1** k = 2 cao
- **(a) Answer: 2**
- (b) **M1** use point (4,9) in y = mx - 3 to find m (method)
- (b) **A1** m = 3 cao
- (b) **M1** compare gradients to test for parallel/perpendicular (method)
- (b) **B1** state: neither (gradients 2 and 3 are not equal and not negative reciprocals) oe
- **(b) Answer: m = 3; neither**

Question 6

- (a) **M1** form gradient (8 - a)/(a - 2) and equate to 3 or equivalent correct setup
- (a) **A1** 8 - a = 3(a - 2) or equivalent rearranged form cao
- **(a) Answer: 8 - a = 3(a - 2)**
- (b) **M1** expand and collect terms correctly: 8 - a = 3a - 6 leads to correct rearrangement
- (b) **A1** a = 7/2 cao and check a ≠ 2 so valid
- **(b) Answer: a = 7/2**

Question 7

- (a) **M1** rearrange 2x - y = 5 to y = 2x - 5 to identify gradient 2
- (a) **A1** m = -1/2 cao
- **(a) Answer: m = -1/2**
- (b) **M1** use y = mx + c with m = -1/2 and substitute (1,4) to find c
- (b) **A1** y = -1/2 x + 9/2 cao
- **(b) Answer: y = -1/2 x + 9/2**
- (c) **M1** find intersection of r and s by solving their equations to get the point (method)
- (c) **A1** intersection (19/5, 13/5) cao
- **(c) Answer: (19/5, 13/5)**

Question 8

- (a) **M1** form x^2 - mx - 2 = 0 or equivalent correct rearrangement
- (a) **A1** x^2 - mx - 2 = 0 cao
- **(a) Answer: x^2 - mx - 2 = 0**
- (b) **M1** use discriminant b^2 - 4ac = 0 with a=1, b=-m, c=-2 leading to m^2 - 4(1)(-2) = 0
- (b) **M1** correct algebra to obtain m^2 + 8 = 0 then solve or equivalent
- (b) **A1** state there are no real m (m^2 + 8 = 0 gives imaginary m) oe
- (b) **B1** conclude: no real tangent lines of form y = mx + 2 to y = x^2 (cao) or state m = ±2i (if complex allowed) oe
- **(b) Answer: No real values of m (m^2 + 8 = 0 so m = ±2i).**

Question 9

- (a) **B1** gradient = (8 - 2)/(3 - 0) = 2 cao
- **(a) Answer: 2**
- (b) **M1** set (4 - k)/(k - 1) = 2 and rearrange to form an equation
- (b) **M1** solve 4 - k = 2(k - 1) leading to correct linear equation
- (b) **A1** k = 2 cao
- **(b) Answer: 2**
- (c) **M1** find gradient using points (1,2) and (2,4): (4 - 2)/(2 - 1) = 2 (method)
- (c) **M1** use y = mx + c and substitute a point to find c
- (c) **A1** y = 2x (cao)
- **(c) Answer: y = 2x**