

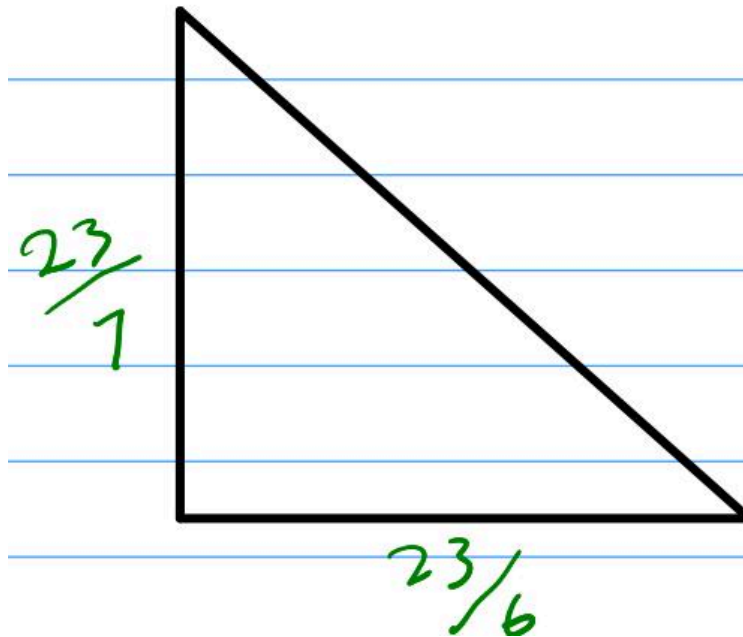
- 1
- Calculate gradient: $m = \frac{-5-1}{4-2} = \frac{-6}{2} = -3$ (M1)
 - Substitute into $y - y_1 = m(x - x_1)$: $y - 1 = -3(x - 2)$ (M1)
 - Final equation: $y = -3x + 7$ (A1)

(Total for question 1 is 3 marks)

- 2
- Find gradient of l_1 : $3y = -2x - 5 \Rightarrow y = -\frac{2}{3}x - \frac{5}{3}$, so $m_1 = -\frac{2}{3}$ (M1)
 - Find gradient of l_2 : $m_2 = \frac{1-7}{5-1} = \frac{-6}{4} = -\frac{3}{2}$ (M1)
 - Compare gradients: Not parallel as $m_1 \neq m_2$. Not perpendicular as $-\frac{3}{2} \times -\frac{2}{3} = 1 \neq -1$ (M1)
 - Conclusion: Neither (A1)

(Total for question 2 is 4 marks)

- 3
- (a)
- Gradient $m = \frac{-1-5}{5-(-2)} = -\frac{6}{7}$ (M1)
 - $y - 5 = -\frac{6}{7}(x + 2)$ (M1)
 - $7y - 35 = -6x - 12 \Rightarrow 6x + 7y - 23 = 0$ (A1)
- (b)
- Find x -intercept ($y = 0$): $6x = 23 \Rightarrow x = \frac{23}{6}$ (M1)
 - Find y -intercept ($x = 0$): $7y = 23 \Rightarrow y = \frac{23}{7}$ (M1)
 - Area = $\frac{1}{2} \times \text{base} \times \text{height} = \frac{1}{2} \times \frac{23}{6} \times \frac{23}{7} = \frac{529}{84}$ (A1)



(Total for question 3 is 6 marks)

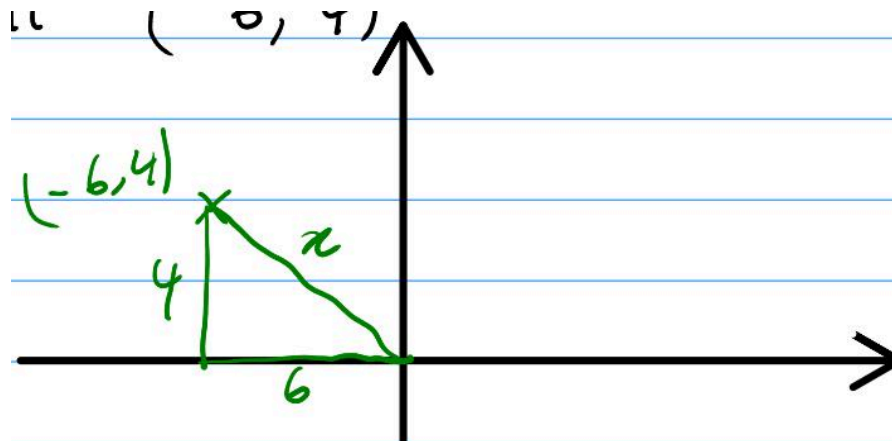
4

- (a)
- Gradient formula: $\frac{8-(k+2)}{2k-3-(-1)} = \frac{1}{3}$ (M1)
 - $\frac{6-k}{2k-2} = \frac{1}{3} \Rightarrow 18 - 3k = 2k - 2 \Rightarrow 5k = 20 \Rightarrow k = 4$ (A1)
- (b)
- Point A is $(-1, 6)$. Gradient is $\frac{1}{3}$. (M1)
 - $y - 6 = \frac{1}{3}(x + 1)$ (M1)
 - $y = \frac{1}{3}x + \frac{19}{3}$ (A1)
- (c)
- Midpoint of AB: $(\frac{-1+5}{2}, \frac{6+8}{2}) = (2, 7)$ (M1)
 - Perpendicular gradient: $-1/(1/3) = -3$ (M1)
 - $y - 7 = -3(x - 2) \Rightarrow y - 7 = -3x + 6$ (M1)
 - $3x + y - 13 = 0$ (A1)

(Total for question 4 is 9 marks)

5

- Find A and B: $y = 0 \Rightarrow x = -12$; $x = 0 \Rightarrow y = 8$. Points are $(-12, 0)$ and $(0, 8)$. (M1)
- Midpoint: $(\frac{-12+0}{2}, \frac{0+8}{2}) = (-6, 4)$ (M1)
- Distance from origin: $\sqrt{(-6)^2 + 4^2} = \sqrt{36 + 16} = \sqrt{52}$ (M1)
- Simplify: $\sqrt{52} = 2\sqrt{13}$ (A1)



(Total for question 5 is 4 marks)

6

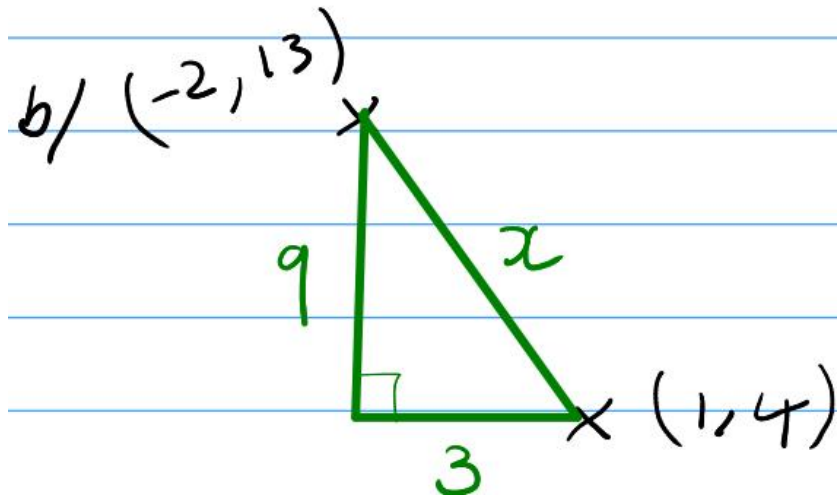
- (a)
- $y - 7 = 2(x - 5)$ (M1)
 - $y = 2x - 3$ (A1)
- (b)
- Perpendicular gradient $= -\frac{1}{2}$ (M1)
 - $y = -\frac{1}{2}x + 1$ (A1)

(Total for question 6 is 4 marks)

- 7
- Set up simultaneous equations: $5x + 2y = 4$ and $x - 4y = -1$ (M1)
 - Solve equations (e.g. multiply first by 2): $10x + 4y = 8$ (M1)
 - $11x = 7 \Rightarrow x = \frac{7}{11}, y = \frac{9}{22}$ (A1)
- (Total for question 7 is 3 marks)

- 8
- Find gradient of l_1 : $3y = 2x - 4 \Rightarrow m_1 = \frac{2}{3}$ (M1)
 - Perpendicular gradient $m_2 = -\frac{3}{2}$ (M1)
 - $y + 1 = -\frac{3}{2}(x - 4)$ (M1)
 - $2y + 2 = -3x + 12$ (M1)
 - $3x + 2y - 10 = 0$ (A1)
- (Total for question 8 is 5 marks)

- 9
- (a)
- $m = \frac{13-4}{-2-1} = \frac{9}{-3} = -3$ (M1)
 - $y - 4 = -3(x - 1)$ (M1)
 - $y = -3x + 7$ (A1)
- (b)
- Distance = $\sqrt{(1 - (-2))^2 + (4 - 13)^2}$ (M1)
 - $\sqrt{3^2 + (-9)^2} = \sqrt{9 + 81} = \sqrt{90} = 3\sqrt{10}$ (A1)



(Total for question 9 is 5 marks)

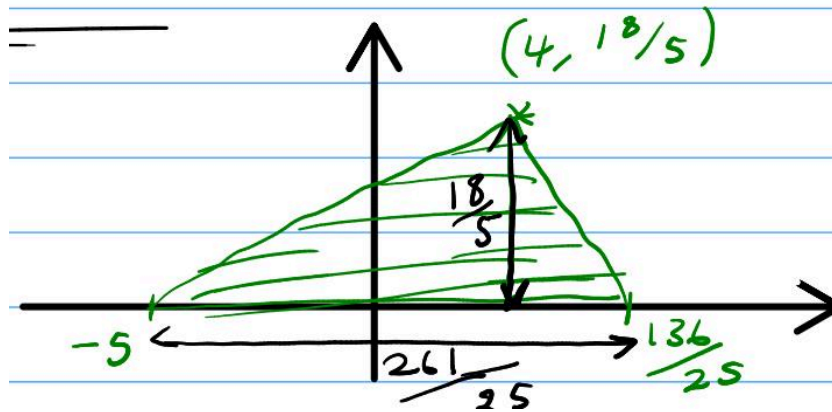
10

- (a)
- $y - 5 = 3(x + 2)$ (M1)
 - $y = 3x + 11$ (A1)
- (b)
- Perpendicular gradient $= -\frac{1}{3}$ (M1)
 - $y = -\frac{1}{3}x + 4$ (A1)
- (c)
- $3x + 11 = -\frac{1}{3}x + 4$ (M1)
 - $\frac{10}{3}x = -7 \Rightarrow x = -2.1$ (M1)
 - $y = 3(-2.1) + 11 = 4.7$. Point is $(-2.1, 4.7)$ (A1)

(Total for question 10 is 7 marks)

11

- (a)
- Rearrange l_1 to find gradient: $5y = 2x + 10 \Rightarrow y = \frac{2}{5}x + 2$, so $m_1 = \frac{2}{5}$ (M1)
 - Find y -coordinate of P : $y = \frac{2}{5}(4) + 2 = \frac{18}{5}$ (M1)
 - Find perpendicular gradient: $m_2 = -\frac{5}{2}$ (M1)
 - Use $y - y_1 = m(x - x_1)$ and rearrange to required form: $25x + 10y - 136 = 0$ (A1)
- (b)
- Find x -intercept of l_1 (Q): $0 - 10 = 2x \Rightarrow x = -5$ (M1)
 - Find x -intercept of l_2 (R): $25x - 136 = 0 \Rightarrow x = \frac{136}{25}$ (M1)
 - Calculate base QR : $\frac{136}{25} - (-5) = \frac{261}{25}$ (M1)
 - Calculate area: $\frac{1}{2} \times \text{base} \times \text{height} = \frac{1}{2} \times \frac{261}{25} \times \frac{18}{5} = 18.792$ (A1)



(Total for question 11 is 8 marks)

- 12
- Find equation using $(2, -1)$ and $(-2, 11)$: $m = \frac{11 - (-1)}{-2 - 2} = -3$
 - $y - (-1) = -3(x - 2) \implies y = -3x + 5$
 - Test $(1, 2)$: $2 = -3(1) + 5$ (True)
 - Test $(-1, 7)$: $7 = -3(-1) + 5 = 8$ (False)
 - Correct answer is $(-1, 7)$ (B1)

(Total for question 12 is 1 mark)

- 13
- (a)
- Gradient $AB = \frac{2-5}{4-(-2)} = -\frac{1}{2}$ (M1)
 - CD is parallel to AB , so $m = -\frac{1}{2}$. Passes through $(6, -4)$.
 - $y - (-4) = -\frac{1}{2}(x - 6) \implies y = -\frac{1}{2}x - 1$ (A1)
- (b)
- AD is perpendicular to AB , so gradient $AD = 2$ (M1)
 - Equation AD : $y - 5 = 2(x + 2) \implies y = 2x + 9$ (M1)
 - Intersection of CD and AD : $2x + 9 = -\frac{1}{2}x - 1 \implies \frac{5}{2}x = -10 \implies x = -4$
 - $y = 2(-4) + 9 = 1$. Coordinates $(-4, 1)$ (A1)

(Total for question 13 is 5 marks)

- 14
- Midpoint of $AB = (\frac{-3+7}{2}, \frac{-4+2}{2}) = (2, -1)$ (M1)
 - Gradient $AB = \frac{2-(-4)}{7-(-3)} = \frac{6}{10} = \frac{3}{5}$ (M1)
 - Perpendicular gradient $= -\frac{5}{3}$
 - $y - (-1) = -\frac{5}{3}(x - 2) \implies 3y + 3 = -5x + 10 \implies y = -\frac{5}{3}x + \frac{7}{3}$ (A1)

(Total for question 14 is 3 marks)

- 15
- Rearrange l_1 : $4y = 3x + 11 \implies y = \frac{3}{4}x + \frac{11}{4}$, so $m_1 = \frac{3}{4}$ (M1)
 - Gradient $l_2 = \frac{-1-5}{-5-3} = \frac{-6}{-8} = \frac{3}{4}$ (M1)
 - Conclusion: Gradients are the same, therefore the lines are parallel (A2)

(Total for question 15 is 4 marks)

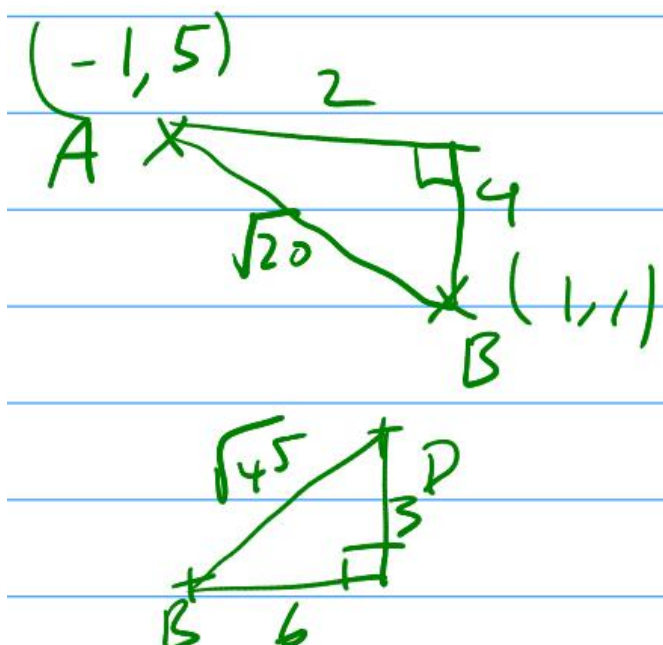
16

- Midpoint $AB = (1, -2)$ (M1)
- Gradient $AB = \frac{-7-3}{4-(-2)} = -\frac{5}{3}$ (M1)
- Perpendicular gradient $= \frac{3}{5}$
- Equation of bisector: $y + 2 = \frac{3}{5}(x - 1) \Rightarrow y = \frac{3}{5}x - \frac{13}{5}$ (M1)
- Solve simultaneously with $y = 2x + 1$: $2x + 1 = \frac{3}{5}x - \frac{13}{5} \Rightarrow 10x + 5 = 3x - 13 \Rightarrow 7x = -18 \Rightarrow x = -\frac{18}{7}$ (M1)
- $y = 2(-\frac{18}{7}) + 1 = -\frac{29}{7}$ (M1)
- $P = (-\frac{18}{7}, -\frac{29}{7})$ (A1)

(Total for question 16 is 6 marks)

17

- (a)
- Gradient $AB = \frac{1-5}{1-(-1)} = -2$ (M1)
 - Gradient AC (should be AC or BD for adjacent side): Gradient $AC = \frac{8-5}{5-(-1)} = \frac{1}{2}$ (M1)
 - Show perpendicularity: $-2 \times \frac{1}{2} = -1$ (M1)
 - Check other sides: Gradient $CD = -2$ and Gradient $BD = \frac{1}{2}$. Since opposite sides are parallel and adjacent sides are perpendicular, it is a rectangle. (A1)
- (b)
- Length $AB = \sqrt{(1 - (-1))^2 + (1 - 5)^2} = \sqrt{4 + 16} = \sqrt{20}$ (M1)
 - Length $AC = \sqrt{(5 - (-1))^2 + (8 - 5)^2} = \sqrt{36 + 9} = \sqrt{45}$ (M1)
 - Area $= \sqrt{20} \times \sqrt{45} = \sqrt{900} = 30 \text{ units}^2$ (A1)



(Total for question 17 is 6 marks)

18

- (a)
- Rearrange l_1 : $2y = -4x - 7 \implies y = -2x - 3.5$, so $m_1 = -2$ (M1)
 - Perpendicular gradient $m = \frac{1}{2}$ (A1)
- (b)
- Solve $-2x - 3.5 = 0.5x + 4$ (M1)
 - $-7.5 = 2.5x \implies x = -3$ (M1)
 - $y = 0.5(-3) + 4 = 2.5$. Coordinates $(-3, 2.5)$ (A1)

(Total for question 18 is 5 marks)

19

- (a)
- Points are $(0, 71)$ and $(15, 73)$ (M1)
 - Gradient $m = \frac{73-71}{15-0} = \frac{2}{15}$ (M1)
 - Equation: $x = \frac{2}{15}n + 71$ (A1)
- (b)
- For 2020, $n = 60$ (M1)
 - $x = \frac{2}{15}(60) + 71 = 8 + 71 = 79$ (M1)
 - Comparison: The model underestimated the life expectancy (79 vs 81.8). The model may not be suitable. (A1)

(Total for question 19 is 6 marks)

20

- (a)
- Points are $(0, 71)$ and $(15, 73)$ (M1)
 - Gradient $m = \frac{73-71}{15-0} = \frac{2}{15}$ (M1)
 - Equation: $x = \frac{2}{15}n + 71$ (A1)
- (b)
- For 2020, $n = 60$ (M1)
 - $x = \frac{2}{15}(60) + 71 = 8 + 71 = 79$ (M1)
 - Comparison: The model underestimated the life expectancy (79 vs 81.8). The model may not be suitable. (A1)

(Total for question 20 is 6 marks)

21

- (a)
- Identifies coordinates $(0, 22.5)$ and $(20, 33.6)$ (M1)
 - Calculates gradient $m = \frac{33.6-22.5}{20} = 0.555$ (M1)
 - Forms equation $A = 0.555n + 22.5$ (A1)
- (b)
- Substitutes $n = 26$ into their model: $A = 0.555(26) + 22.5 = 36.93$ (M1)
 - Compares 36.93 with 35.7 and notes the model overestimates (M1)
 - Concludes the model may not be suitable (A1)

(Total for question 21 is 6 marks)

22

- Rearranges bisector to $y = -\frac{1}{3}x + \frac{10}{3}$ to find gradient of CD is 3 (M1)
- Sets up gradient equation: $3 = \frac{8-c}{d-2} \Rightarrow c + 3d = 14$ (M1)
- Finds midpoint $(\frac{2+d}{2}, \frac{c+8}{2})$ and substitutes into $3y + x = 10$ (M1)
- Simplifies to $3c + d = -6$ (M1)
- Solves simultaneous equations to find $c = -4$ and $d = 6$ (A1)

(Total for question 22 is 5 marks)
