Straight line graph modelling As level Edexcel Maths Past Papers Answers

01.

Question	Scheme	Marks	AOs
a	Attempts $H = mt + c$ with both $(3, 2.35)$ and $(6, 3.28)$	M1	3.3
	Method to find both m and c	dM1	3.1a
	$H = 0.31t + 1.42$ oe	A1	1.1b
		(3)	
(b)	Uses the model and states that the initial height is their 'b'	B1ft	3.4
	Compares 140 cm with their 1.42 (m) and makes a valid comment. In the case where $H = 0.31t + 1.42$ it should be this fact supports the use of the linear model as the values are close.	B1ft	3.5a
		(2)	
			(5 marks)

Notes

Mark parts (a) and (b) as one

(a)

M1: For creating a linear model with both pieces of information given.
Eg. Accept sight of $2.35 = 3m + c$ and $3.28 = 6m + c$ Condone slips on the 2.35 and 3.28.
Allow for an attempt at the "gradient" $m = \frac{3.28 - 2.35}{6 - 3} (= 0.31)$ or the intercept.
Allow for a pair of simultaneous in any variable even x and y

dM1: A full method to find both constants. For simultaneous equations award if they arrive at values for m and c.
If they attempted the gradient it would be for attempting to find "c" using $y = mx + c$ with their m and one of the points $(3, 2.35)$ or $(6, 3.28)$

A1: A correct model using allowable/correct variables. $H = 0.31t + 1.42$ Condone $h \leftrightarrow H, t \leftrightarrow T$
Allow equivalents such as $H = \frac{31}{100}t + \frac{142}{100}$, $t = \frac{H - 1.42}{0.31}$ but not $H = \frac{0.93}{3}t + 1.42$
Do not allow $H = 0.31t + 1.42$ m (with the units)

(b) To score any marks in (b) the model must be of the form $H = mt + b$ where $m > 0, b > 0$

B1ft: States or implies that 1.42 (with or without units) or 142 cm (including the units) is the original height or the height when $t = 0$
You should allow statements such as c = 1.42 or original height = 1.42 (m)
Follow through on their value of 'c', so for $H = 0.25t + 1.60$ it is scored for stating the initial height is 1.60 (m) or 160 cm. Do not follow through if $c \leqslant 0$

B1ft: Compares 140 cm with their 1.42 (m) **and** makes a valid comment.
In the case where $H = 0.31t + 1.42$ it should be this fact supports the use of the linear model as the values are close or approximately the same. Allow $1.42\text{m} \approx 1.4\text{m}$ or similar
In the case of $H = 0.25t + 1.60$ it would be for stating that the fact that it does not support the use of the model as the values are too different. If they state $1.60 > 1.40$ this is insufficient. They cannot just state that they are not the same. It must be implied that there is a significant difference.
As a rule of thumb use "good model" for between 135cm and 145 cm.

This requires a correct calculation for their H, a correct statement with an appreciation shown for the units and a correct conclusion.

Notes On Questions Continue

SC B1 B0 Award SC for incomplete answers which suggest the candidate knows what to do.
Eg. In (b) $H = 0.31t + 1.42$ followed by in (c) It supports the model as when $t = 0$ it is approximately 140 cm

02.

Question	Scheme	Marks	AOs
a	Attempts $A=mn+c$ with either $(0,190)$ or $(8,169)$ Or attempts gradient eg $m=\pm\frac{190-169}{8}\left(=-2.625\right)$	M1	3.3
	Full method to find a linear equation linking A with n E.g. Solves $190=0n+c$ and $169=8n+c$ simultaneously	dM1	3.1b
	$A=-2.625n+190$	A1	1.1b
		(3)	
(b)	Attempts $A=-2.625\times19+190=...$	M1	3.4
	$A=140.125$ g km^{-1}	A1	1.1b
	It is predicting a much higher value and so is not suitable	B1ft	3.5a
		(3)	
			(6 marks)

Notes

(a)

M1: Attempts $A=mn+c$ with either $(0,190)$ or $(8,169)$ considered.
Eg Accept sight of $190=0n+c$ or $169=8m+c$ or $A-169=m(n-8)$ or $A=190+mn$ where m could be a value.
Also accept an attempt to find the gradient $\pm\frac{190-169}{8}$ or sight of ±2.625 or $\pm\frac{21}{8}$ oe

dM1: A full method to find both constants of a linear equation
Method 1: Solves $190=0n+c$ and $169=8n+c$ simultaneously
Method 2: Uses gradient and a point Eg $m=\pm\frac{190-169}{8}\left(=-2.625\right)$ and $c=190$
Condone different variables for this mark. Eg. y in terms of x.

A1: $A=-2.625n+190$ or $A=-\frac{21}{8}n+190$ oe

(b)

M1: Attempts to substitute "n" $=19$ into their linear model to find A. They may call it $x=19$
Alternatively substitutes $A=120$ into their linear model to find n.

A1: $A=140.125$ from $n=19$ Allow $A=140$
or $n=26/27$ following $A=120$

B1ft: Requires a correct calculation for their model, a correct statement and a conclusion
E.g For correct (a) $A=140$ is (much) higher than 120 so the model is not suitable/appropriate.
Follow through on a correct statement for their equation. As a guide allow anything within [114,126] to be regarded as suitable. Anything less than 108 or more than 132 should be justified as unsuitable.

Note B0 Recorded value is not the same as/does not equal/does not match the value predicted

03.

Question	Scheme	Marks	AOs
a	Uses or implies that $V = ad + b$	B1	3.3
	Uses both $40 = 80a + b$ and $25 = 200a + b$ to get either a or b	M1	3.1b
	Uses both $40 = 80a + b$ and $25 = 200a + b$ to get both a and b	dM1	1.1b
	$\Rightarrow V = -\frac{1}{8}d + 50$ o.e.	A1	1.1b
		(4)	
(b)(i)(ii)	States **either** that the initial volume was 50 {litres} **or** that the distance travelled was 400 {km}	B1 ft	3.4
	Attempts to find **both** answers by solving $0 = -\frac{1}{8}d + 50$ **and** $0 = 400 - 8V$	M1	3.4
	States **both** that the initial volume was 50 litres **and** that the distance travelled was 400 km	A1	3.2b
		(3)	
(c)	States, e.g., "Poor model" as 320km is significantly less than 400 km.	B1ft	3.5a
		(1)	

(8 marks)

Notes:

(a)

B1: Attempts a linear model, i.e., uses or implies that $V = ad + b$ or $d = mV + c$ which may be in terms of, e.g., y and x

M1: Awarded for translating the problem in context and starting to solve.
It is scored when both $40 = 80a + b$ and $25 = 200a + b$ are written down and the candidate proceeds to find either a or b
Alternatively, scored when both $200 = 25m + c$ and $80 = 40m + c$ are written down and the candidate proceeds to find either m or c
You may just see $\pm\frac{25-40}{200-80}$ or $\pm\frac{200-80}{25-40}$ or 8km for every litre o.e. so check carefully for attempts at the gradient.

dM1: Uses $40 = 80a + b$ and $25 = 200a + b$ to find both a and b (or m and c)
Alternatively, if the gradient is found, proceeds to use one of the bullet points to find c, with the usual rules applying for straight line (coordinates must be used the correct way round, i.e., they would lead to the correct answer).

A1: $V = -\frac{1}{8}d + 50$ or exact equivalent, e.g., $d = 400 - 8V$ or $d + 8V = 400$ etc.
Withhold this mark if their answer is not stated in terms of V and d

Mark parts (b)(i) and (b)(ii) together. Note that they may restart and not use an equation.

B1ft: States **either** the initial volume was 50 {litres} **or** the distance travelled was 400 {km} but it must be clearly for the correct part, e.g., $V = 50$.
Follow through on their a and b (or m and c). This may be scored from $40 + \frac{80}{8}$ or $\frac{400}{8}$

M1: Complete attempt to find both answers. Must be from a **linear** model.

	Substitutes $V = 0$ and finds d by attempting to solve their $0 = -\frac{1}{8}d + 50$ **and** substitutes $d = 0$ and finds V by attempting to solve their $0 = 400 - 8V$ Note that one (or both) of these attempts may be implied by correct values ft their equations.
A1:	States both 50 litres and 400 km. Units are required to be correct for both values. It must be clear which answer applies to each part, which may be simply by correct units. Accept l or L for litres.
(c)	
B1ft:	**Main Scheme (comparing (b)(ii) with 320)** This mark is only available for answers from (b)(ii) if they are < 290 **or** > 350 Concludes **poor** model (o.e.) and states that 320 is **significantly** less than "400" (o.e.) Note that $320 << 400$ so it is a poor model is acceptable. It is not sufficient to say $320 \neq 400$ or $320 < 400$ so it is a poor model. Condone "the 400 is **too** far away from 320". **Alternative (finding remaining fuel after 320 km)** States **poor** model (o.e.) because after 320 km the model predicts there will be 10 litres left, which is **significantly** more than an empty tank / **much** too high compared to an empty tank (o.e.).

04.

Question	Scheme	Marks	AOs
☐	Complete method to find the RHS of an equation for l e.g., Attempts gradient = $\frac{80-60}{10}\{=2\}$ and uses intercept = 60	M1	1.1b
	$\{y=\}2x+60$	A1	1.1b
	Deduces the RHS of the equation for C is $\{y=\}ax(x-6)$ and attempts to use $(10,80)$ to find the value of a	M1	3.1a
	Equation of C is $\{y=\}2x(x-6)$	A1	1.1b
	$2x(x-6) \leqslant y \leqslant 2x+60$	B1ft	2.5
		(5)	

(5 marks)

Notes:

M1: Complete attempt to use the given information to find an equation or inequality for l, which may be $l =$ or have no LHS. $y - 80 = 2(x - 10)$ is acceptable for this mark.

A1: $\{y=\}2x+60$ This is not scored by $y - 80 = 2(x - 10)$

M1: Deduces the RHS of the equation of C is $\{y=\}ax(x-6)$, $a \neq 1$, and attempts to use $(10,80)$ to find the value of a which may be implied. Again, there may be no LHS.
Other possible and more lengthy alternatives include:
1) Setting the RHS to be $\{y=\}a(x-3)^2+b$ and using $(0,0)$ and $(10,80)$ to find a and b
2) Setting the RHS to be $\{y=\}px^2+qx$ and using $(6,0)$ and $(10,80)$ to find p and q

A1: $\{y=\}2x(x-6)$ or alternative such as $\{y=\}2(x-3)^2-18$ or $\{y=\}2x^2-12x$
This may be implied by an inequality $y...2x(x-6)$ and may be seen as, e.g., $C=2x(x-6)$

B1ft: "$2x(x-6)$" $\leqslant y \leqslant$ "$2x+60$" o.e. must follow from their l and C and apply isw
Follow through only on a quadratic for C and a straight line for l
Do not allow a mixture of inequalities, i.e., $<$ with $\leqslant$
Allow $2x^2-12x < y < 2x+60$ or as separate inequalities $y > 2x(x-6)$, $y < 2x+60$
Do not allow $2x(x-6) < R < 2x+60$ **or** $2x(x-6) < f(x) < 2x+60$ **or** $2x(x-6) < 2x+60$
Ignore any reference to $-3 < x < 10$
Note: $y=2x+60$ and $y=2x(x-6)$ incorrectly expanded to $y=2x^2-12$ followed by $2x^2-12 \leqslant y \leqslant 2x+60$ would score 11110