

Marking Scheme

page 1

Qn No.	Workings	Description	Mark Allocation
2ai	Discounted Price $= 0.85 \times 2888$ $= \$2454.80$ Price inclusive of GST $= 2454.80 \times 1.07$ $= \$2626.64$ (nearest cent)		M1 M1 A1
2aii	Amount of US dollars he receives $= \frac{3800}{1.43}$ $= \text{US\$}2657.34$ $= \text{US\$}2657$ (nearest dollar)		M1 A1
2aiii	<u>Solution 1</u> Amount of SG dollars he receives $= 2657.34 \times 1.38$ $= \$3667.13$ Percentage Loss $= \frac{3800 - 3667.13}{3800} \times 100\%$ $= 3.4966$ (5 s.f) $= 3.50\%$ (3 s.f) <u>Solution 2</u> Amount of SG dollars he receives $= 2657 \times 1.38$ $= \$3666.66$ Percentage Loss $= \frac{3800 - 3666.66}{3800} \times 100\%$ $= 3.5089$ (5 s.f) $= 3.51\%$ (3 s.f)		M1 A1 M1 A1
2b	Discounted Price $= 2300 \times 0.9$ $= \$2070$ Cost Price of laptop $= \frac{100}{95} \times 2070$ $= \$2178.95$ (nearest cent)		M1 M1 A1
3a	$p = 19$		B1
3b	Refer to Graph		P2 C1

Qn No.	Workings	Description	Mark Allocation
3c	170, 180 or 190 books (accept any 1)		B1
3di	Gradient = $\frac{10-19}{800-400} = -0.0225$	Tangent accurately drawn	M1
	Accept (- 0.01 to - 0.04)	Calculated gradient	A1
3dii	Gradient represents the rate of reduction(decrease) of the cost of production per copy of the book.		B1
3ei	Refer to Graph Correct line plotted		P1 L1
3eii	$200 \leq x \leq 900$		B1
4a	Let the height of the cone be h Vol of Cone = 2 x Vol of hemisphere $\frac{1}{3}\pi(6)^2 h = 2 \times \frac{2}{3}\pi(6)^3$ $12h = 288$ $h = \frac{288}{12}$ $h = 24$	Equate both volumes Show $\frac{288}{12}$	M1 AG1
4b	Let the slant height of the cone be l . By Pythagoras Theorem, $l^2 = 6^2 + 24^2$ $l = \sqrt{612}$ $l = 24.739$ or 24.738 (truncate 5 sf) Total Surface Area of Solid $= \pi(6)(24.739) + 2\pi(6)^2$ $= 692.51$ (5 s.f) $= 693 \text{ cm}^2$ (3 s.f) or 692 cm^2 (truncate 5s.f)		M1 M1 A1
4ci	$\frac{x}{y} = \frac{6}{24} = \frac{1}{4}$ (by similar triangles)		B1
4cii	$\frac{x}{y} = \frac{1}{4}$ $x = \frac{1}{4}y$ Volume of frustum $= \frac{1}{3}\pi(6)^2(24) - \frac{1}{3}\pi x^2 y$ Vol of small cone = Vol of frustum + Vol of hemisphere $\frac{1}{3}\pi x^2 y = \frac{1}{3}\pi(6)^2(24) - \frac{1}{3}\pi x^2 y + \frac{2}{3}\pi(6)^3$	Form Equation	M1

Qn No.	Workings	Description	Mark Allocation
	$\frac{2}{3}\pi x^2 y = \frac{1}{3}\pi(6)^2(24) + \frac{2}{3}\pi(6)^3$ $\frac{2}{3}x^2 y = \frac{1}{3}(6)^2(24) + \frac{2}{3}(6)^3 \text{ (divide both sides by } \pi)$ $\frac{2}{3}x^2 y = 432$ <p>Sub $x = \frac{1}{4}y$ into equation</p> $\frac{2}{3}\left(\frac{1}{4}y\right)^2 y = 432$ $\frac{1}{24}y^3 = 432$ $y^3 = 10368$ $y = 21.8 \text{ (3 s.f.)}$	<p>Sub $x = \frac{1}{4}y$ into equation</p>	<p>M1</p> <p>A1</p>
4cii	<p>Alternate Solution 2</p> <p>Let the volume of the top part (cone be V_1), middle frustum be V_2, and hemisphere by V_3.</p> $\frac{V_1 + V_2}{V_3} = \frac{2}{1}$ $\frac{V_1}{V_1 + V_2} = \left(\frac{x}{6}\right)^3$ $\frac{V_1}{V_1 + V_2} = \left(\frac{\frac{1}{4}y}{6}\right)^3 \text{ given } x = \frac{1}{4}y$ $\frac{V_1}{V_1 + V_2} = \frac{y^3}{13824}$ <p>Therefore,</p> $V_1 : V_1 + V_2 : V_3$ $y^3 : 13824$ $2 : 1$ $y^3 : 13824 : \frac{13824}{2}$ $y^3 : 13824 : 6912$ <p>Since</p> $\frac{V_1}{V_2 + V_3} = \frac{1}{1}$ $\frac{y^3}{13824 - y^3 + 6912} = \frac{1}{1}$ $20736 - y^3 = y^3$ $2y^3 = 20736$	<p>Sub $x = \frac{1}{4}y$ into equation</p> <p>Form Equation</p>	<p>M1</p> <p>M1</p>

Qn No.	Workings	Description	Mark Allocation
	$y^3 = 10368$ $y = \sqrt[3]{10368}$ $y = 21.8 \text{ (3 s.f.)}$		A1
4cii	<p>Alternate Solution 3</p> $\text{Vol of Solid} = \frac{1}{3}\pi(6)^2(24) + \frac{2}{3}\pi(6)^3$ $= 432\pi$ $\text{Vol of Upper part} = 432\pi \div 2 = 216\pi$ $\frac{\text{Vol of Upper}}{\text{Vol of Lower}} = \left(\frac{y}{24}\right)^3$ $\left(\frac{y}{24}\right)^3 = \frac{216\pi}{\frac{1}{3}\pi(6)^2(24)}$ $\frac{y}{24} = \sqrt[3]{\frac{216\pi}{288\pi}}$ $y = 24 \sqrt[3]{\frac{216\pi}{288\pi}}$ $y = 21.8 \text{ cm (3.s.f.)}$		M2 A1
5a	$\text{Grad of } PQ = \frac{4 - (-5)}{2 - (-1)}$ $= 3$ <p>Sub (2, 4) into $y = 3x + c$</p> $4 = 3(2) + c$ $c = 4 - 6$ $c = -2$ <p>$\therefore y = 3x - 2$ (shown)</p>	<p>Show working for Gradient</p> <p>Show working for y-intercept</p>	B1 AG1
5b	$y = 3x - 2 \quad \text{----- (1)}$ $3y - 2x = 1 \quad \text{----- (2)}$ <p>Sub (1) into (2)</p> $3(3x - 2) - 2x = 1$ $9x - 6 - 2x = 1$ $7x = 7$ $x = 1$ <p>Sub $x=1$ into Eqn (1)</p> $y = 3(1) - 2$ $y = 1$	<p>Elimination or Substitution method</p> <p>Lose 1 mark if x and y values are correct but</p>	M1 A1

Qn No.	Workings	Description	Mark Allocation
	S (1, 1)	state coordinate S wrongly.	A1
5c	Length of PQ $= \sqrt{(4 - (-5))^2 + (2 - (-1))^2}$ $= \sqrt{81 + 9}$ $= \sqrt{90}$ $= 9.4868$ (5 s.f) $= 9.49$ units (3 s.f)		M1 A1
5d	$x = -1$		B1
5e	Substitute $x = -4$ into $y = 3x - 2$ $y = 3(-4) - 2$ $y = -12 - 2$ $y = -14$ The point A does not lie on the line because when $x = -4$, $y = -14 \neq -5$.		M1 A1
6a	$\angle ACD = 32^\circ$ (\angle s in same seg.)		B1
6b	$\angle BCD = 32^\circ + 58^\circ$ $= 90^\circ$ Since it obeys right angle in semicircle property , $\Rightarrow BD$ is a diameter. (shown)	Student should show $\angle BCD = 90^\circ$ and give correct reason. Can accept short form for circle property.	B1
6c	$\angle DAB = 90^\circ$ (right \angle in semicircle) $\angle DAY = 180^\circ - 90^\circ - 58^\circ$ $= 32^\circ$ (adj \angle s on a straight line)	Award 1 mark as long answer is correct and either reason is given	B1
6d	$\angle FCE = \angle FEC = \frac{180^\circ - 120^\circ}{2}$ (base \angle s of isos. Δ) $= 30^\circ$ $\angle ECD = 180^\circ - 90^\circ - 30^\circ$ (adj. \angle s on straight line) $= 60^\circ$ $\angle FED = 90^\circ$ (\angle s in opp. seg.) $\angle CED = 90^\circ - 30^\circ$ $= 60^\circ$ $\therefore \angle CDE = 60^\circ$ Since all 3 angles are 60° $\Rightarrow \Delta CDE$ is an equilateral Δ . (shown)	show $\angle ECD = 60^\circ$ show $\angle FED = 90^\circ$ by stating \angle s in opp. seg. show $\angle CED = 60^\circ$ and conclude ΔCDE is equilateral.	B1 B1 AG1

Qn No.	Workings	Description	Mark Allocation
6d	<p>Alternate Solution</p> $\angle CDE = 180 - 120$ $= 60^\circ$ (\angle s in opposite segments) $\angle FCD = 180 - 90$ $= 90^\circ$ (adj \angle s on straight line) $\angle FED = 180 - 90$ $= 90^\circ$ (\angle s in opposite segments) $\angle FCE = \angle FEC = \frac{180 - 120}{2}$ $= 30^\circ$ (Base \angle s of Isos. Δ) $\angle ECD = 90 - 30$ $= 60^\circ$ $\angle CED = 180 - 60 - 60$ $= 60^\circ$ (sum of \angle s in Δ) Since all 3 angles are 60° $\Rightarrow \Delta CDE$ is an equilateral Δ . (shown)	<p>show $\angle CDE = 60^\circ$</p> <p>show $\angle FED = 90^\circ$ by stating \angles in opp. seg.</p> <p>show $\angle CED = 60^\circ$ and conclude ΔCDE is equilateral.</p>	<p>B1</p> <p>B1</p> <p>AG1</p>
6ei	$\angle COE = 120^\circ$ (\angle at centre = 2 \angle s at circumference) $\Rightarrow \angle OCE = \angle OEC = 30^\circ$ (base \angle s of Isos. Δ) $\angle COE = \angle CFE = 120^\circ$ (A) $\angle OCE = \angle FCE = 30^\circ$ (base \angle s of Isos. Δ) (A) CE is common (S) $\therefore \Delta OCE \equiv \Delta FCE$ (AAS)	<p>Show any two statements with clear reasons given.</p> <p>Correct conclusion and show AAS property</p>	<p>B2</p> <p>B1</p>
6eii	$COEF$ is a rhombus.		B1
7ai	$T_n = 3n + 1$		B1
7aii	$T_{88} = 3(88) + 1$ $= 265$		B1
7bi	$1^3 + 2^3 + 3^3 + 4^3 + 5^3 = 225 = (1 + 2 + 3 + 4 + 5)^2 = \left(\frac{5 \times 6}{2}\right)^2$		B1
7bii	$\text{Sum} = \left(\frac{10 \times 11}{2}\right)^2 = 3025$		B1
7biii	$q = \left(\frac{n(n+1)}{2}\right)^2$		B1
7biv	$1296 = \left(\frac{n(n+1)}{2}\right)^2$ $36 = \frac{n(n+1)}{2}$ (square root both sides) $72 = n^2 + n$ $n^2 + n - 72 = 0$ $(n - 8)(n + 9) = 0$ $n = 8$ or $n = -9$ (reject)		<p>M1</p> <p>A1</p>

Qn No.	Workings	Description	Mark Allocation
7bv	600 is not a square number. The sum of all numbers in the rows should be a square number.		B1
8a	$p = 50$		B1
8bi	20kg		B1
8bii	Lower Quartile = 15 kg Upper Quartile = 23 kg Interquartile Range = $23 - 15$ = 8 kg		M1 A1
8biii	44 th Percentile = 19 kg		B1
8ci	Interquartile Range = $30 - 20$ = 10 kg		B1
8cii	$\frac{1}{4} \times 200 = 50$ men.		B1
8ciii	The median weight loss of Genesis Fitness Centre is higher than Alpha Fitness Centre ($25\text{kg} > 20\text{kg}$) It is untrue that Alpha Fitness Centre is more effective at weight loss.	State median and comment that it is untrue.	B1
8di	P (Charles fails the test) = $1 - 0.8$ = 0.2 P (Charles passes only at the third attempt) = $0.2 \times 0.2 \times 0.8$ = 0.032		B1
8dii	P(Charles passes in the first attempt) = 0.8 P(Charles passes only at the second attempt) = 0.2×0.8 = 0.16 P(Charles passes in either the first or second attempt) = $0.8 + 0.16$ = 0.96		M1 A1
9ai	$\overline{BC} = \overline{OC} - \overline{OB}$ $\overline{BC} = \begin{pmatrix} 2 \\ 1 \end{pmatrix} - \begin{pmatrix} 1 \\ 5 \end{pmatrix}$ $\overline{BC} = \begin{pmatrix} 1 \\ -4 \end{pmatrix}$		B1
9aai	$ \overline{BC} = \sqrt{1^2 + (-4)^2}$ $ \overline{BC} = 4.12 \text{ units}$		M1 A1

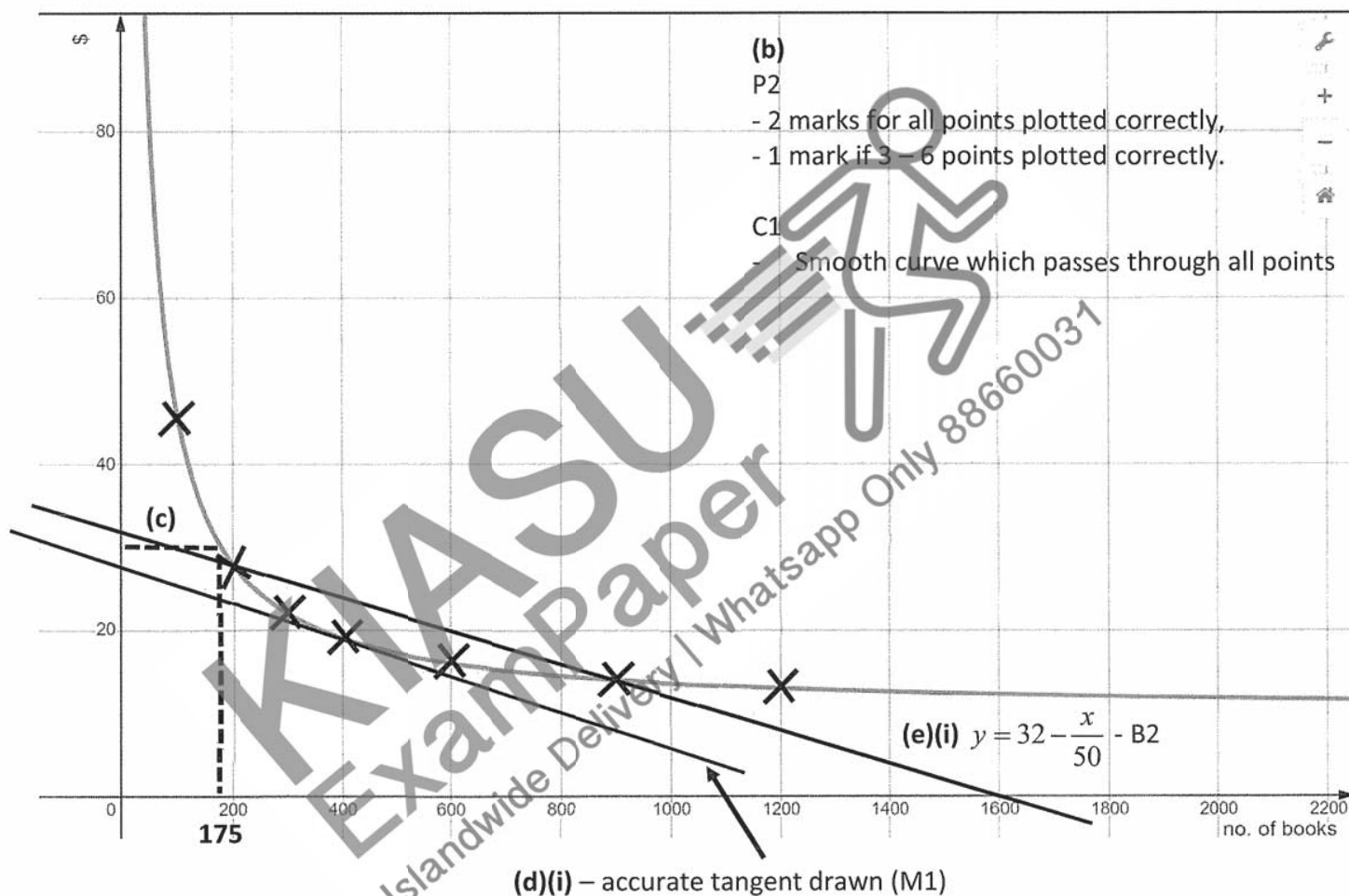
Qn No.	Workings	Description	Mark Allocation
9bia	$\overrightarrow{VW} = \overrightarrow{VU} + \overrightarrow{UV}$ $= -a + (6b - 2a)$ $= 6b - 3a$ Or $3(2b - a)$		B1
9bib	$\overrightarrow{WX} = \overrightarrow{WV} + \overrightarrow{VX}$ $= -(6b - 3a) + 2b - 2a$ $= -4b + a$		B1
9bic	$\overrightarrow{XZ} = \overrightarrow{XV} + \overrightarrow{VZ}$ $= -(2b - 2a) - \frac{3}{2}a$ $= -2b + \frac{1}{2}a$		B1
9bii	$\overrightarrow{WX} = -4b + a = 2(-2b + \frac{1}{2}a)$ $\overrightarrow{XZ} = -2b + \frac{1}{2}a$ $\therefore \overrightarrow{WX} = 2\overrightarrow{XZ}$ Since $\overrightarrow{WX} = 2\overrightarrow{XZ}$, \overrightarrow{WX} is parallel to \overrightarrow{XZ} with X as the common point. Therefore, the points W, X and Z lie on a straight line.	Show $\overrightarrow{WX} = 2\overrightarrow{XZ}$ or $WX = 2XZ$ Write concluding statement	M1 AG1
9biia	$\frac{\text{Area of } \Delta ZUX}{\text{Area of } \Delta ZVW} = \left(\frac{ZU}{ZV}\right)^2$ $\frac{VU}{UZ} = \frac{2}{1}$ $= \left(\frac{1}{1+2}\right)^2$ $= \frac{1}{9}$		B1
9biiib	$\frac{\text{Area of } \Delta XVW}{\text{Area of } \Delta ZVW} = \frac{\frac{1}{2} \times XW \times h}{\frac{1}{2} \times ZW \times h}$ $\frac{XW}{ZX} = \frac{2}{1}$ $= \frac{2}{2+1}$ $= \frac{2}{3}$		B1
9biiic	$\overrightarrow{UX} = \overrightarrow{UW} + \overrightarrow{WX}$ $= 6b - 2a - 4b + a$ $= 2b - a$ $\overrightarrow{VW} = 6b - 3a = 3(2b - a)$ $\therefore VW = 3UX$	Show $VW = 3UX$	M1

Qn No.	Workings	Description	Mark Allocation
	$\frac{\text{Area of } \triangle X VW}{\text{Area of trapezium } UVWX} = \frac{\frac{1}{2} \times VW \times h}{\frac{1}{2} \times (UX + VW) \times h}$ $= \frac{VW}{UX + VW}$ $= \frac{3}{1+3}$ $= \frac{3}{4}$		A1
10a	<p>Eggs Number of Eggs required = $300 \times 2 = 600$ eggs Price for 600 eggs: 60 packs of Pasar Eggs: $\\$2.70 \times 60 = \\162 (cheapest) 40 packs of Dason Eggs: $\\$4.55 \times 40 = \\182 50 packs of Seng Seng Eggs: $\\$3.70 \times 50 = \\185 <u>Cheapest cost of 300 Breakfast Set (Eggs) = \$162</u></p> <p>Bread Number of slices of bread required = $300 \times 2 = 600$ slices of bread</p> <p>Price for at least 600 slices of bread: 43 packets of Gardenia Bread: $\\$2.70 \times 43 = \\116.10 (cheaper) 50 packets of Sunshine Bread: $\\$2.50 \times 50 = \\125 <u>Cheapest cost of 300 Breakfast Sets (Bread) = \$116.10</u></p> <p>Sausage Number of Sausages required = 300 sausages Price of 300 sausages: 30 packs Master Grocer: $\\$5.25 \times 30 = \\157.50 50 packs of Grand Chef: $(\\$3.20 \times 50) - (\\$0.35 \times 25) = \\$151.25$ (cheaper) <u>Cheapest cost of 300 Breakfast Sets (Sausage) = \$151.25</u></p> <p>Ham Number of slices of ham required = 300 slices of ham Price of 300 slices of ham: 30 packs of FairPrice Ham: $(4.35 \times 30) \times 0.8 = \\104.40 30 packs of Smart Choice Ham: $3.30 \times 30 = \\$99$ (cheaper) <u>Cheapest cost of 300 Breakfast Sets (Ham) = \$99</u></p>	<p>Find Cost of 43 packets of Gardenia Bread or 60 packs of Pasar Eggs</p> <p>Find Cost of 50 packs Grand Chef Sausage as cheaper option</p> <p>Find Cost of 30 packs of Smart Choice Ham as cheaper option</p>	<p>EB 1</p> <p>S1</p> <p>H1</p>

Qn No.	Workings	Description	Mark Allocation
	<p>Coffee</p> <p>Number of packets required = 300 packets</p> <p>Price of at least 300 packets of coffee</p> <p>9 packs of Nescafe (inclusive of 1 free): $\\$6.15 \times 8 = \\49.20</p> <p>12 packs of Indocafe: $\\$3.95 \times 12 = \\47.40 (cheaper)</p> <p><u>Cheapest cost of 300 Breakfast Sets (Indocafe Coffee)</u></p> <p><u>= \$47.40</u></p> <p>Lowest Possible Cost for 300 all day breakfast</p> <p>$= 162 + 116.10 + 151.25 + 99 + 47.40$</p> <p>$= \\575.75</p>	<p>Find Indocafe Coffee as cheaper option</p> <p>Lowest Total Cost</p>	<p>C1</p> <p>A1</p>
10b	<p>Assumption:</p> <ul style="list-style-type: none"> - No cost incurred for cooking. - No food wastage made during the cooking - All 300 sets are sold 	Any valid assumptions	A1
10b	<p>Solution 1</p> <p>Funded expenses</p> <p>$= \\$575.75 - \\200</p> <p>$= \\$375.75$</p> <p>Total sales class must make to raise at least \$600 for charity</p> <p>$= \text{funded expenses} + \text{charity amount}$</p> <p>$= \\$575.75 - \\$200 + \\600</p> <p>$= \\$975.75$</p> <p>To make sure up to 40% of the sales can be used to cover expenses</p> <p>$= \frac{375.75}{975.75} \times 100\%$</p> <p>$= 38.508\%$ (less than 40%)</p> <p>Minimum amount to charge for each breakfast set</p> <p>$= \frac{975.75}{300}$</p> <p>$= \\$3.30$ (nearest ten cent)</p>	<p>Total Sales (with criteria 2)</p> <p>Check that the total sales meet the criteria 1</p> <p>Correct minimum price</p>	<p>S1</p> <p>C1</p> <p>P1</p>

Qn No.	Workings	Description	Mark Allocation
10b	<p>Solution 2</p> <p>Funded expenses $= \\$575.75 - \\200 $= \\$375.75$</p> <p>Total sales class must make to if used 40% to cover expenses $= \frac{100}{40} \times 375.75$ $= \\$939.375$</p> <p>Amount left for charity $= \\$939.375 - \\375.75 $= \\$563.625$ (not enough for charity)</p> <p>Additional amount needed to raise at least \$600 for charity $= \\$600 - \\563.625 $= \\$36.375$</p> <p>Adjusted total sales class $= \\$939.375 + \\36.375 $= \\$975.75$</p> <p>Minimum amount to charge for each breakfast set $= \frac{975.75}{300}$ $= \\$3.30$ (nearest ten cent)</p>	<p>Total Sales (with criteria 1)</p> <p>Check that the total sales meet the criteria 2</p> <p>Correct minimum price</p>	<p>S1</p> <p>C1</p> <p>P1</p>

Question 3



$$\text{Gradient} = \frac{10 - 19}{800 - 400} = -0.0225 \text{ - A1}$$

End of marking scheme