CSSA

CATHOLIC SECONDARY SCHOOLS ASSOCIATION OF NSW
2020 TRIAL HIGHER SCHOOL CERTIFICATE EXAMINATION
MATHEMATICS STANDARD 2

Section I

15 marks

Questions 1-15 (1 mark each)

Question	Answer	Content	Syllabus Assessed	Targeted Performance Bands
1	C	Network terminology	MS-N2.1	2-3
2	A	Loans	MS-F4.2	2-3
3	D	Scatterplots	MS-S4	2-3
4	B	Median	MS-S1.2	3-4
5	C	Ratio	MS-M7	3-4
6	D	Area of a triangle	MS-M6	3-4
7	D	Linear relationships	MS-A2	3-4
8	B	Units of energy	MS-M1.3	4-5
9	B	Critical path	MS-N3	4-5
10	A	Latitude and longtitude	MS-M2	4-5
11	A	Medicine dosage	MS-A1	4-5
12	C	Probability	MS-S2	4-5
13	A	Normal distribution	MS-S5	5-6
14	B	Shortest path	MS-N2.2	5-6
15	D	Compass bearings	MS-M6	5-6

Section II

85 marks
Questions 16 – 44

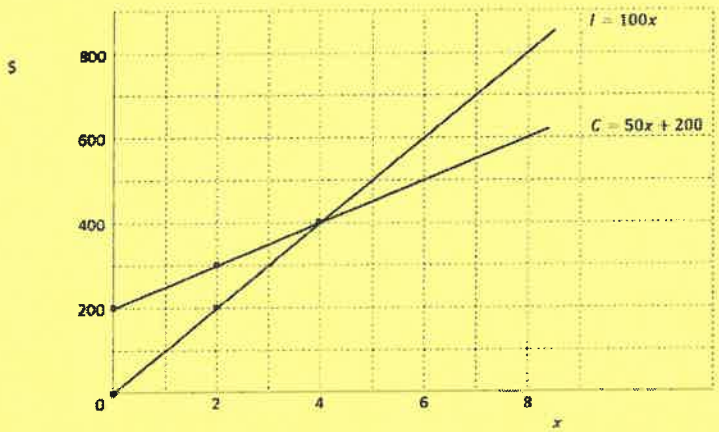
Question 16 (2 marks)
Content: **MS-A1**
Outcomes assessed: **MS2-12-1**
Targeted Performance Bands: **3-4**

Solution	Criteria	Marks
$BAC_{female} = \frac{10N - 7.5H}{5.5M}$ $= \frac{(10\times5) - (7.5\times3)}{5.5 \times 75}$ $= 0.067$	**1 mark** for correct substitution into formula **2 marks** for correct working and answer	**2**

Question 17 (2 marks)
Content: **MS-M1.3**
Outcomes assessed: **MS2-12-3**
Targeted Performance Bands: **2-3**

Solution	Criteria	Marks
$5 \times 365 \times 300 \div 1000 \times 0.30$ $= \$164.25$	**1 mark** for progress towards answer with one error in working **2 marks** for correct working and answer	**2**

Question 18
18a (2 marks)
Content: **MS-A4.1**
Outcomes assessed: **MS2-12-6**
Targeted Performance Bands: **3-4**

Solution	Criteria	Marks
	**1 mark** for one correct line marked on the graph **2 marks** for two correct lines marked on the graph	**2**

18b (1 mark)
Content: **MS-A4.1**
Outcomes assessed: **MS2-12-6**
Targeted Performance Bands: **2-3**

Solution	Criteria	Mark
Break-even = 4 items	**1 mark** for correct answer	**1**

Question 19 (2 marks)
Content: **MS-S2**
Outcomes assessed: **MS2-12-2**
Targeted Performance Bands: **2-3**

Solution	Criteria	Marks
$31\% + 7\% = 38\%$ $38\% \times 1200 = 456$ people	**1 mark** for correct addition of two percentages **2 marks** for correct working and answer	**2**

Question 20 (4 marks)
Content: **MS-F4.1**
Outcomes assessed: **MS2-12-5**
Targeted Performance Bands: **3-4**

Solution	Criteria	Marks
Option A $= 5 \times \$3600$ $= \$18\,000$ Option B $= \$92\,000 \times 3\% \times 5$ $= \$13\,800$ Option C $= \$92\,000\,(1 + 3\%)^5 - \$92\,000$ $= \$14\,653.21$ Therefore, Option A gives Molly the biggest pay increase	**1 mark** for correct calculation of one option **2 marks** for correct calculation of two options **3 marks** for correct calculation of three options **4 marks** for correct calculation of all three options and a correct statement	**4**

Question 21 (2 marks)
Content: **MS-A2**
Outcomes assessed: **MS2-12-6**
Targeted Performance Bands: **3-4**

Solution	Criteria	Marks
$m = \frac{\text{rise}}{\text{run}}$ $m = \frac{-2500}{30}$ $m \approx -83\frac{1}{3}$ This represents a loss of value of the laptop of approximately \$83.33 per month	1 **mark** for correct calculation of the gradient **2 marks** for correct gradient and explanation of meaning	**2**

Question 22 (3 marks)
Content: **MS-A1**
Outcomes assessed: **MS2-12-1**
Targeted Performance Bands: **3-4**

Solution	Criteria	Marks
$\frac{m}{3} = 2m - 1$ $m = 3(2m - 1)$ $m = 6m - 3$ $-5m = -3$ $m = \frac{3}{5}$	**1 mark** for correct answer without working or for a maximum of two errors in working **2 marks** for a maximum of one error in working **3 marks** for correct working and answer	**3**

Question 23 (3 marks)
Content: **MS-F5**
Outcomes assessed: **MS2-12-5**
Targeted Performance Bands: **3-4**

Solution	Criteria	Marks
Value from table for 1.2% per period for 12 periods = 12.82455 FV = $12.82455 \times 250 = \$3206.14$ Interest = $3206.14 - (250 \times 12)$ $= \$206.14$	**1 mark** for identiying correct value from table **2 marks** for calculation of FV **3 marks** for correct working and answer	**3**

Question 24 (2 marks)
Content: **MS-F4.1**
Outcomes assessed: **MS2-12-5**
Targeted Performance Bands: **3-4**

Solution	Criteria	Marks
$5000 \times \$8.20 = \$41\,000$ $\frac{6000}{41000} \times 100 = 14.6\%$ *or,* $\$6000 \div 5000 = \$1.20$ $\frac{1.20}{8.20} \times 100 = 14.6\%$	**1 mark** for correct calculation of total market value *or* dividend payment per share **2 marks** for correct working and answer	**2**

Question 25
25a (1 mark)
Content: **MS-A1**
Outcomes assessed: **MS2-12-1**
Targeted Performance Bands: **2-3**

Solution	Criteria	Mark
$P = 18n - 400$ $= 18 \times 200 - 400$ $= \$3200$	**1 mark** for correct answer	**1**

25b (1 mark)
Content: **MS-A1**
Outcomes assessed: **MS2-12-1**
Targeted Performance Bands: **3-4**

Solution	Criteria	Mark
$P = 18n - 400$ $P + 400 = 18n$ $18n = P + 400$ $n = \frac{P + 400}{18}$	**1 mark** for correct answer	**1**

25c (1 mark)
Content: **MS-A1**
Outcomes assessed: **MS2-12-1**
Targeted Performance Bands: **2-3**

Solution	Criteria	Mark
$n = \frac{P + 400}{18}$ $n = \frac{5000 + 400}{18}$ $n = \frac{5400}{18}$ $n = 300$ guests	**1 mark** for correct answer	**1**

Question 26 (2 marks)
Content: **MS-M7**
Outcomes assessed: **MS2-12-3**
Targeted Performance Bands: **3-4**

Solution	Criteria	Marks
$s = \frac{d}{t}$ $= \frac{3200\text{ m}}{3\text{ mins }16\text{ secs}}$ $= \frac{3.2\text{ km}}{0°\,3'\,16''}$ $= 58.8$ km/h	**1 mark** for correct conversion of units **2 marks** for correct working and answer	**2**

Question 27 (3 marks)
Content: **MS-S1.2**
Outcomes assessed: **MS2-12-7**
Targeted Performance Bands: **4-5**

Solution	Criteria	Marks
IQR = 7 − 4 = 3 Upper limit = $Q_3 + 1.5 \times IQR$ = 7 + (1.5 × 3) = 11.5 ∴ The maximum score is 12 which is larger than the upper limit so it *is* an outlier for the data	**1 mark** for correct calculation of IQR **2 marks** for correct calculation of upper limit **3 marks** for correct concluding statement with supporting calculations	3

Question 28 (5 marks)
Content: **MS-F1.3**
Outcomes assessed: **MS2-12-5**
Targeted Performance Bands: **4-5**

Solution	Criteria	Marks
Electric car: Purchase price = $48 800 On-road costs = $900 × 5 = $4500 Fuel cost = 25 000 ÷ 100 × 15 × $0.25 × 5 = $4687.50 Servicing = $450 × 5 = $2250 TOTAL = $60 237.50 **Petrol car:** Purchase price = $29 990 On-road costs = $1600 × 5 = $8000 Fuel cost = 25 000 ÷ 100 × 7.6 × $1.49 × 5 = $14 155 Servicing = $2000 × 5 = $10 000 TOTAL = $62 145 Rob should purchase the **electric car** as it will cost him less over the 5 year period. (Additionaly there is an added benefit of being better for the environment)	**1 mark** for correct calculation of electricity cost for the electric car **2 marks** for correct calculation of total cost of the electric car **3 marks** for correct calculation of total cost of the electric car and the cost of petrol for the petrol car **4 marks** for correct calculation of total cost of the electric car and total cost of the petrol car **5 marks** for correct calculation of total cost of the electric car, total cost of the petrol car and a correct concluding statement	5

Question 29 (2 marks)
Content: **MS-M1.2**
Outcomes assessed: **MS2-12-3**
Targeted Performance Bands: **3-4**

Solution	Criteria	Marks
$r = 1.5$ m $V = \pi r^2 h$ $V = \pi \times 1.5^2 \times 4$ $V = 28.27$ m^3 1 m^3 = 1kL ∴ capacity = 28.27kL = 28 274 L	**1 mark** for correct calculation of volume of the water tank **2 marks** for correct working and answer in litres	**2**

Question 30
30a (1 mark)
Content: **MS-S5**
Outcomes assessed: **MS2-12-7**
Targeted Performance Bands: **3-4**

Solution	Criteria	Mark
$z = \frac{x - \mu}{\sigma}$ $z = \frac{2.9 - 2.4}{0.2}$ $z = 2.5$	**1 mark** for correct answer	**1**

30b (2 marks)
***Content:*MS-S5**
***Outcomes assessed:* MS2-12-7**
***Targeted Performance Bands:* 4-5**

Solution	Criteria	Marks
z-score of between -2 and 2 $\approx$ 95% of scores 2 × standard deviation = 2 × 0.2 m = 0.4 m either side of the mean Therefore 95% of scores are 2.4 m $\pm$ 0.4 m 95% of the trees are between 2 m and 2.8 m	**1 mark** for correct calculation of 0.4 m either side of mean **2 marks** for correct working and answers	**2**

Question 31 (3 marks)
***Content:* MS-M7**
***Outcomes assessed:* MS2-12-4**
***Targeted Performance Bands:*4-5**

Solution	Criteria	Marks
$A \approx \frac{h}{2}(d_f + d_l) + \frac{h}{2}(d_f + d_l)$ $\approx \frac{25}{2}(19.8 + 14.3) + \frac{25}{2}(14.3 + 0)$ $\approx 426.25 + 178.75$ $\approx 605\ \text{m}^2$ $V \approx 605 \times 0.12$ $\approx 72.6\ \text{m}^3$	**1 mark** for use of the trapezoidal rule with an error such as incorrect value of h **2 marks** for correct working and answer for area **3 marks** for correct working and answer for volume	**3**

Question 32 (2 marks)
Content: **MS-A4.2**
Outcomes assessed: **MS2-12-1**
Targeted Performance Bands: **4-5**

Solution	Criteria	Marks
$t = \frac{k}{s}$ $2\frac{15}{60} = \frac{k}{100}$ $k = 2\frac{15}{60} \times 100$ $k = 225$ $\therefore t = \frac{225}{s}$ When travelling at 60km/h: $t = \frac{225}{s}$ $t = \frac{225}{60}$ $t = 3.75$ hours *or,* $t = 3$ hours, 45 minutes	**1 mark** for correct calculation of k **2 marks** for correct working and answer	**2**

Question 33 (2 marks)
Content: **MS-M1.1**
Outcomes assessed: **MS2-12-3**
Targeted Performance Bands: **3-4**

Solution	Criteria	Marks
$\%\ \text{error} = \frac{0.05}{15.2} \times 100 = 0.329\%$	**1 mark** for using correct absolute error **2 marks** for correct working and answer	**2**

Question 34 (2 marks)
Content: **MS-M6**
Outcomes assessed: **MS2-12-3**
Targeted Performance Bands: **4-5**

Solution	Criteria	Marks
$\frac{x}{\sin 72} = \frac{6.8}{\sin 56}$ $x = \frac{6.8}{\sin 56} \times \sin 72$ $x = 7.8$ km	**1 mark** for correct use of sine rule **2 marks** for correct working and correctly rounded answer	**2**

Question 35 (2 marks)
Content: **MS-M2**
Outcomes assessed: **MS2-12-3**
Targeted Performance Bands: **4-5**

Solution	Criteria	Marks
Difference between UTC $+9$ and UTC -5 is 14 hours. Washington DC is 14 hours behind Tokyo. 14 hours before 8pm on Sunday = 6am on Sunday	**1 mark** for calculation of 14 hours of time difference or partly correct answer **2 marks** for correct day *and* time	**2**

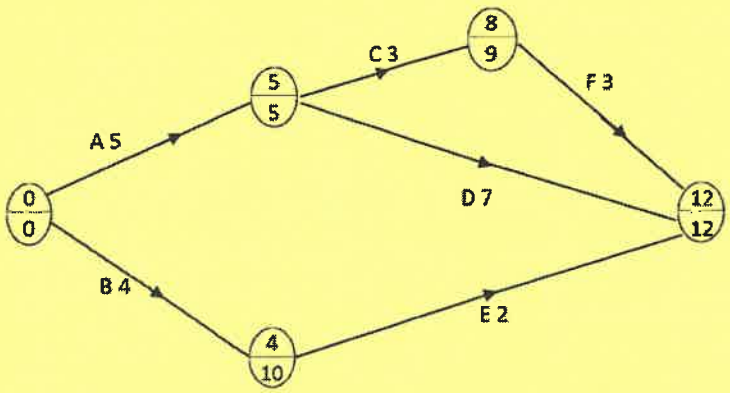
Question 36

36a (2 marks)

Content: **MS-N3**

Outcomes assessed: **MS2-12-8**

Targeted Performance Bands: **5-6**

Solution	Criteria	Marks
	**1 mark** for some correct values that indicate understanding of network concepts **2 marks** for all correct values	2

36b (1 mark)

Content: **MS-N3**

Outcomes assessed: **MS2-12-8**

Targeted Performance Bands: **4-5**

Solution	Criteria	Mark
$10 - 4 = 6$ hours	**1 mark** for correct answer	1

Question 37

37a (1 mark)

Content: **MS-S4**

Outcomes assessed: **MS2-12-7**

Targeted Performance Bands: **4-5**

Solution	Criteria	Mark
$r = 0.63$	**1 mark** for correct answer	**1**

37b (2 marks)

Content: **MS-S4**

Outcomes assessed: **MS2-12-7**

Targeted Performance Bands: **4-5**

Solution	Criteria	Marks
$m = 0.51$ $c = 40.16$ $\therefore y = 0.51x + 40.16$	**1 mark** for correct gradient and/or y-intercept **2 marks** for correct values and correct equation	**2**

37c (1 mark)

Content: **MS-S4**

Outcomes assessed: **MS2-12-7**

Targeted Performance Bands: **4-5**

Solution	Criteria	Mark
The correlation co-efficient will be **lower/weaker** when the additional student is included in the data (The value is now $r = 0.009$)	**1 mark** for correct answer	**1**

37d (1 mark)

Content: **MS-S4**

Outcomes assessed: **MS2-12-7**

Targeted Performance Bands: **4-5**

Solution	Criteria	Mark
Disagree. The original data indicated that there may be a correlation. However, when the additional student is included, there is almost no correlation between driving hours and marks in Visual Arts.	**1 mark** for correct answer	**1**

Question 38 (2 marks)
***Content:*MS-S5**
***Outcomes assessed:*MS2-12-7**
***Targeted Performance Bands:*4-5**

Solution	Criteria	Marks
-2 to $1 = 3$ standard deviations 3 standard deviations $= 21 - 12 = 9$ $\therefore$ each standard deviation is $9 \div 3 = 3$ $\sigma = 3$ Mean: $-2 = \frac{12 - \mu}{3}$ $-6 = 12 - \mu$ $\mu = 12 + 6$ $\mu = 18$	**1 mark** for correct calculation of the standard deviation or other progress towards answer **2 marks** for correct working and answer	**2**

Question 39
39a (1 mark)
***Content:*MS-A4.2**
***Outcomes assessed:*MS2-12-6**
***Targeted Performance Bands:* 5-6**

Solution	Criteria	Mark
$t = 0$ $C = 21 + (74 \times 3^{-0.2\times0})$ $C = 21 + (74 \times 3^{0})$ $C = 95°\,C$	**1 mark** for correct answer	**1**

39b (1 mark)
***Content:*MS-A4.2**
***Outcomes assessed:*MS2-12-6**
***Targeted Performance Bands:* 3-4**

Solution	Criteria	Mark
$C = 21 + (74 \times 3^{-0.2\times10})$ $C = 21 + (74 \times 3^{-2})$ $C = 29.222\ldots°\,C$ $C = 29°\,C$	**1 mark** for correct answer	**1**

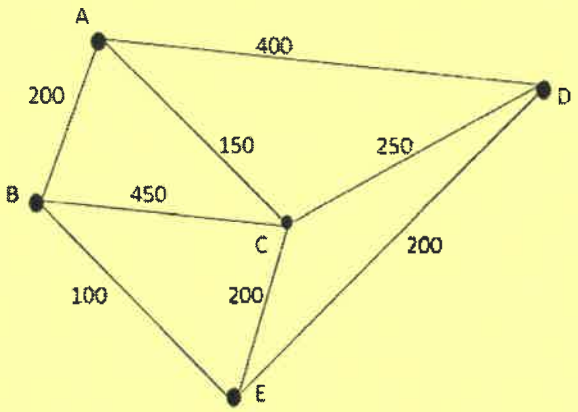
Question 40

40a (2 marks)

Content: **MS-N2.1**

Outcomes assessed: **MS2-12-8**

Targeted Performance Bands: **3-4**

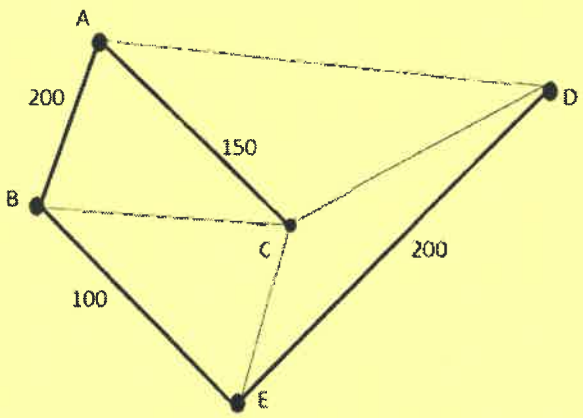
Solution	Criteria	Marks
	**1 mark** for some correct features and values on a network diagram **2 marks** for a correct network diagram such as the one given	**2**

40b (2 marks)

Content: **MS-N2.2**

Outcomes assessed: **MS2-12-8**

Targeted Performance Bands: **3-4**

Solution	Criteria	Marks
 150 + 200 + 100 + 200 = 650 m	**1 mark** for correct identification of a mimimum spanning tree such as the one given **2 marks** for a correct spanning tree and calculation of least amount of cable	**2**

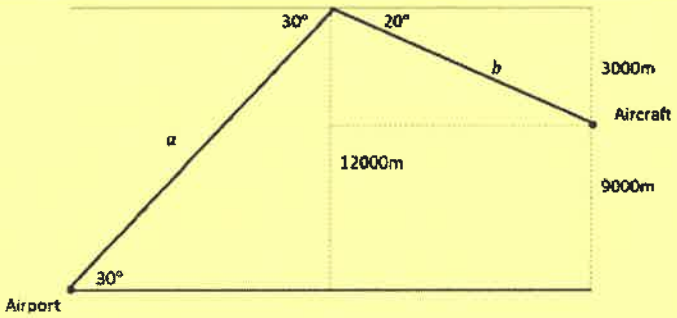
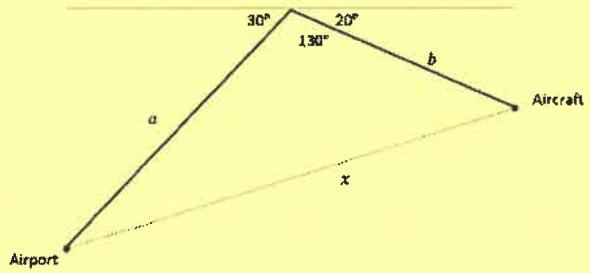
Question 41 (2 marks)
Content: **MS-M1.2, MS-A1**
Outcomes assessed: **MS2-12-4**
Targeted Performance Bands: **4-5**

Solution	Criteria	Marks
$A \approx \frac{h}{2}(d_f + d_l)$ $24.15 \approx \frac{5.75}{2}(d_f + 4.42)$ $48.3 \approx 5.75(d_f + 4.42)$ $8.4 \approx d_f + 4.42$ $\therefore d_f = 3.98$ km	**1 mark** for correct substitution into Trapeziodal formula **2 marks** for correct working and answer	**2**

Question 42 (4 marks)
Content: **MS-M7**
Outcomes assessed: **MS2-12-3**
Targeted Performance Bands: **5-6**

Solution	Criteria	Marks
Power of old globes $= 60 \times 15 + 100 \times 5$ $= 1400$ watts Power of new globes $= 7 \times 15 + 12 \times 5$ $= 165$ watts Power saved $= 1400 - 165 = 1235$ watts Cost of saving each week $= 1235 \div 1000 \times 40 \times 0.25367$ $= \$12.53$ Cost of saving for year $= \$12.53 \times 52$ $= \$651.63$	**1 mark** for calculation of power of old or new globes only **2 marks** for calculation of amount of energy saved **3 marks** for calculation of saving each week or one other error in working **4 marks** for full correct working and answer	**4**

Question 43 (5 marks)
***Content:*MS-M6**
***Outcomes assessed:* MS2-12-4**
***Targeted Performance Bands:* 6**

Solution	Criteria	Marks
 $\sin 30° = \frac{12\,000}{a}$ $a = \frac{12\,000}{\sin 30°}$ $a = 24\,000$ m $\sin 20° = \frac{3000}{b}$ $b = \frac{3000}{\sin 20°}$ $b = 8771.4$ m  $x^2 = a^2 + b^2 - 2ab\cos x$ $x^2 = 24000^2 + 8771.4^2$ $- 2 \times 24000 \times 8771.4 \times \cos 130°$ $\therefore x = 30\,390$ m	**1 mark** for one correct answer for length a, length b **or** obtuse angle, 130° **2 marks** for two correct answers for length a, length b **or** obtuse angle, 130° **3 marks** for three correct answers for length a. length b **and** obtuse angle, 130° **4 marks** for above correct plus correct substitution into cosine rule. **5 marks** for complete correct working and answer	**5**

Question 44

44a (4 marks)

Content: **MS-F4.1**

Outcomes assessed: **MS2-12-5**

Targeted Performance Bands: **5-6**

Solution	Criteria	Marks
October: $\$6500\ (1+\frac{4.5\%}{365})^{31}$ $= \$6524.89$ **November:** $\$6524.89 + \$6500 = \$13\,024.89$ $\$13\,024.89\ (1+\frac{4.25\%}{365})^{30}$ $= \$13\,070.46$ **December:** $\$13\,070.46 + \$6500 = \$19\,570.46$ $\$19\,570.46\ (1+\frac{4\%}{365})^{31}$ $= \$19\,637.06$	**1 mark** for correct calculation of value at end of October **2 marks** for correct calculation of value at start of November **3 marks** for correct calculation of value at end of November **4 marks** for correct calculation of value at end of December	4

44b (2 mark)

Content: **MS-F4.1**

Outcomes assessed: **MS2-12-5**

Targeted Performance Bands: **5-6**

Solution	Criteria	Marks
$\$19\,637.06 = PV\ (1+\frac{3.2\%}{12})^3$ $PV = \frac{\$19\,637.06}{(1+\frac{3.2\%}{12})^3}$ $PV = \$19\,480.80$	**1 mark** for correct substitution into FV or PV formula **2 marks** for correct working and answer	2

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