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- 1 (a) Express 20 minutes as a percentage of 1.40 hours.
 (b) Express 7.2 km/h in m/s.

Answer (a)% [1]
 (b)m/s [1]

- 2 By writing each number correct to 1 significant figure, estimate the value of

$$\frac{406.7 \times 0.3029}{201.4}$$

Show your workings clearly.

Answer..... [2]

- 3 Simplify $\frac{4x-1}{3} - \frac{x-1}{5}$.

Answer..... [2]

- 4 (a) The total population in Singapore in year 2014 was 5.94 million. Express the number in standard form.
 (b) Write 250,690, 000 mm in km. Express your answer in standard form.

Answer (a) [1]
 (b)km [1]

- 5 On 24 May 2014, the temperature in Singapore is 30 °C while that in England is -3 °C. Find
 (a) the difference between the two temperatures,
 (b) the mean of the two temperatures.

Answer (a) °C [1]
 (b) °C [1]

- 6 (a) Find the fraction exactly halfway between $\frac{1}{5}$ and $\frac{1}{6}$.
 (b) Find the lowest common multiple of 12, 18, 24.

Answer (a) [1]
 (b) [1]

- 7 By completing the square, $y = x^2 + 4x - 6$ can be expressed in the form $y = (x - a)^2 + b$.
 (a) Find
 (i) a ,
 (ii) b .
 (b) Hence, or otherwise, solve $x^2 + 4x - 6 = 0$.

Answer (a)(i) $a =$ [1]
 (a)(ii) $b =$ [1]
 (b) $x =$ and $x =$ [2]

- 8 Solve the following simultaneous equations.

$$3x - 2y = 7$$

$$5y - 2 - x = 0$$

Answer $x = \dots\dots\dots$, $y = \dots\dots\dots$ [3]

- 9 It is given that y varies inversely as the square of x and given that $x = 2$ when $y = 40$.

(a) Express y in terms of x .

(b) Find the value of y when $x = 5$.

Answer (a) $\dots\dots\dots$ [2]

(b) $\dots\dots\dots$ [1]

- 10 Given that $m = \frac{a+b}{a-b}$, express b in terms of a and m .

Answer $\dots\dots\dots$ [3]

- 11 (a) Factorise $6xy - 21x - 28 + 8y$.

(b) Simplify $\frac{a^3b - (ab)^2}{3a} \div (a - b)$.

Answer (a) $\dots\dots\dots$ [2]

(b) $\dots\dots\dots$ [2]

- 12 The stem-and-leaf diagram below records the marks of a Mathematics test obtained by 40 students in class 4E2.

Stem	Leaf
4	1 5 9 9
5	0 0 1 5 6 6 9 9
6	0 1 3 7 7 9
7	0 1 3 3 3 3 3 5 6 9
8	0 2 2 4 5 6 9
9	0 0 2 2

Find

(a) the median,

(b) the mode,

(c) the percentage of students who scored higher than 73.

Answer (a) $\dots\dots\dots$ [1]

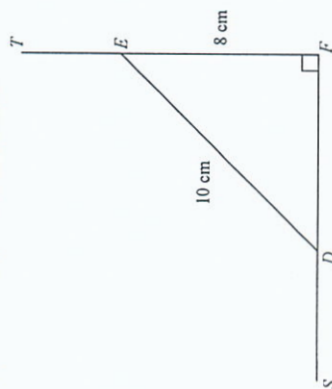
(b) $\dots\dots\dots$ [1]

(c) $\dots\dots\dots\%$ [2]

- 13 Given the sum of interior angles of a polygon is 3 times the sum of its exterior angles, calculate the number of sides of the polygon.

Answer..... [3]

- 14 In the diagram below, ED , TEF and SDF are straight lines.



Express, as a fraction in its lowest terms, the value of

- (a) $\tan \angle EDF$,
(b) $\cos \angle EDS$.

Answer (a)..... [2]

(b)..... [1]

- 15 A factory has 15 workers working 12 hours a day. They can finish a project in 7 days. How many workers will be needed to complete the same project in 4 days, if they work 7 hours a day?

Answer..... [3]

- 16 Find the value of x in the following equations.

(a) $16 \div 8^x - 1 = 0$

(b) $\frac{1}{25} = \sqrt{5^x}$

Answer (a) $x =$ [2]

(b) $x =$ [2]

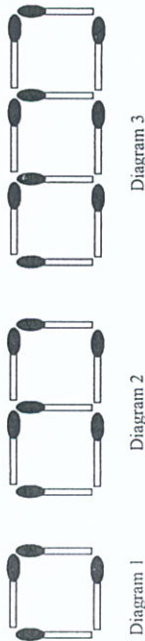
- 17 (a) Solve $\frac{x}{2} - 3 \leq 1$.

- (b) Given that x is a prime number, write down the list of values for x that satisfy the inequality in part (a).

Answer (a)..... [1]

(b)..... [1]

- 18 The diagram below shows a sequence formed by using layers of matchsticks.

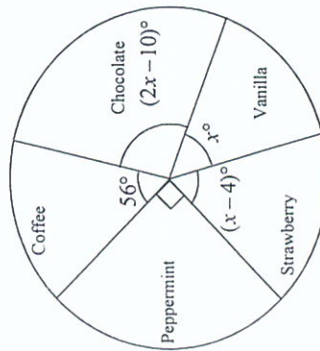


Find the number of matchsticks in

- (a) the 5th diagram,
(b) the n^{th} diagram,
(c) the 97th diagram.

Answer (a)..... [1]
(b)..... [1]
(c)..... [1]

- 19 The following pie chart represents the findings from a survey on the favourite ice-cream flavours of Secondary 4 students. 180 students choose peppermint as their favourite ice-cream flavor.

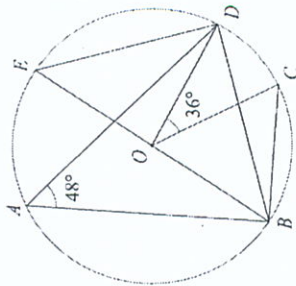


- (a) Find the total number of students who took the survey.
(b) Calculate the value of x .
(c) Express the number of students whose favourite ice-cream is chocolate as a percentage of the number of students whose favourite ice-cream is coffee.

Answer (a)..... [1]
(b)..... [2]
(c)..... [2]

- 20 In the diagram below, A, B, C, D and E are points on the circumference of a circle with centre O . Given that $\angle DOC = 36^\circ$ and $\angle BAD = 48^\circ$, calculate

- (a) $\angle BED$,
(b) $\angle CBD$,
(c) $\angle EDB$,
(d) $\angle OCB$.



Answer (a).....° [1]
(b).....° [1]
(c).....° [1]
(d).....° [2]

- 21 A water pump can fill a tank at the rate of 60 litres per hour. The tank has a capacity of 480 litres.
(a) Find the time needed for the pump to fill up the tank.
(b) If a second water pump can fill the same tank at the rate of 80 litres per hour, find the time needed for the second water pump to fill up the tank.
(c) If both the water pumps are turned on together, find the time taken to fill up the tank.

Answer (a)hours [1]
(b)hours [1]
(c)hours [1]

22 Answer the whole of this question on the space below.

- (a) (i) Construct a triangle PQR such that $PQ = 6.5$ cm, $RQ = 10$ cm, and $\angle PQR = 106^\circ$. [2]
 (ii) Measure and write down the length of PR .
 (b) On the same diagram, construct
 (i) the perpendicular bisector of line PQ , [2]
 (ii) the angle bisector of $\angle PQR$. [2]

- 23 The equation of a line k is $2x - 3y + 6 = 0$. Find
 (a) the gradient of line k ,
 (b) the coordinates of the point where line k intersects the x-axis.

Answer (a)..... [2]

(b)..... [2]

- 24 A container has 40 pens, some of which are red, green and the rest are blue. A pen is drawn at random from the container. The probability of drawing a red pen is 0.2 and the probability of getting a non-blue pen is 0.7. Find
 (a) the probability of getting a black pen,
 (b) the number of green pen in the container,
 (c) the probability of getting a red pen and a blue pen, when two pens are taken from the container at random.

Answer (a)..... [1]

(b)..... [2]

(c)..... [2]

Answer (a)(i)..... cm [1]

-End of Paper-

Qn.	Mark Scheme	Marks Awarded	Remarks
1a	$= 23.8\%$ or $23\frac{17}{21}$	B1	
1b	2 m/s	B1	
2	$= \frac{400 \times 0.3}{200}$ $= 0.6$	M1 A1	
3	$= \frac{5(4x-1)-3(x-1)}{15}$ $= \frac{17x-2}{15}$	M1 A1	
4a	$= 5.94 \times 10^6$	B1	
b	2.5069×10^2	B1	
5a	33	B1	
5b	13.5	B1	
6a	$= \frac{11}{60}$	B1	
6b	72	B1	
7a	$y = (x+2)^2 - 10$ (i) $a = -2$, (ii) $b = -10$	B1 B1	
7b	$x+2 = \pm\sqrt{10}$ $x = 1.162277, x = -5.162277..$ $x = 1.16$ or $x = -5.16$	M1 A1	
8	$x = 5y - 2$ $y = 1$ $x = 3$	M1 A1 A1	
9a	$K = 160$ $y = \frac{160}{x^2}$	M1 A1	
b	$y = 6.4$	B1	

10	$m(a-b) = a+b$ $a(m-1) = b+mb$ $a = \frac{b(1+m)}{m-1}$	M1 M1 A1	
11a	$= 3x(2y-7) + 4(2y-7)$ $= (3x+4)(2y-7)$	M1 A1	
11b	$= \frac{a^2b(a-b)}{3a} \times \frac{1}{a-b}$ $= \frac{ab}{3}$	M1 A1	
12a	72	B1	
12b	73	B1	
12c	Percentage $= \frac{14}{40} \times 100\%$ $= 35\%$	M1 A1	
13	$(n-2)180 = 3(360)$ $n = 8$	M1, M1 A1	
14a	DF = 6 $\tan \angle EDF = 1\frac{1}{3}$	M1 A1	
14b	$\cos \angle EDS = -\frac{3}{5}$	B1	
15	$15 \times 12 \times 7 = 4 \times 7 \times w$ $w = 45$	M2 A1	
16a	$2^4 = 2^{3x}$ $x = 1\frac{1}{3}$	M1 A1	
16b	$5^{-2} = 5^{x^2}$ $x = -4$	M1 A1	
17	$x \leq 8$	B1	
17b	$x = 2, 3, 5, 7$	B1	
18a	16	B1	
18b	$T_n = 3n + 1$	B1	
18c	292	B1	

19a	720		B1	
19b	$90 + 56 + x + x - 4 + 2x - 10 = 360$ $x = 57$		M1 A1	
19c	Percentage = $\frac{2(57) - 10}{56} \times 100\%$ = 186% or $185\frac{5}{7}\%$		M1 A1	
20a	48		B1	
20b	18		B1	
20c	90		B1	
20d	$\angle OBD = 42$ $\angle OCB = 42 + 18$ (iso triangle) = 60		M1 A1	
21a	8		B1	
21b	6		B1	
21c	Time = $\frac{480}{80 + 60}$ = $3\frac{3}{7}$		B1	
23a	$y = \frac{2}{3}x + 2$ Gradient = $\frac{2}{3}$		M1 A1	
23b	When $y = 0$, $2x + 6 = 0$ $x = -3$ Coordinate = $(-3, 0)$		M1 A1	
24a	0		B1	
24b	Red pen = 8 Non blue = 28 Green = 20		M1 A1	
24c	$P(1R \text{ and } 1B) = \left(\frac{12}{40}\right)\left(\frac{8}{39}\right) \times 2$ = $\frac{8}{65}$		M1 A1	

Section A (44 marks)

Answer all the questions in this section.

1 (a) Factorise completely $6a^2 - 3ab + 2ac - bc$. [2]

(b) Simplify $\frac{3x+1}{2} - \frac{4x}{5}$. [2]

2 (a) John is x years old.

Karl is 2 years older than John.

Tommy is twice as old as Karl.

Write down, in terms of x ,

(i) Karl's age, [1]

(ii) Tommy's age. [1]

(b) Given that their mean age is 14 years old, write down an equation in x and solve it to find John's age. [3]

3 Mr. Tan purchased an apartment which was advertised at \$1 200 000. He paid a down payment of 40% and took up a bank loan for the remaining amount. The bank charged a simple interest of 4.5% per annum for a loan repayment period of 20 years.

(a) Calculate the total amount of interest Mr. Tan has to pay for taking up the bank loan. [2]

(b) Calculate his monthly instalment. [2]

(c) Express the final cost of the apartment as a percentage of the advertised price. [2]

4 The exchange rate between the Euro (€) and the Singapore dollar (S\$) was €1 = S\$1.49 while the exchange rate between the Singapore dollar and the Malaysian ringgit was S\$1 = RM2.56.

(a) Find the amount of Singapore dollars needed to exchange for €1500. [1]

(b) Jane wants to exchange RM5000 for Euros. Calculate the amount of Euros she will receive. Give your answer corrected to the nearest Euro. [2]

[Turn Over]

5 The table below shows an extract of the tax rates from Inland Revenue in 2015.

Chargeable Income	Rate (%)	Gross Tax Payable (\$)
First \$20 000	0	0
Next \$10 000	2	200
First \$30 000	-	200
Next \$10 000	3.50	350
First \$40 000	-	550
Next \$40 000	7	2800
First \$80 000	-	3350
Next \$40 000	11.5	4600
First \$120 000	-	7950
Next \$40 000	15	6000
First \$160 000	-	13950
Next \$40 000	17	6800

(a) Calculate the tax payable for a chargeable income of \$115 000 according to the tax rates given in the table above. [2]

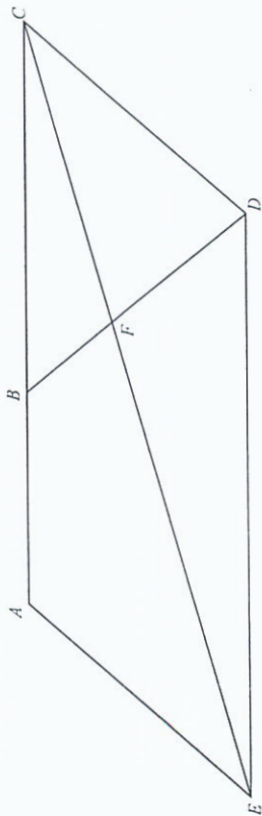
(b) An additional information on reliefs is given below.

Reliefs : personal, \$3000; wife, \$2000; children, \$2000 each; parent, \$5000 per parent.

Mr Lim has three children and he has to support his wife and mother. Calculate the amount of income tax that Mr Lim has to pay if his annual income is \$70 000. [2]

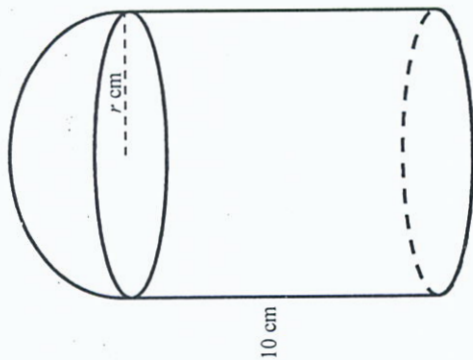
- 6 The diagram below shows a parallelogram $ACDE$.

CE is the diagonal of $ACDE$ and CE meets BD at F .



- (a) Prove that triangle BCF and triangle DEF are similar. [2]
- (b) Given that $3DE = 5BC$ and $CF = 6.3$ cm, find the length of EF . [2]
- (c) Find [1]
- (i) $\frac{\text{area of triangle } BCF}{\text{area of triangle } DEF}$, [1]
- (ii) $\frac{\text{area of triangle } BCF}{\text{area of triangle } FCD}$, [1]
- (iii) $\frac{\text{area of triangle } BCF}{\text{area of parallelogram } ACDE}$. [2]

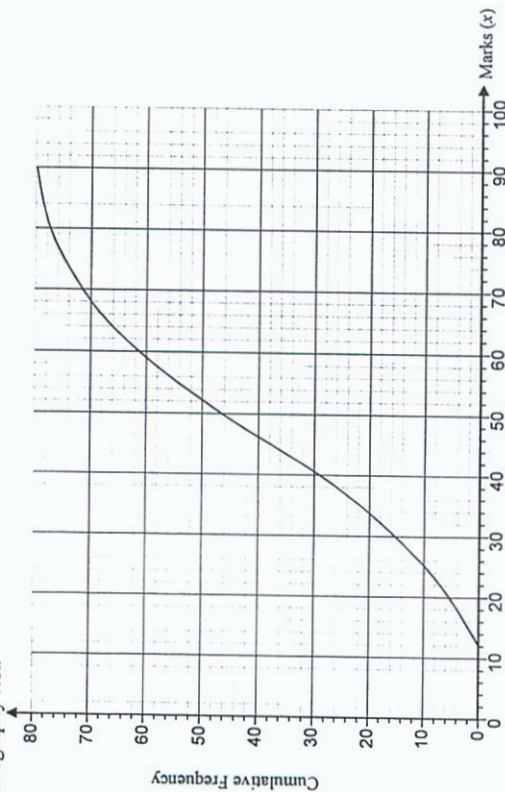
- 7 The diagram shows a solid formed by joining a cylinder with a hemisphere.



The cylinder and hemisphere have a common radius of r cm.
The height of the cylinder is 10 cm.

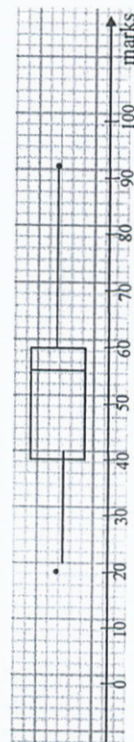
- (a) Given that the total surface area of the solid is $128\pi \text{ cm}^2$, show that $r = 4$. [3]
- (b) Calculate the volume of the solid. [3]

- 8 The cumulative frequency curve below shows the marks obtained by 80 students in a Geography test.



- (a) Use the graph to estimate
- the median mark, [1]
 - the interquartile range, [1]
 - the probability of selecting a student who failed given that the passing mark is 44, [1]
 - the percentage of students who scored a distinction given that the minimum score for a distinction is 68 marks. [2]

- (b) The same group of 80 students sat for a History test and their results are summarized in the box-and-whiskers plot below.



Write down

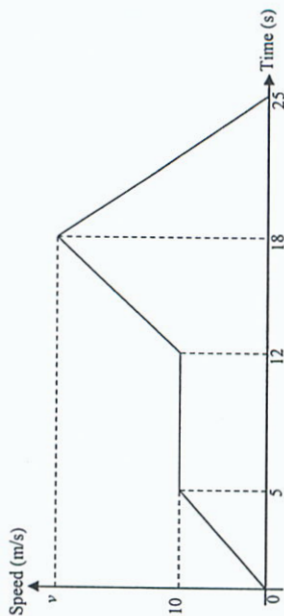
- the median mark, [1]
- the interquartile range. [1]

- (c) A student said that the class did better for the History test. Explain whether you agree with him. [1]

Section B (16 marks)

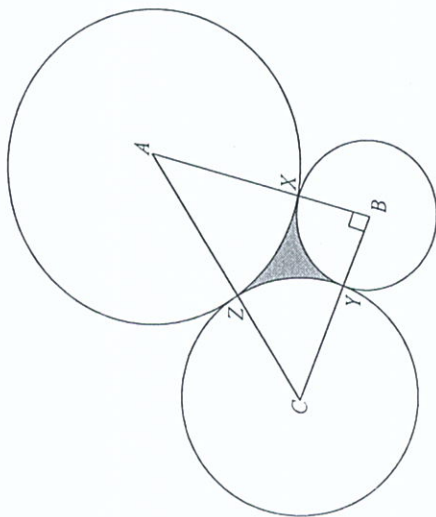
Answer any two the questions in this section. Each question carries 8 marks.

- 9 The diagram below shows the speed-time graph of an object.



- Find the acceleration of the object between 0 and 5 seconds. [1]
- Given that the average speed for the whole journey is 10.72 m/s,
 - find the total distance travelled, [1]
 - show that the value of v is 22. [3]
- Find the speed of the object at 20 seconds. [2]
- Describe the motion of the object between 5 and 12 seconds. [1]

- 10 The diagram shows 3 circles with centres at A , B and C such that circle A and circle B touch at X , circle B and circle C touch at Y and circle A and circle C touch at Z . The radius of circle A and circle B are 12 cm and 3 cm respectively.



- (a) Given that angle $ABC = 90^\circ$, show that the radius of circle C is 5 cm. [2]
 (b) Find the size of angle BAC . [2]
 (c) Find the area of the shaded region. [4]

- 11 Answer the whole of this question on a sheet of graph paper.

The table gives some values of x and the corresponding values of y where $y = 2x^2 - 5x + 2$.

x	-2	-1	0	1	2	3	4
y	20	9	2	a	0	5	14

- (a) Find the value of a . [1]
 (b) Using a scale of 2 cm to 1 unit on the x -axis and 2 cm to 5 units on the y -axis, draw the graph of $y = 2x^2 - 5x + 2$ for $-2 \leq x \leq 4$. [2]
 (c) Using your graph, find
 (i) the value of y when $x = 2.5$, [1]
 (iii) the gradient of the graph when $x = 1.5$. [2]
 (d) By adding a suitable line to the graph, solve the equation $2x^2 - 5x = 6$. [2]

- End of Paper -

[Turn Over

1(a)	$6a^2 - 3ab + 2ac - bc = 3a(2a - b) + c(2a - b)$ $= (3a + c)(2a - b)$	M1 A1	
1(b)	$\frac{3x+1}{2} - \frac{4x}{5}$ $= \frac{15x+5-8x}{10}$ $= \frac{5+7x}{10}$	M1 A1	Common Denominator
2(ai)	$x + 2$	B1 B1	
2(aii)	$2(x + 2)$ or $2x + 4$		
2(b)	$\frac{x+x+2+2x+4}{3} = 14$ $4x + 6 = 42$ $x = 9$	M1 A1	ECF
3(a)	Amount left after deposit $= \frac{60}{100} \times 1200000$ $= \$720\,000$ Amount of interest $= 720000 \times \frac{4.5}{100} \times 20$ $= \$648\,000$	M1 A1	
3(b)	Monthly installment $= \frac{720000 + 648000}{20 \times 12}$ $= \$5700$	M1 A1	
3(c)	Percentage of final cost $= \frac{1200000 + 648000}{1200000} \times 100\%$ $= 154\%$	M1 A1	
4(a)	Amount of SGD needed $= 1.49 \times 1500 = \$2235$	B1	
4(b)	Amount of SGD $= 5000 \div 2.56$ $= \$1953.125$ Amount of Euros received $= 1953.125 \div 1.49$ $= €1311$ (nearest Euro)	M1 A1	

5(a)	tax payable $= \$3350 + \frac{11.5}{100} \times 35000$ $= \$7375$	M1 A1	
5(b)	Chargable income $= 70000 - 3000 - 2000 - 6000 - 5000$ $= \$54000$ tax payable $= \$550 + \frac{7}{100} \times 14000$ $= \$1530$	M1 A1	
6(a)	$\angle BFC = \angle DFE$ (vert opp angles) $\angle BCF = \angle DEF$ (alt angles, $BC \parallel ED$) Hence triangle BCF and triangle DEF are similar.	B1 B1	
6(b)	$3DE = 5BC$ $\frac{BC}{DE} = \frac{3}{5} = \frac{CF}{EF}$ $\frac{3}{5} = \frac{6.3}{EF}$ $EF = 10.5 \text{ cm}$	M1 A1	
6(c)	$\frac{\text{Area of triangle } BCF}{\text{Area of triangle } DEF} = \left(\frac{3}{5}\right)^2 = \frac{9}{25}$	B1	
6(cii)	$\frac{\text{Area of triangle } BCF}{\text{Area of triangle } FCD} = \frac{3}{5}$	B1	
6(ciii)	$\frac{\text{Area of triangle } DEF}{\text{Area of triangle } FCD} = \frac{25}{15}$ $\frac{\text{Area of triangle } BCF}{\text{Area of parallelogram } ACDE} = \frac{9}{40}$	M1 A1	

7(a)	$128\pi = 2\pi r^2 + 2(10)\pi r + \pi r^2$ $128 = 3r^2 + 20r$ $3r^2 + 20r - 128 = 0$ $(3r + 32)(r - 4) = 0$ $r = -\frac{32}{3}$ (NA) or $r = 4$	BI M1 A1	Factorise
7(b)	Volume of solid = $\frac{2}{3}\pi(4)^3 + \pi(4)^2(10)$ $= 637 \text{ cm}^3$ (to 3 s.f)	BI, BI A1	Sub $r = 4$ for formula of vol of hemisphere Sub $r = 4$ for formula of vol of cylinder
8(ai)	Median mark = 46 marks	BI	
8(a(ii))	Interquartile range = $59 - 34 = 25$ marks	BI	
8(a(iii))	Probability of selecting a student who failed = $\frac{9}{20}$	BI	
8(iv)	Percentage of students who scored distinction = $\frac{10}{80} \times 100\%$ $= 12.5\%$	M1 A1	
8(bi)	Median mark = 56 marks	BI	
8(b(ii))	Interquartile range = $60 - 40 = 20$ marks	BI	
8(c)	Yes. The median mark for History test is higher than the median mark for Geography test.	BI	
9(a)	Acceleration = 2m/s^2	BI	
9(bi)	Total distance = $10.72 \times 25 = 268\text{m}$	BI	
9(b(ii))	Let the maximum speed be v . $268 = \left(\frac{1}{2} \times (12 + 7) \times 10\right) + \left(\frac{1}{2} \times (10 + v) \times 6\right) + \left(\frac{1}{2} \times 7 \times v\right)$ $268 = 95 + (30 + 3v) + \left(\frac{7}{2}v\right)$ $v = 22$ Maximum speed = 22 m/s (shown)	M1 M1	
9(c)	Let the speed at 20 seconds be x m/s $\frac{22}{7} = \frac{x}{5}$ $x = 15\frac{5}{7}$ Speed at 20 seconds = $15\frac{5}{7}$ m/s	A1 M1 A1	

9(d)	The object is travelling at a constant speed.	BI	
10(a)	Let the radius of circle C be x cm. $(12 + x)^2 = (x + 3)^2 + 15^2$ $144 + 24x + x^2 = x^2 + 6x + 9 + 225$ $18x = 90$ $x = 5$ (shown)	M1 A1	
10(b)	$\tan \angle BAC = \frac{8}{15}$ or $\sin \angle BAC = \frac{8}{17}$ or $\cos \angle BAC = \frac{15}{17}$ $= 28.072$ $= 28.1^\circ$ (to 1 dp)	M1	
10(c)	$\angle BCA = 61.928^\circ$ Area of sector AXZ = $\frac{28.072}{360} \times \pi \times 12^2 = 35.276 \text{ cm}^2$ Area of sector CZY = $\frac{61.928}{360} \times \pi \times 5^2 = 13.510 \text{ cm}^2$ Area of sector BXY = $\frac{1}{4} \times \pi \times 3^2 = 7.0685 \text{ cm}^2$ Area of shaded region $= \frac{1}{2} \times 8 \times 15 - 35.276 - 13.510 - 7.0685$ $= 4.15 \text{ cm}^2$ / 4.14 cm^2 (to 3 sf)	M2 M1 A1	For any 2 Area of triangle – area of sectors
11(a)	$a = -1$	BI	
10(b)	Smooth Curve Labelling axes / equation / origin	BI BI	
10(c(i))	$y = 2$ (± 0.5)	BI	
10(c(ii))	Draw tangent Gradient = 1 (± 0.3) (to 3 sf)	BI BI	
10(d)	Draw $y = 8$ $x = 3.4$ and $x = -0.9$ (± 0.1)	BI BI	