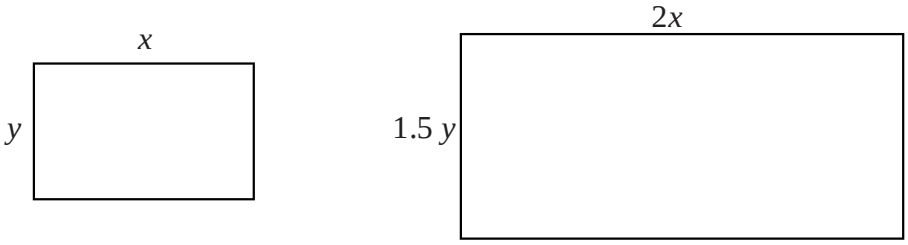
QN	Solution	Criteria	Marks	
1a	$\frac{x+8}{x} = x + 3$ $x + 8 = x^2 + 3x$ $x^2 + 2x - 8 = 0$ $(x + 4)(x - 2) = 0$ $x = -4, 2$	$x + 8 = x(x + 3)$ seen or implied attempts to factorise or solve quadratic # accept at most one mistake $x = -4, 2$	M1 M1 A1	**8**
1b	$(2x + 3)(x - 5)(x + 1) = 0$ $x = -\frac{3}{2}$, $x = 5$ or $x = -1$	$x = -\frac{3}{2}$, $x = 5$ or $x = -1$	A3	
1c	$2x^2 - 3x - 5$ $= (2x - 5)(x + 1)$	$(2x - 5)(x + 1)$ # Award 1 mark for swapped signs # Award 1 mark overall if candidate moves on to solve $(2x - 5)(x + 1) = 0$	A2	
2a	$343^{-\frac{2}{3}} = \frac{1}{\left(\sqrt[3]{343}\right)^2} = \frac{1}{7^2} = \frac{1}{49}$	Uses one of the laws of indices correctly $\frac{1}{7^2}$ or $\frac{1}{49}$	M1 B1 **FMNW**[1]	**6**
2bi	$4a^2 - 9$	Correct expansion of $(2a - 3)(2a + 3)$ # accept at most one mistake Simplifies to $4a^2 - 9$	M1 A1	
2bii	$(2\sqrt{7} - 3)(2\sqrt{7} + 3) = 4 \times \left(\sqrt{7}\right)^2 - 9$ $= 28 - 9 = 19$	Puts $a = \sqrt{7}$ or 2.65 in the result obtained in part **2(b)(i)** # No marks are awarded when $4a^2 - 9$ is not used but candidate uses calculator 19	M1 A1**ft**[2]	
3ai	$\boldsymbol{x \propto y^2}$ $x = ky^2$ $54 = k \times 3^2$ $k = 6$ When $y = 4.5$, $x = 6 \times 4.5^2 = 121.5$ **OR** $\frac{x}{y^2}$ is constant. So $\frac{54}{9} = \frac{x}{4.5^2}$ and $x = 121.5$	$x = ky^2$ $k = 6$ $x = 121.5$ # Award second method mark for candidates using $x = ky$ or $y = kx$ **OR** $\frac{x}{y^2}$ is constant $\frac{54}{9} = \frac{x}{4.5^2}$ $x = 121.5$	M1 M1 A1 M1 M1 A1	**10**

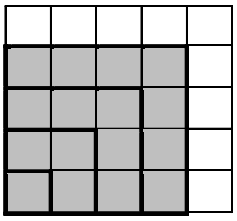
[1] FMNW stands for "full marks no working"

[2] ft stands for "follow through"

3aii	$x = 6y^2$ $y^2 = \frac{x}{6}$ $y = \pm\sqrt{\frac{x}{6}} = \pm\sqrt{\frac{486}{6}} = \pm\sqrt{81} = \pm 9$	$x = 6y^2$ or substitution in eqt of previous part $y = \sqrt{\frac{x}{6}}$ or y subject for an eqt including y^2 $y = \pm 9$, accept $y = 9$	M1 M1 A1	
3b	 Candidate may choose arbitrary values for the length and breadth of the small wall, then multiply the sides by 1.5 and 2 respectively… etc **OR** Area of small wall is xy Area of bigger wall is $3xy$ Bigger wall takes 3 times as much to paint It takes 90 mins **OR** Area of the larger wall is 3 times the area of the smaller wall (2 × 1.5) Therefore large wall takes 90 mins	Considers the area of at least one of the walls divides the area of larger wall by that of the smaller wall to compare the two areas 90 mins Compares the areas Length of larger wall $2x$ Breadth of larger wall $1.5\,y$ 90 mins Multiplies ratios 90 mins	M1 M2 A1 M1 M1 M1 A1 M3 A1	
4i	Since E is the centre of arc AB; AE = BE Since B is the centre of arc AE; AB = BE So ABE is equilateral with AE = BE = AB And ∠ABE = 60°	Shows that AE = BE **or** AB = BE Shows that **both** AE = BE and AB = BE # above marks awarded when candidate identifies centre or radius of arc ∠ABE = 60° because △ABE is equilateral	M1 M1 M1	**10**
4iia	Length of arc AB = $\frac{60}{360} \times 2\pi \times 0.82$ = 0.86m	Length of arc = $\frac{60}{360} \times 2\pi \times r$ # Substitution NOT necessary for this M1 0.86 # Accept 86cm	M1 A1	
4iib	Length of arc AE = length of arc AB Perimeter ABCDE = (0.86×2) + (1.2 ×2) + 0.82 = 4.94m	Adds up the necessary sides 4.94m # Accept 494cm	M1 A1	
4iiic	$\sin 60° = \frac{AF}{AB}$ AF = 0.82 × sin 60° = 0.71m Height = AF + BC = 0.71 + 1.2 = 1.91m	Use of trig to find AF Height = AF + BC 1.91m # Accept 191 cm # Accept rounding to any number of dp	M1 M1 A1	

5a	Least volume of barrel is 224.5 litres Largest volume of each bottle is 755 ml, i.e. 0.755l Least no of bottles…$\frac{224.5}{0.755}$ =297.4 bottles Least no of bottles to be filled completely is 297 bottles	Least volume of barrel is 224.5 litres # Accept least vol of barrel is 224.4l Largest volume of each bottle is 755 ml Uses $\frac{\text{least vol of barrel}}{\text{largest vol of bottle}}$ 297	M1 M1 M1 A1	**11**
5b	E. g. $\frac{3}{4}, \frac{4}{5}, \frac{5}{6}, \ldots$ **OR** infinite	Names one fraction Names another fraction Shows there are many fractions Candidates saying there are many fractions… they never end… infinite number, get all marks… do not penalize explanations which are not well articulated as long as it is clear that they know there are many possible fractions	M1 M1 M1 M3	
5ci	$\frac{2}{3}x + 5 < 39$ $\frac{2}{3}x < 34$ $x < 34 \times \frac{3}{2}$ $x < 51$	Separates the terms in *x* appropriately $x < 51$ # Award M1 A0 if candidate works out correctly using the equals sign rather than the inequality sign *….getting x=51*	M1 A1	
5cii	$5 - 3x \leq 38$ $-3x \leq 33$ $x \geq -11$	Separates the terms in *x* appropriately $x \geq -11$ # Award M1 A0 if candidate works out correctly using the equals sign rather than the inequality sign	M1 A1	
6i	Using Pythagoras thm for △RTN, RT = $\sqrt{3.5^2 + 10^2}$ = 10.59 m	Use of Pythagoras thm RT = $\sqrt{3.5^2 + 10^2}$ Accept 10.59, 10.6, 11	M1 M1 A1	**12**
6ii	Tan ∠TRN = $\frac{10}{3.5}$ = 2.85714 ∠TRN = $\tan^{-1}$ (2.85714) = 70.7°	∠TRN identified as the angle of elevation Tan ∠TRN = $\frac{10}{3.5}$ Accept 65.3°- 71.5° for ∠TRN # Award M1M1A1 where candidates find correctly ∠RTN instead of ∠TRN	M1 M1 A1	
6iii	Using the cosine formula in △SRT $RT^2 = 9^2 + 6^2 - 2\times9\times6\times\cos b$ $\cos b = \frac{10.59^2 - 9^2 - 6^2}{-2\times9\times6} = \frac{112.25 - 81 - 36}{-108}$ $b = \cos^{-1}(0.044) = 87.5°$ Using the sine formula in △SRT $\frac{9}{\sin \angle SRT} = \frac{10.59}{\sin b}$ $\sin \angle SRT = \frac{9 \times \sin 87.5^\circ}{10.59} = 0.849$ ∠SRT = 58.1° a = 58.1 + 70.7 = 128.8°	Use sine or cosine formula to find *b* $RT^2 = 9^2 + 6^2 - 2\times9\times6\times\cos b$ Accept 87.4°- 92.2° for *b* Uses sine or cosine formula to determine ∠SRT ∠SRT = 58.1° # Accept from 54.8 to 58.2 Adds values obtained for ∠SRT & ∠TRN	M1 M1 A1 M1 A1 M1	

<table>
<tr><td>7</td><td>$y = 2x - 2$… (i)
$2y^2 = 4x^2 + 1$… (ii)
use eqt (i) to substitute for x in eqt (ii)
$2(2x - 2)^2 = 4x^2 + 1$
$2(4x^2 - 8x + 4) = 4x^2 + 1$
$8x^2 - 16x + 8 - 4x^2 - 1 = 0$
$4x^2 - 16x + 7 = 0$
$(2x - 1)(2x - 7) = 0$
$x = ½$ or $x = 3½$
When $x = ½$, $y = -1$
When $x = 3½$, $y = 5$
OR
$x = \frac{y+2}{2}$
$2y^2 = 4\left(\frac{y+2}{2}\right)^2 + 1$
$2y^2 = y^2 + 4y + 4 + 1$
$y^2 - 4y - 5 = 0$
$(y - 5)(y + 1) = 0$
$y = 5$ or $y = -1$
When $y = 5$, $x = 3½$
When $y = -1$, $x = ½$</td><td>Substitutes for y…or x… in the quadratic
Expands quadratic, e.g.
$(2x - 2)^2 = 4x^2 - 8x + 4$
$(y + 2)^2 = y^2 + 4y + 4$
Simplification…. Up to:
$4x^2 - 16x + 7 = 0$ OR $y^2 - 4y - 5 = 0$
with at most one mistake
Factorisation of quadratic or use of quadratic formula
When $x = ½$, $y = -1$
When $x = 3½$, $y = 5$
Two correct values
Two correct values</td><td>M1
M1
M1
M1
A1
A1</td><td>6</td></tr>
<tr><td>8i</td><td></td><td>(a) median is 48
(b) interquartile range is 63 – 34 = 29</td><td>B1
B1</td><td>12</td></tr>
<tr><td>8ii</td><td><table><tr><th>t in months</th><th>CF</th></tr><tr><td>$0 < t \leq 30$</td><td>0</td></tr><tr><td>$0 < t \leq 40$</td><td>3</td></tr><tr><td>$0 < t \leq 50$</td><td>14</td></tr><tr><td>$0 < t \leq 60$</td><td>33</td></tr><tr><td>$0 < t \leq 70$</td><td>46</td></tr><tr><td>$0 < t \leq 80$</td><td>50</td></tr></table></td><td>Computes values cumulatively
All values correct</td><td>M2
A1</td><td></td></tr>
<tr><td>8iii</td><td>See last page for CF plot</td><td>One mark for every two points plotted correctly
No mark given if 8ii is completely wrong</td><td>3</td><td></td></tr>
<tr><td>8iv</td><td>Median is 55.2 months
Interquartile range is 63−49 = 14 months</td><td>54-58
13-15</td><td>B1
B1</td><td></td></tr>
<tr><td>8v</td><td>Type B is more likely to last longer, since its median is higher and its interquartile range is smaller as compared to Type A</td><td>Picks the type with the larger median
Explanation to mention at least that the median is higher</td><td>M1
M1</td><td></td></tr>
</table>

9i		Length of arc AB = $\frac{2\pi xL}{360}$ or equivalent	A1	**7**
9ii		Perimeter of base is $2\pi r$	A1	
9iii	$\frac{2\pi xL}{360} = 2\pi r$ $\frac{xL}{360} = r$ $x = 360 \times \frac{r}{L}$	length of arc AB = perimeter of base x made the subject of the equation # Another method - Equating the area of the cone (πrL) to the area of the sector. This method should also be accepted.	M1 M1	
9iv	Area of sector AOB = $\frac{x}{360}\pi L^2 = \frac{r}{L}\pi L^2 = \pi rL$	Finds area of sector AOB in terms of x Substitutes for x πrL	M1 M1 A1	
10i			B1	**8**
10ii		16 = 1 + 3 + 5 +7	B1	
10iii	**(a)** n^2 **(b)** $n + n - 1 = 2n - 1$	**(a)** n^2 **(b)** shows correct approach $2n - 1$ or equivalent # Award M1A0 for answer $2n$	B1 M1 A1 **FMNW**	
10iv	$81 = 9^2$…. $n = 9$ and $2n - 1 = 17$ 81 = 1 + 3 + 5 + 7 + 11 + 13 + 15 + 17	$n = 9$ $2n - 1 = 17$ 81 = 1 + 3 + 5 + 7 + 9 + 11 + 13 + 15 + 17	1 1 1 **FMNW**	
11i		$x = -3$ and $x = -1$ # Award zero marks if quadratic is factorized # Award B1, B0 for $y = -3$, $y = -1$	B1 B1	**10**
11ii	When $x = -2$, $y = 1$ $1 = (-2)^2 - 8 + k$ $k = 5$	Constructs equation $1 = (-2)^2 - 8 + k$ $k = 5$	M1 A1 **FMNW**	
11iii	When $x = -6$, $y = 0$ (Similarly for $x = 2$) $-6^2 + (4\times-6) + k = 36 - 24 + k = 0$ So $k = -12$ **OR** When $y = 0$, $x = -6$ or $x = 2$ $0 = x^2 + 4x + k$ $0 = (x + 6)(x - 2)$ $k = -12$ and $y = x^2 + 4x - 12$ is the appropriate equation	Substituting $x = -6$ or $x = 2$ in $x^2 + 4x + k$ $k = -12$ $0 = x^2 + 4x + k$ $0 = (x + 6)(x - 2)$ $k = -12$ Award one mark for a statement of the form, "*When* $x = -6$, $y = 0$"	M2 A1 M2 A1	
11iv	Graph meets the x-axis once if it touches	Graph passes through $(-2, 0)$	M2	

	the x-axis at $(-2\ ,\ 0)$ $0 = (-2)^2 - 8 + k$ So $k = 4$ OR $y = x^2 + 4x + k$ $0 = (x + 2)(x + 2)$ So $k = 4$	$k = 4$	A1 **FMNW**	

8iii