	Calculator Prelim Revision 2 - Answers
1	Find the decimal multiplier $100\% - 4\% = 96\% = 0.96$ Use the formula for 4 years 1045×0.96^4 Give both unrounded and rounded answer 887.6 Full marks can also be awarded for finding the decrease year by year 2020 $1045 \times 0.96 = 1003.2$ 2021 $1003.2 \times 0.96 = 963.072$ 2022 $963.072 \times 0.96 = 924.549$ 2023 $924.549 \times 0.96 = 887.6$ No marks will be given for subtracting 4% 3 times $1045 - 4 \times 41.8 = 877.8$
2	Use the formula for arc length $Arc = \frac{65}{360} \times \pi \times 30 = 17\ cm$ 1 mark is available for sector area $Area = \frac{65}{360} \times \pi \times 15^2 = 127.6\ cm^2$
3	Substitute b into the formula and set equal to 34 $34 = \frac{1}{3}b + 9$ Solve for b $25 = \frac{1}{3}b,\ b = 75$ No marks are given for substituting 34 into the formula $\frac{1}{3} \times 34 + 9 = 20.3$
4	Use the cosine rule $\cos Q = \frac{110^2 + 100^2 - 165^2}{2 \times 110 \times 100}$ Calculate the exact value $\cos Q = -\frac{41}{176} = -0.232954\ldots$ Find angle Q $Q = 103.5°$ 2 marks are available for: • $\cos R = \frac{165^2 + 100^2 - 110^2}{2 \times 165 \times 100}$, $R = 40.4°$ or $\cos P = \frac{165^2 + 110^2 - 100^2}{2 \times 165 \times 110}$, $P = 36.1°$
5	$3\boldsymbol{v} = \begin{pmatrix} 0 \\ -12 \\ 21 \end{pmatrix}$, $3\boldsymbol{v} - \boldsymbol{u} = \begin{pmatrix} 2 \\ -15 \\ 16 \end{pmatrix}$,
6	The gradient of this straight line is $m = \frac{-3-1}{-3-0} = \frac{4}{3}$. The equation of the straight line is $y = \frac{4}{3}x + 1$

7

Angle E is $180° - 34° - 82° = 64°$

Either use the Sine Rule or the Cosine Rule to find the length of side DF

Sine Rule

$$\frac{DF}{\sin 64} = \frac{46.4}{\sin 82}$$
$$DF = \frac{46.4 \times \sin 64}{\sin 82}$$
$$DF = 42.1\ m$$

Cosine Rule

$$DF^2 = 46.4^2 + 26.2^2 - 2 \times 46.4 \times 26.2 \times \cos 64$$
$$DF^2 = 1773.561929$$
$$DF = \sqrt{1773.561929}$$
$$DF = 42.1\ m$$

One complete circuit is $46.4 + 26.2 + 42.1 = 114.7\ m$
$1000 \div 114.7 = 8.7$. The footballers must complete 9 circuits

8

(a) $4x + 3y = 3874$ (b) $5x + 4y = 4899$

$4x + 3y = 3874$
$5x + 4y = 4899$

Scale $20x + 15y = 19370$
$20x + 16y = 19596$
$y = 226, \quad x = 799$

One adult costs £799, one child costs £226, so the price of the third group is
$2 \times 799 + 226 = £1824$. The travel agent has overcharged by £3

8

Evaluate the discriminant $b^2 - 4ac = (-7)^2 - 4 \times 4 \times -5 = 129$

Substitute into the quadratic formula $x = \frac{-(-7) \pm \sqrt{129}}{2 \times 8}$

Unrounded answers $x = \frac{7+\sqrt{129}}{8} = 2.294727..,\ x = \frac{7-\sqrt{129}}{8} = -0.544727\ldots$

Rounded answers $x = 2.3$ and $x = -0.5$

10

Form an equation $86\% = 9.38 \times 10^{11}$

Calculate 100% $100\% = (9.38 \times 10^{11}) \div 86 \times 100 = 1.090697974 \times 10^{12}$

Round answer Volume of the Earth is 1.1×10^{12}

Rounding mark is only available if unrounded answer is shown.

3 marks are available for using reverse percentages with an incorrect percentage, i.e.

$114\% = 9.38 \times 10^{11}, \quad 100\% = 8.2280701.. \times 10^{11} = 8.2 \times 10^{11}$

No marks will be given for finding 114% of the volume for Venus

$9.38 \times 10^{11} \times 1.14 = 1.069 \times 10^{2} = 1.1 \times 10^{12}$

11

(i) $2x + 5y = 20$ rearranges to give $y = -\frac{2}{5}x + 4$, gradient is $-\frac{2}{5}$

(ii) The x-intercept is when $y = 0$, $2x + 5y = 20 \rightarrow 2x + 0 = 20,\ x = 10,\ (10,0)$

12	(a) P is $(90°, 1)$	
	(b) Form an equation	$4\sin x - 3 = 0$
	Rearrange	$\sin x = \frac{3}{4}$
	First answer	$x = 448.6°$
	Second answer	$x = 131.4°$
13	Use Pythagoras to form an equation	$(x+8)^2 = x^2 + (x+7)^2$
	Expand brackets	$x^2 + 16x + 64 = x^2 + x^2 + 14x + 49$
	Rearrange = 0	$0 = x^2 - 2x - 15$
	Factorise and solve for x	$0 = (x-5)(x+3),\ x = 5\ and\ x = -3$
	Eliminate negative answer	$x = 5$
14	Working from smaller cup to larger cup, either find the Linear Scale or Volume Scale Factor $LSF = \frac{15}{13}\ (1.1538\ldots),\ or\quad VSF = \frac{600}{400} = 1.5$	
	Make a comparison	Using $LSF = \frac{15}{13}, VSF = \left(\frac{15}{13}\right)^3 = 1.536,\ 1.536 \neq 1.5$ Or using VSF = $\frac{600}{400}$, $LSF = \sqrt[3]{1.5} = 1.1447 \neq \frac{15}{13}\ (1.1538)$
	The two coffee cups are not mathematically similar.	