Question			Answer	Marks	Part marks and guidance	
1	(a)		200	2	**B1** for 50 or 150 soi	Eg. answer 500 or 275 with (5 × 10) + … seen
	(b)		$a = \frac{2(s-ut)}{t^2}$ oe	2	**M1** for $s - ut = ½ at^2$	
2			30 November	3	**B2** for 21 identified as LCM or answer 30 OR **M1** for listing at least four multiples of 3 **and** at least three multiples of 7 OR **M1** for listing/identifying at least four dates for running **and** at least three dates for cycling	 3, 6, 9, 12, 15, 18, 21, … 7, 14, 21, … 12, 15, 18, 21, … 16, 23, 30, …
3	(a)		5.34	4	**B1** for 1.5, 4.5, 7.5, 10.5, 13.5 **M1FT** for 1.5×6 4.5×10 7.5×6 10.5×2 13.5×1 soi 9, 45, 45, 21, 13.5 or 133.5 **M1** for *their* 133.5 ÷ 25	At least 4 midpoints correct FT midpoints or either end of range values consistently used Allow one numerical error Four correct products or 133.5 imply **B1** and **M1**
	(b)		Exact times for each customer are not recorded oe	1		Do not accept, "Because the mid-point is used" or comments on the method used.

Question			Answer	Marks	Part marks and guidance	
4	(a)		$\frac{12}{28} = \frac{3}{7}$ or $\frac{3}{7}$ of 28 = 12 or $12 \div 28 = \frac{3}{7}$	1		Alternative $12 \div 28 = 0.428571\ldots$ and $3 \div 7 = 0.428571\ldots$
	(b)		Integer from 23000 to 23334	2	**M1** for $10\,000 \div \frac{3}{7}$ oe If **M0** then **SC1** for figs 2333… seen	Accept integer from 23000 to 24000 after **M1**
	(c)		The growing conditions on the farm may be **different** to the garden oe or Sample too small oe	1		Mere reference to factors that affect growth is insufficient
5	(a)		42	2	**M1** for $\frac{1.47 \times 10^7}{3.5 \times 10^5}$ oe If 0 scored **SC1** for figs 42 in answer	Eg. $\frac{14\,700\,000}{350\,000}$
	(b)		$4.2[3\ldots] \times 10^9$	3	**B2** for 4 233 600 000 oe as answer or **M1** for *their* $1.47 \times 10^7 \times 288$ If 0 scored **SC1** for figs 423[...] in answer	Eg. $423.[36] \times 10^7$ *their* 1.47×10^7 converted from info in (a)

<table>
<tr><th colspan="3">Question</th><th>Answer</th><th>Marks</th><th colspan="2">Part marks and guidance</th></tr>
<tr><td></td><td>(c)</td><td>(i)</td><td>6450</td><td>3</td><td>B2 for 6447 to 6448
or
M1 for $\frac{1.47\times10^{7}}{(152\times15)}$ oe or figs 6447 in answer</td><td>May be in stages.
NB: 152 × 15 = 2280</td></tr>
<tr><td></td><td></td><td>(ii)</td><td>Each machine makes the same amount of sweets
or There are no breakdowns oe
or Machines running at same rate oe
or All machines run for the same time oe</td><td>1</td><td></td><td></td></tr>
<tr><td>6</td><td>(a)</td><td>(i)</td><td>$\frac{1}{5}$ of Bag A's counters [are red]
or
The ratio of red to yellow in Bag B is 1:3</td><td>1</td><td>Accept 1 : 4 = $\frac{1}{5}$

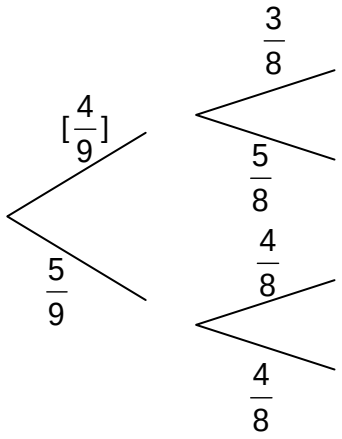
Accept $\frac{1}{4}$ = 1 : 3</td><td>Equivalents may be percentages or decimals
Eg. Bag A: 20% red, Bag B: 25% red.</td></tr>
<tr><td></td><td></td><td>(ii)</td><td>Correct answer is any integer multiple of this.
<table><tr><td></td><td>Red</td><td>Yellow</td></tr><tr><td>Bag A</td><td>4</td><td>16</td></tr><tr><td>Bag B</td><td>5</td><td>15</td></tr></table></td><td>3</td><td>B1 for (Bag A) yellow = 4 × red
and A total = B total

B1 for (Bag B) yellow = 3 × red

If 0 scored SC2 for correct figures but transposed horizontally</td><td>8 32
10 30</td></tr>
</table>

Question			Answer	Marks	Part marks and guidance	
	(b)		20 nfww	**3**	**B1** for two ratios equivalent to 3:4 **M1** for *their* 15:20 reduced to (15-3):20 <u>Alternative approach</u> **B1** for two fractions equivalent to $\frac{3}{7}$ **M1** for *their* $\frac{15}{35}$ reduced to $\frac{15-3}{32}$	6:8, 9:12, 12:16, 15:20,… *their* 15:20 any ratio **but not** 3:4 using equivalent fractions: Eg $\frac{6}{14}$ *or* $\frac{9}{21}$ *or* $\frac{12}{28}$ *or* $\frac{15}{35}$ *their* $\frac{15}{35}$ any fraction but not $\frac{3}{7}$
7			3.5	**4**	**M3** for $\frac{(629.20-520)\div 6}{520}[\times 100]$ OR **B2** for 18.2[0] seen OR **B1** for 109.2[0] seen and **M1** for *their* 109.2[0] ÷ 520 [× 100]	

Question			Answer	Marks	Part marks and guidance	
8			13.7	5	**M4** for $\frac{45}{360}\times 2\times\pi\times 6$ + $\frac{45}{360}\times 2\times\pi\times 2.5$ + 2 × 3.5 oe soi OR **M3** for $\frac{45}{360}\times 2\times\pi\times 6$ oe and $\frac{45}{360}\times 2\times\pi\times 2.5$ oe soi OR **M2** for $\frac{45}{360}\times 2\times\pi\times 6$ oe or $\frac{45}{360}\times 2\times\pi\times 2.5$ oe soi or $2\times\pi\times 6$ + $2\times\pi\times 2.5$ oe soi OR **M1** for $2\times\pi\times 6$ oe or $2\times\pi\times 2.5$ oe soi If **0** scored **SC2** for $\frac{45}{360}\times\pi\times 6^2$ oe and $\frac{45}{360}\times\pi\times 2.5^2$ oe soi by 14.1… and 2.45… or by 11.6 to 11.7 OR **SC1** for $\frac{45}{360}\times\pi\times 6^2$ oe or $\frac{45}{360}\times\pi\times 2.5^2$ oe soi by 14.1… or 2.45…	by 13.67… to 13.68 by 4.71… and 1.96… or by 6.67… to 6.68 by 4.71… or 1.96…or 53.4.. by 37.699… to 37.7 or 15.7… Method marks may be awarded for multiples of π seen in correct working. Eg. $\frac{45}{360}\times 2\times\pi\times 6=\frac{3}{2}\pi$ $\frac{45}{360}\times 2\times\pi\times 2.5=\frac{5}{8}\pi$

Question			Answer	Marks	Part marks and guidance	
9			216	4	**M1** for $5b = 180$ oe and **B1** for [b =] 36 and **M1** for *their* 36 + 180 or *their* 36 × 6 provided *their* answer would be between 180 and 270	Eg. $b + 180 = 6b$ soi by final answer
10			71 000 000 to 89 000 000 in figs or words **and** people/year	2 **and** 1	**M1** for attempt to find 'gradient' using figures from the graph e.g. (7.4 – 2.6) ÷ (2015 – 1951)	Could be in billions Eg. (7 400 000 000 – 2 600 000 000) ÷ (2015 – 1951) For **M1,** condone incorrect conversion used consistently for both population figures.
11	(a)			2	**B1** for $\frac{5}{9}$ and at least one fraction with denominator 8 for second card	

Question			Answer	Marks	Part marks and guidance	
	(b)		$\frac{5}{9}$ oe	**3**	**M2FT** for $\left(\frac{4}{9}\times\frac{5}{8}\right)+\left(\frac{5}{9}\times\frac{4}{8}\right)$ oe OR **M1FT** for $\left(\frac{4}{9}\times\frac{5}{8}\right)$ or $\left(\frac{5}{9}\times\frac{4}{8}\right)$ oe soi by $\frac{20}{72}$ oe	**FT** *their* probabilities from **(a)**
12	**(a)**		5	**1**		
	(b)		(k =) 5 (r =) 1 nfww	**5**	**B1** for 206 = 41*k* + *r* and **B1** for 1031 = 206*k* + *r* and **M1** for 165*k* = 825 and **A1** for *k* = 5 or *r* = 1 If no or partial method shown, allow full marks for final answer correct	If **0** scored, allow **SC2** for final correct answers interchanged Condone attempt to reduce to one variable by sub. or elim. With max of one error
13	**(a)**		1.4355 or 1.436 or 1.44	**2**	**M1** for 16.5 × 87 possibly soi by figs 14355, 1436 or 144	

Question			Answer	Marks	Part marks and guidance	
	(b)		Yes (Trevor is correct) because Eg $220 \div 87^3 \times 100^3 = 334.[\ldots]$ or $334 \times 87^3 \div 100^3 = 219.9\ldots$ to 220	**3**	**M2** for $220 \div 87^3 \times 100^3$ or $334 \times 87^3 \div 100^3$ OR **B1** for 87^3 or 658503 or 100^3 or 1000000 soi	
14	**(a)**		$(34 \times 36) - (25 \times 45) = 99$	**2**	**M1** for either 34×36 or 25×45 soi by 1224 or 1125	

Question			Answer	Marks	Part marks and guidance	
	(b)		Eg. If $M = n$ $L = (n – 1)(n + 1) = n^2 – 1$ $T = (n – 10)(n + 10) = n^2 – 100$ $L – T = (n^2 – 1) – (n^2 – 100) = 99$	**5**	**B2** for defining relative positions algebraically Eg. $n – 1$, $n + 1$, $n – 10$, $n + 10$ or **B1** for at least two relative positions defined algebraically AND **M2** for [L =] $(n – 1)(n + 1) = n^2 – 1$ **and** [T =] $(n – 10)(n + 10) = n^2 – 100$ or **M1** for [L =] $(n – 1)(n + 1) = n^2 – 1$ **or** [T =] $(n – 10)(n + 10) = n^2 – 100$ **or** $L – T$ = (*their* $(n – 1)(n + 1)$ – (*their* $(n – 10)(n + 10)$) If **0** scored, allow **SC1** for one further numerical example	Or equivalent algebraic representation of relative positions. Condone poor notation for B marks eg **B2** for n – 1 × n + 1 – n – 10 × n + 10 For **M** marks, follow through allowed for working with *their* relative positions described algebraically as linear expressions: ie. • L = Multiplication of their left and right expressions • T = Multiplication of their top and bottom expressions **M1** could be awarded by expressing *their* L – *their* T, even if incorrectly expanded **M2** may be embedded
15			85π or 267[.0…]	**3**	**M2** for $\pi \times 5 \times 12 + \pi \times 5^2$ oe OR **B1** for 60π or 25π or 188[.4…] or 188.5 or 78[.5…] or $\pi \times 5^2$	

Question			Answer	Marks	Part marks and guidance	
16	(a)	(i)	**b – a**	1		
		(ii)	$\frac{1}{4}(\mathbf{b}-\mathbf{a})$ or $\frac{1}{4}\mathbf{b}-\frac{1}{4}\mathbf{a}$	1	**FT** from **(a)(i)**	
	(b)		$\overrightarrow{EF}=\overrightarrow{EB}+\overrightarrow{BF}$ = $\frac{1}{4}(\mathbf{b}-\mathbf{a})$ + $\frac{1}{2}\mathbf{b}$ leading to $\frac{1}{4}(3\mathbf{b}-\mathbf{a})$ as given.	2	**M1** for *their* part **(a)(ii)** + $\frac{1}{2}\mathbf{b}$ oe	**(a)(ii)** must be in terms of **a** and **b**
	(c)		$\overrightarrow{AG}=\frac{3}{2}\mathbf{b}-\frac{1}{2}\mathbf{a}$ $\overrightarrow{AG}=2\overrightarrow{EF}$ oe so are parallel.	3	**B2** for $\overrightarrow{AG}=\frac{3}{2}\mathbf{b}-\frac{1}{2}\mathbf{a}$ or **M1** for **b** + $\frac{1}{2}$ (*their* part **(a)(i)**) oe	Allow vectors found in reverse throughout eg. $\overrightarrow{GA}$ instead of $\overrightarrow{AG}$ Condone "AG and EF are multiples of each other" Full marks dependent on both AG and EF in correct simplified forms
17	(a)		$x^2 + y^2 = 100$ oe	1		
	(b)		$8^2 + (-6)^2 = 100$, so it's on the circle oe	2	**M1** for $8^2 + ([-]6)^2$ seen or for substituting $x = 8$ and $y = -6$ into *their* part **(a)**	Alternative using Pythagoras $\sqrt{8^2+6^2}=10$ *their* part **(a)** must be an equation in both x and y.

Question			Answer	Marks	Part marks and guidance	
	(c)		$3y - 4x + 50 = 0$ oe	**5**	**B2** for [tangent gradient =] $\frac{4}{3}$ oe or **M1** for $\pm\frac{6}{8}$ or $\pm\frac{8}{6}$ oe AND **M2** for $y + 6 = their\ \frac{4}{3}(x - 8)$ oe or **M1** for $y = their\ \frac{4}{3}x$ + 'c'	Equivalents include: $y = \frac{4}{3}x - \frac{50}{3}$ Condone decimals with at least 2 decimal places rot: Eg. $y = 1.33x - 16.67$ Equivalent for **M2** includes $y = their\ \frac{4}{3}x$ + c and then attempt to find *c* by substituting in $y = -6$ and $x = 8$
18	**(a)**		$y \leq 2$ $y \geq -2x + 18$ oe	**1** **and** **3**	**B1** for ['gradient'=] -2 soi and **M1** for suitable method to find equation of line eg. $y - 8 = (their - 2) \times (x - 5)$ or $y - 2 = (their - 2) \times (x - 8)$	If **both** inequalities are wrong way round, condone once (max penalty 1 mark) Or **M1** for $y = their\ -2x + c$ with a point from the line substituted in to find *c* For **M1** allow use of an inequality symbol in place of =
	(b)		*y* = 6 shown as a solid line and correct region shaded	**2**	**B1** for line drawn at *y* = 6 OR **B1** for correct squares shaded but no line	Accept dashed line for **B1**

Question			Answer	Marks	Part marks and guidance	
	(c)		$\frac{8}{5}$ oe	5	**M1** for $\frac{1}{2}\times 4\times(8+6)$ soi by 28 **M1** for $\frac{1}{2}\times 4h = \textit{their}\ 28-23$ oe **A1** for [*h* =] 2.5 AND **M1** for [*k* =] 4 ÷ *their* 2.5 oe Alternative method **M1** for $\frac{1}{2}\times 4\times(8+'t')$ **M1** for *their* $\frac{1}{2}\times 4\times(8+'t')$ = 23 oe **A1** for [*t* =] 3.5 AND **M1** for [*k* =] 4 ÷ (6 – *their* 3.5) oe	'*h*' is 'top of triangle' '*t*' is 'top of trapezium' Must be a trapezium