Higher tier Paper 2 – Calculator

Question	Working	Answer	Mark	AO	Notes
1	$7 + 28 + 22 = 57$	11, 44 and 38	P P A	3.1b 3.1b 1.3b	P1 for a correct process to develop algebraic expressions for each number and set up an inequality, e.g. $x + 4x + 4x - 6 > 57$ or for a correct trial with a prime number P1 for a correct process to solve the inequality, e.g. $x > (57 + 6) \div 9$ (= 7) or for a correct trial with the prime number as 7 resulting in a sum of 57 A1 cao
2	$3x - 3c = 2x + 5$ $x = 3c + 5$	Shown	P P C	2.2 2.2 2.4a	P1 for a process to start a chain of reasoning P1 for a process to isolate terms in x C1 convincing explanation from $x = 3c + 5$
3 (a)		720	P P A	3.1c 3.3 1.3b	P1 attempt to find the maximum biscuits for one of the ingredients, e.g. $5000 \div 150$ (= 33.3…) or $2500 \div 75$ (= 33.3…) or $3000 \div 100$ (= 30) or $320 \div 10$ (= 32) P1 for identifying butter as the limiting factor or 30×24 (= 720) seen A1 for 720 cao

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3 (b)		116.25%	M	1.3b	M1 for a correct method of finding either 70% (= 504) or 30% (= 216) of 720
			P	3.1b	P1 for a process to find the cost of "216" at 55p for 4 (= £29.70)
			P	3.1b	P1 for a process to find revenue, e.g. "504" × £0.25 + "£29.70" (= £155.70)
			P	3.1b	P1 for a process to find profit, e.g. "£155.70" – £45 – £27 (= £83.70)
			M	1.3b	M1 for $\frac{'83.70'}{72} \times 100$
			A	1.3b	A1 for 116.25%
4		Demonstration	M	1.1	M1 for using a radius and a half of the radius in the substitution into $A = \pi r^2$ (or choosing 10 and 5 for the respective radii oe)
			P	2.4a	P1 for a process to find the area of a quadrant, e.g. $\frac{1}{4} \times \pi x^2$ and $4 \times \frac{1}{4} \times \pi \left(\frac{x}{2}\right)^2$ (x may be numerical)
			C	2.4a	C1 for concluding the argument by showing that both areas equate to $\frac{\pi x^2}{4}$ (x may be numerical in which case both areas must be shown to be the same multiple of π)

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5 (a)(i)		Correct drawing	M A	1.3a 1.3a	M1 for a correct bearing drawn or for a correct distance drawn or quoted A1 for a correct position of *B*
(a)(ii)		230°	B	1.1	B1 for 230° cao
5 (b)		Correct statement with evidence	P M P C	2.3a 1.3b 2.2 2.1a	P1 for drawing a correct right-angle triangle showing line East from *A* and perpendicular from *B* (can be implied by correct trigonometric ratio) M1 for $\cos 50° = \frac{d}{36}$ oe P1 for $36 \times \cos 50°$ oe C1 for deduction 23.14 km plus a statement saying that the ship is always more than 23 km from the lighthouse
6 (a)		No + written evidence	P C	2.2 2.4a	P1 for a start to the process that leads to a decision, e.g. $n = \frac{93 - 2}{3}$ oe C1 for a convincing argument for 'No' (e.g. because *n* is not a whole number)
6 (b)	$3n + 2 + 3n + 2 + 3$	$6n + 7$	M A	1.3a 1.3a	M1 for $3n + 2 + 3n + 2 + 3$ oe A1 cao
6 (c)	$3n + 2 + 3n + 2 + 3 = 91$ $n = 14$ $3 \times 14 + 2$	44	P A	3.1a 1.3a	P1 for a process that translates the problem into a suitable form that would lead to a solution, e.g. '$6n + 7$' = 91 Or $t + t + 3 = 91$ or $(91 - 3) \div 2$ A1 cao

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7 (i)	$\frac{72}{100}\times 80$	60	P	3.1c	P1 for a correct process to find the number of students with a score of at least 72% e.g. $\frac{72}{100}\times 80$
			P	3.2	P1 for process to use graph to find number who exceeded 57.6
			A	1.3a	A1 56 - 64
(ii)		Assumption and how it affects answer	C	3.5	C1 for assumption stated and how it affects answer to (i), e.g. the marks are so distributed within the interval such that numbers can be found by reading directly from graph (need both the assumption and how it affects the answer to gain the mark)
8 (a)		Shown	M	1.3a	M1 for $x(x^2 - 1)$ or $(x^2 + x)(x - 1)$ oe
			A	1.3a	A1 cao
8 (b)		Shown	P	2.4b	P1 for explanation to show that $n^3 - n$ is the product of three consecutive positive integers, e.g. $n^3 - n = (n-1)n(n+1)$
			C	2.4b	C1 for a correct conclusion to the proof, e.g. at least one of these is even and one is a multiple of 3 so the product is a multiple of 6
8 (c)	$2^{61}-1$ is prime so not a multiple of 3 2^{61} is not a multiple of 3 Hence $2^{61}+1$ must be a multiple of 3	Shown	P	2.4a	P1 for recognising that $2^{61}-1, 2^{61}$ and $2^{61}+1$ are three consecutive positive integers
			C	2.4a	C1 for a convincing argument
9 (a)	Width of surface = $d + d + 3$ Area of cross-section = $\frac{d}{2}(d+d+3+3)$	$A = d(d+3)$	P	3.1b	P1 for correct process to find width of surface
			P	3.1b	P1 for correct process to find cross-sectional area, e.g. $\frac{d}{2}(d+d+3+3)$
			A	1.3b	A1 for $A = d(d+3)$ or $A = d^2 + 3d$

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9 (b)	$A = 1.5(1.5 + 3)$	6.75 m^2	M A	1.3a 1.3a	M1 for substitution of 1.5 in formula or a complete method starting again A1 for 6.75
9 (c)	486000 ÷ 60 = 8100 8100 L = 8.1 m^3 8.1 ÷ 6.75	1.2 m/s	P P P A	3.1d 3.1d 3.1d 1.3b	P1 for a correct process to convert rate to per second, e.g. 486 000 ÷ 60 (=8100) P1 for process to convert to m^3, e.g." 8100" ÷ 1000 P1 for process to convert litres/min to m/s, e.g. "8.1" ÷ ".75" A1 cao
10		Proof	P C C	2.4b 2.4b 2.4b	P1 for recognising that angle *O* is common P1 for angle *OTP* = angle *TSO* with 'alternate segment theorem' C1 for completion of proof, e.g. third angles are equal, so triangles are equiangular
11 (a)	Venn diagram	Correct diagram (See diagram at end)	P P C	2.3a 2.3a 2.3b	P1 to begin to interpret given information, e.g. 3 overlapping labelled ovals with central region correct P1 to extend interpretation of given information, e.g. 3 overlapping labelled ovals with at least 5 regions correct C1 for correct process to communicate given information, e.g. 3 overlapping labelled ovals with all regions correct, including outside
11 (b)		$\frac{23}{80}$	B	1.3a	B1 ft diagram

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11 (c)		$\frac{19}{40}$	M A	1.3a 1.3a	M1 for probability with denominator 40 A1 $\frac{19}{40}$ oe
12 (a)	$10 \times 10 \times 10 \times 10$	10000	M A	1.3a 1.3a	M1 $10 \times 10 \times 10 \times 10$ A1 cao
12 (b)	$5 \times 4 \times 5 \times 4$	400	M A	1.3a 1.3a	M1 $5 \times 4 \times 5 \times 4$ A1 cao
13	$2x - 4 = x^2 - 4x + 4$ $x^2 - 6x + 8 = 0$ $(x-4)(x-2) = 0$ $x = 4, \quad x = 2$ When $x = 4$, $y = 4$ When $x = 2$, $y = 0$ $4 - 2 = 2$ $4 - 0 = 4$ $2^2 + 4^2$	√20	P P P A P A	3.1b 3.1b 3.1b 1.3b 3.1a 1.3a	P1 for a process to eliminate y, e.g. $2x - 4 = x^2 - 4x + 4$ followed by reduction to 3 term quadratic P1 for factorisation or formula for a 3 term quadratic = 0 P1 for a process to find the values of y A1 all 4 values ($x = 4$ $y = 4$, and $x = 2$, $y = 0$) P1 for a correct process to find the distance^2 or distance between the 2 points, e.g. $('4' - '2')^2 + ('4' - '0')^2$ A1 √20
14 (a)	$(\sum fx =)$ 24×25 + 42×50 + 64×70 + 44×85 + 54×100 = 16 320 $(\sum f =)$ 24+42+64+44+54 =228 Mean = 16 320÷228 = 71.6	Conclusion + support	P P M A C	2.3a 3.1b 1.3b 1.3b 2.1b	P1 for process to interpret histogram to find frequencies, e.g. (40 − 10) × 0.8 P1 for process to use frequencies and midpoints M1 for $(\sum fx) \div (\sum f)$ A1 for a value 71 – 72 C1 (dependent on P1) for an inference based on

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					the calculated value of the mean, e.g. the evidence supports the hypothesis as the mean in 2013 is lower
14 (b)		No + reason	C	2.5b	C1 No, because the histogram does not show individual values
15	$\frac{1000 \times 13..915}{8.25^2 \times 83.5} = 2.448$ $\frac{1000 \times 13..905}{8.35^2 \times 84.5} = 2.360$	2.4 g /cm^3	B P P P A	1.1 3.1c 3.1c 2.4a 1.3a	B1 for $83.5 \leq h < 84.5$ or $8.25 \leq d < 8.35$ (or correct bounds) or $13.905 \leq M < 13.915$ (or correct bounds). Accept $h = 84.5$ or $d = 8.35$ or $M = 13.915$ P1 for correct process to find upper bound of D (= 2.4(48... or 0.0024(48...)) oe P1 for correct process to find lower bound of D (= 2.3 (60... or 0.0023(6...)) oe P1 for an explanation or a correct process to find D to an appropriate degree of accuracy A1 2.4 g /cm^3

Question 11(a)