Higher tier Paper 1 – Non-calculator

Question	Working	Answer	Mark	AO	Notes
1	80 ÷ (7 – 2) (=16) '16' × 3	£48	P P A	3.1d 3.1d 1.3b	P1 for a strategy to start to solve problem, e.g. 80 ÷ (7 – 2) (=16) P1 for full process to solve problem, e.g. '16' × 3 A1 cao
2 (a)		84 to 85	P P P A	2.3a 2.3b 3.1d 1.3b	P1 for interpreting the data and deciding to draw a graph or a table to represent the data P1 for a correct process to label axes or communicate the data connections P1 drawing in an appropriate line of best fit or model the problem as a linear function in time A1 for correctly reading off the value at 2030 in the range 84 to 85 or using their linear function correctly to give an answer in this range
(b)			C C	3.4b 3.4b	C1 for a valid comment eg cannot assume a linear relationship C1 for a valid comment eg that one cannot predict accurately with a date so far away from the original data
3 (i) (ii)		$2^3 \times 3 \times 5$ $2^4 \times 3^3 \times 5^2$	B B	1.3a 1.3a	B1 cao B1 cao
4		locus (see diagram at end)	C C	2.3b 2.3b	C1 for method of showing a rotation about one fixed point, e.g. quarter circle with radius *PC* centre *C* or radius *PB* centre B or *PA* centre A C1 for understanding it is a continuous process, e.g.

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			C	2.3b	quarter circle with radius *PC* centre *C* and radius *PB* centre B and radius *PA* centre A C1 for fully correct drawing
5 (a)	$3x + 5y = 4$ $10x - 5y = 35$ $13x = 39$	$x = 3, y = -1$	M M A	1.3b 1.3b 1.3b	M1 for correct method to eliminate one variable M1 for correct method to find second variable A1 for $x = 3$ and $y = -1$
5 (b)	$x + 5 > 8$ $x > 3$ $2x - 3 < 7$ $2x < 10$ $x < 5$	$x = 4$	B B B	1.3b 1.3b 1.3b	B1 for $x > 3$ or for $x < 5$ B1 for $x > 3$ **and** for $x < 5$ B1 for $x = 4$ from $x > 3$ and $x < 5$
6 (a) (i)	$4 \times 3 \times 2000^2$	48 000 000 km^2	M	1.3a	M1 for use of $4\pi r^2$ with either π or r rounded to 1 significant figure
(ii)			A C	1.3a 3.4a	A1 accept 50 000 000 km^2 C1 for appropriate evaluation of method, e.g. 3 and 2000 both less than true values
6 (b)	$9.75 \times 10^7 \times 1000 \div (3 \times 10^8)$	325 s	M M A	1.3b 1.3b 1.3b	M1 for use of distance ÷ time M1 for consistent units A1 cao
7	Shaded area in B $= 1 - \frac{2}{5} - \frac{1}{8}$ **or** $\frac{3}{5} - \frac{1}{8}$	$\frac{19}{40}$	P P A	3.1b 3.1b 1.3b	P1 for strategy to start to solve problem, e.g. $1 - \frac{3}{5}$ **or** $1 - \frac{7}{8}$ **or** correct equation, e.g. $x + \frac{1}{8} = \frac{3}{5}$ P1 for setting up a calculation that will lead to the correct answer, e.g. $1 - \frac{2}{5} - \frac{1}{8}$ **or** $\frac{3}{5} - \frac{1}{8}$ **or** $\frac{7}{8} - \frac{2}{5}$ A1 cao

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8	$\frac{4.5}{15}\times\frac{5}{8}=\frac{22.5}{120}$ $\frac{22.5}{120}\times 100$	18.75 (%)	P P A	3.1d 3.1d 1.3b	P1 for process to find amount of amount of land for wheat, e.g. $\frac{4.5}{15}\times\frac{5}{8}$ P1 for complete process, e.g. $\frac{22.5}{120}\times 100$ A1 18.75 oe
9		84°	P P P A	3.1b 3.1b 3.1b 1.3b	P1 for process to find size of interior angle of hexagon or pentagon P1 for establishing a correct process to find angle *JAF*, e.g. *JAF* = (180 − 108) ÷ 2 P1 for a complete process to find angle *BAJ* A1 cao

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10	Method 1 2200 − 1700 = 500 30000 − 0000 = 10000 For every £100 increase in wage the increase in sales = £2000 1850 − 1700 = 150 Difference in sales = 1.5×2000 = 3000 20000 + 3000 Method 2 Use $y = mx + c$ $1700 = 20000m + c$ $2200 = 30000m + c$ $m = \frac{2200 - 1700}{30000 - 20000}$ = 0.05 $c = 2200 - 30000 \times 0.05 = 700$ When $y = 1850$, $x = \frac{1850 - 700}{0.05}$ Method 3 Draw a graph	23000	P P P A	2.3a 3.1d 3.1d 1.3b	P1 for process to interpret information, e.g. 2200 – 1700 = 500 oe or use $y = mx + c$ or start to draw graph P1 for process to build on initial strategy, e.g. 2200 − 1700 = 500 and 30000 − 20000 = 10000 oe use proportional increase or process to find m and c P1 for strategy to use found information, e.g. 1000 ÷ 5 or use values of m and c or use straight line graph A1 cao

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11 (a)		B	B	1.1	B1 cao
11 (b)(i)		$\frac{1}{4}$ of original force	P	3.1c	P1 for $F = \frac{k}{d^2}$ and $F = \frac{k}{(2d)^2}$ (d may be numerical) or 'Force gets smaller'
			P	3.3	P1 for full interpretation of results rather than a specific distance, e.g. $\frac{1}{4}$ of original force
(b)(ii)	$40 = \frac{k}{3^2}$ $(k = 360)$	3.6 N	M	1.3b	M1 for $40 = \frac{k}{3^2}$
	$360 \div 10^2$		M	1.3b	M1 for complete method, e.g. $360 \div 10^2$
			A	1.3b	A1 cao
12 (a)	$g(1 - 5\times1) = 1 + 5\times(-4)$ or $1 + 5f(1) = 1 + 5\times(-4)$	Shown with working	P P	2.2 2.2	P1 for process to begin expansion, e.g. $(1 - 5\times1)$ or $1 + 5f(1)$ P1 for full process to stated expression
12 (b)	$f^{-1}(x) = \frac{1-x}{5}$	Proof	P	2.4b	P1 for start to proof, e.g $f^{-1}(x) = \frac{1-x}{5}$ or $g^{-1}(x) = \frac{x-1}{5}$
	$f^{-1}(x) + g^{-1}(x) = \frac{1-x}{5} + \frac{x-1}{5}$ $= \frac{1-x+x-1}{5} = 0$		P	2.4b	P1 For continuation of proof, e.g. $g\,f^{-1}(x) = \frac{1-x}{5}$ and $g^{-1}(x) = \frac{x-1}{5}$
			P	2.4b	P1 for a complete proof with all steps shown

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13	$0.5(u + 2u)\times12 + 2u \times 10$	Show	P P P P	2.3a 2.2 2.2 2.2	P1 for process to interpret information, e.g. draw graph P1 for process to identify a strategy, e.g. statement that distance is area under graph or one correct area P1 for process to find complete area, e.g. $0.5(u + 2u) \times 12 + 2u \times 10$ P1 for all steps given leading to result $38u$
14 (a)	$\frac{4}{6}\times\frac{4}{6}$	$\frac{16}{36}$	P A	3.1c 1.3a	P1 for process to calculate probability of RR, e.g. $\frac{4}{6}\times\frac{4}{6}$ or sample space with all elements correctly identified A1 oe
14 (b)	$3\times\frac{2}{6}\times\frac{2}{6}\times\frac{4}{6}$	$\frac{48}{216}$	P P A	3.1d 3.1d 1.3b	P1 for process to calculate probability of RRL in any one order, e.g $\frac{2}{6}\times\frac{2}{6}\times\frac{4}{6}$ P1 for process to calculate correct probability, e.g. $3\times\frac{2}{6}\times\frac{2}{6}\times\frac{4}{6}$ A1 oe
14 (c)		Yes + reason	C	2.4a	C1 Yes because an even number of +1s and –1s cannot give the answers +3 or –3

Question	Working	Answer	Mark	AO	Notes
15	$\angle DOC = 46^o$ $\angle OCD = (180^o - 46^o)/2$ $\angle ADC = 100^o$ $\angle DCA = 57^o$ $\angle OCA = 67^o - 57^o$	10^o	P P P P C C	2.2 2.2 2.2 2.2 1.1 1.1	P1 $\angle DOC = 2 \times 23^o$ (angle at centre is twice angle at circumference) P1 $\angle OCD = (180^o - '46'^o)/2$ (base angles of isosceles triangle OCD) and $\angle ABC = 180^o - 100^o$ (angles on a straight line sum to 180^o) P1 $\angle ADC = 100^o$ (opposite angles of a cyclic quadrilateral sum to 180^o) P1 $\angle DCA = 180^o - '100'^o - 23^o$ (angle sum of a triangle is 180^o) C1 for complete chain of reasoning to find angle OCA seen with 10^o and at least 1 circle theorem quoted C1 dependent on all previous marks for full reasons at each stage

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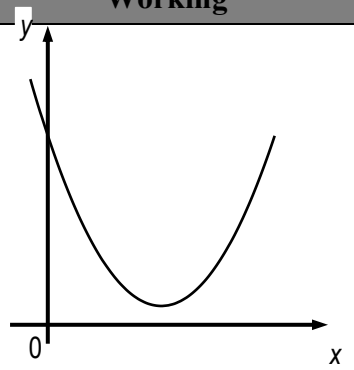
16 (i)			M	1.3b	M1 for $(x – 2.5)^2 – (2.5)^2 + 10$ **or** attempt to find points to plot – must have at least 3 correct points evaluated
			A	1.3b	A1 for $(x – 2.5)^2 + 3.75$ or parabola with minimum marked at (2.5, 3.75)
			C	2.3b	C1 for parabola drawn with minimum in 1st quadrant **or** y intercept at (0, 10)
			C	2.3b	C1 for parabola drawn with minimum in 1st quadrant at (2.5, 3.75) **and** y intercept at (0, 10)
(ii)		Explanation	C	2.4a	C1 for a start to explanation, e.g. f$(x + 2) – 3$ is a translation of $\begin{pmatrix} -2 \\ -3 \end{pmatrix}$ or attempt to draw graph of f(x + 2) – 3 or Graph of $y = f(x + 2)$ and $y = 3$ drawn or $(x + 2)^2 – 5(x + 2) + 10 – 3 = 0$ $(x^2 – x + 1 = 0)$
			C	2.4a	C1 for a convincing explanation, e.g. new minimum at (0.5, 0.75) so graph will not cross x axis **or** no interception between y = f$(x + 2)$ and $y = 3$ or demonstration that $x^2 – x + 1 = 0$ has no real roots

Question	Working	Answer	Mark	AO	Notes
17	$(2x-1)^2 = (x+1)^2 + (x-1)^2 - 2(x+1)(x-1)\cos 120^o$ $4x^2 - 4x + 1 = x^2 + 2x + 1 + x^2 - 2x + 1 - 2(x^2-1) \times (-0.5)$ $x^2 - 4x = 0$ $x = 4$ Area $= 0.5 \times 3 \times 5 \times \sin 120°$	$\frac{15}{4}$	B P P M P P A	1.1 3.2 3.2 1.3b 3.2 3.2 1.3b	B1 for correct statement of cosine rule or $\frac{1}{2}ab\sin C$ or value of cos 120° or value of sin120° P1 for strategy to start to solve problem, e.g. $(2x-1)^2 = (x+1)^2 + (x-1)^2 - 2(x+1)(x-1)\cos 120^o$ P1 for strategy to reduce to a quadratic equation, e.g. $x^2 - 4x = 0$ M1 for method to solve quadratic equation P1 for attempt to use $0.5ab\sin C$ with numeric or algebraic values substituted P1 for process to equate to $k\sqrt{3}$ A1 for $k = \frac{15}{4}$ oe

Question 4