International GCSE Maths A January 2020 – Paper 2HR Mark scheme

Apart from Questions 1b, 7, 16c, 19a, 21b, 24 and 25 where the mark scheme states otherwise, the correct answer, unless clearly obtained by an incorrect method, should be taken to imply a correct method.

Question		Working	Answer	Mark	Notes	
1	(a)		5^{19}	1	B1	
	(b)			2	M1	A factor tree / division ladder of 3 or more factors ($\neq 1$), multiplying to 800, which must include 2 and 5. Condone 1 error when product $\neq 800$
			2×2×2×2×2×5×5		A1	dep on M1 oe eg $2^5 \times 5^2$
						Total 3 marks

2		$10 \times 5 + 30 \times 11 + 50 \times 8 + 70 \times 19 + 90 \times 9$ $(50 + 330 + 400 + 1330 + 810)$		3	M2	Correct products using midpoints (allowing one error) with intention to add. M1 for products using frequency and a consistent value within the range (allowing one error) with intention to add. or correct products using midpoints without addition (allow 1 error)
			2920		A1	N.B. 2920 ÷ 52 (=56.2..) scores M2A0
						Total 3 marks

3		$4x$ or $x - 7$		4	M1	Correct expression for *B* or *C*
		$x + 4x + x - 7 = 137$ oe			M1	Correct equation
		$x = 144 \div 6$ (=24) or $6x = 144$ or $6x - 144 = 0$			M1	Gathering up the *x*'s and numbers Dep on previous M1
			17		A1	
						Total 4 marks

Question	Working	Answer	Mark	Notes
4	$8.5^2 + 5.6^2 (= 103.61)$		3	M1
	$\sqrt{8.5^2 + 5.6^2}$			M1
		10.2		A1 Accept 10.1 to 10.2 or better
				Total 3 marks

Question	Working	Answer	Mark	Notes
5	3 hours 36 mins = 216 (mins) or 3.6 (hours) or $3\frac{36}{60}$ oe (hours)		3	M1
	$2470 \div 3.6$ or $2470 \div 3\frac{36}{60}$ or $2470 \div 216 \times 60$			M1 Allow $2470 \div 3.36$ (=735 or better)
		686		A1 Accept 686.1 or better
				Total 3 marks

Question	Working	Answer	Mark	Notes
6		Fully correct perpendicular bisector with all relevant arcs shown.	2	B2 Fully correct bisector with all arcs. Correct arcs can be on the same side of *AB*. B1 for all correct arcs and no bisector drawn or for a correct bisector within guidelines but no arcs. NB: On tramlines = within tramlines.
				Total 2 marks

Question	Working	Answer	Mark	Notes
7	(adding) $10x = -5$ or $21x + 35y = 42$ $21x - 15y = -33$ then $50y = 75$		3	M1 Correct method to eliminate *x* or *y* Or making coefficients of *x* or *y* the same **and** correct operator has been applied to eliminate *x* or *y* (2 out of 3 terms correct implies a correct operator) or correct algebraic substitution for *x* or *y* into other equation
		$x = -0.5$ oe $y = 1.5$ oe		A1 Both A marks dep on M1 A1
				Total 3 marks

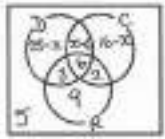| Question	Working	Answer	Mark		Notes
8	$20\,000 \times 0.81^3$ oe			M2	M1 for $20\,000 \times 0.81$ oe (= 16 200) or $20\,000 \times 1.19$ oe (= 23 800) or $20\,000 \times 1.19^3$ oe (= 33 703.18)
		10 629		A1	Accept $10\,628 \rightarrow 10\,629$
					Total 3 marks
9	$30 = \dfrac{27}{1.2\,x}$		3	M1	Or for $\dfrac{27}{30}$ (= 0.9)
	$1.2x = \dfrac{27}{30}$ or $36x = 27$ or $22.5 \div 30$			M1	
		0.75 oe		A1	
					Total 3 marks
10 (a)		3.74×10^7	2	B2	B1 for 37 400 000 (oe but not in standard form) or 3.74×10^n ($n \neq 7$) or 3.7×10^7 or 3.8×10^7
(b)		11	1	B1	Allow $11 \rightarrow 11.1$
					Total 3 marks
11 (a)		$-1, 0, 1, 2, 3, 4$	2	B2	B1 for $-2, -1, 0, 1, 2, 3, 4$ or $-1, 0, 1, 2, 3$
(b)		$y \leq 6$ oe $x + y \geq 5$ oe $y \geq x - 3$ oe	2		B2 for 3 correct inequalities B1 for 2 correct inequalities SC B2 for $y \geq 6$ oe <u>and</u> $x + y \leq 5$ oe <u>and</u> $y \leq x - 3$ oe (In all cases allow $<$ in place of $\leq$, and $>$ in place of $\geq$)
					Total 4 marks

Question	Working	Answer	Mark	Notes	
12	180 – 2 × 66 (= 48) (360 – "48") ÷ 2 (= 156) 180 – "156" (= 24) 360 ÷ "24"		3	M1 M1ft	Could be marked on diagram Final stage of calculation
	Alt : 180 – 2 × 66 (= 48) 360 ÷ (0.5 × "48")			M1 M1ft	Could be marked on diagram Final stage of calculation
	Alt:180 – 2 × 66 (= 48) (360 – "48") ÷ 2 (= 156) $\frac{180\,(n-2)}{n}$ = "156" "24"n = 360 or $\frac{180\,(15-2)}{15}$ (= 156)			M1 M1ft	Could be marked on diagram Final stage of calculation or embedded correct answer.
		15		A1	
					Total 3 marks

Question	Working	Answer	Mark	Notes	
13	$\frac{h}{2}$ × (7+12) × 10 = 608 oe		3	M2	M1 for $\frac{h}{2}$ × (7 + 12) × 10
		6.4		A1	
					Total 3 marks

Question	Working	Answer	Mark	Notes	
14	5, 7, 11, 12, 13, 14, 15, 16, 17, 18, 18		3	M1	Ordering marks (allow 1 error)
	11 and 17 selected			M1	LQ = 11 and UQ =17 identified
		6		A1	
					Total 3 marks

Question		Working	Answer	Mark	Notes	
15	(a)		2, −1.5, −3, 0	2	B2	B1 for 2 or 3 values correct
	(b)			2	M1ft	At least 5 points plotted correctly ft from table dep on B1 in part (a)
					A1	For correct smooth curve.
						Total 4 marks

Question	Working	Answer	Mark	Notes
16 (a)		$\dfrac{3}{10}, \dfrac{7}{12}, \dfrac{5}{12}, \dfrac{7}{12}, \dfrac{5}{12}$	2	B2 B1 for $\dfrac{3}{10}$ oe B1 for all other correct probabilities 2d.p truncated or rounded (e.g 0.58 or 0.41 or 0.42)
(b)	$\dfrac{7}{10}$ x "$\dfrac{5}{12}$" or "$\dfrac{3}{10}$" x "$\dfrac{7}{12}$" oe		3	M1ft
	$\dfrac{7}{10}$ x "$\dfrac{5}{12}$" + "$\dfrac{3}{10}$" x "$\dfrac{7}{12}$" oe			M1ft
		$\dfrac{56}{120}$ oe		A1 eg $\dfrac{7}{15}$ or 0.46....(2 dp truncated or rounded)
(c)	"$\dfrac{3}{10}$" x "$\dfrac{5}{12}$" x $x = \dfrac{3}{100}$ oe		3	M1ft A correct equation involving the unknown probability
	$x = \dfrac{3}{100} \div$ "$\dfrac{15}{120}$" $(= \dfrac{6}{25})$ oe			M1ft Isolating or calculating the value of x
		25		A1 Dep on M1
				Total 8 marks

Question	Working	Answer	Mark	Notes
17 (a)			3	B3 All 8 values inserted correctly B2 for 4 to 7 correct values B1 for 2 or 3 correct values NB: Expressions involving x do not have to be simplified.
(b)	"$[(25 - x) + (x - 6) + (16 - x) +$ $3 + 6 + 2 + 9 + 5]$" $= 50$		2	M1ft For sum of all their values = 50 oe
		10		A1
(c)		14	1	B1ft
				Total 6 marks

Question	Working	Answer	Mark	Notes
18	eg $9 \times 6 = 8 \times PD$ oe		2	M1 A correct equation involving *PD*
		6.75		A1 oe
				Total 2 marks

Question	Working	Answer	Mark	Notes
19 (a)	eg $\dfrac{2(4-3x)}{10} - \dfrac{5(3x-5)}{10} = -3$ oe or $2(4 - 3x) - 5(3x - 5) = -3 \times 2 \times 5$		3	M1 Correct fractions over common denominator as an equation or Multiplying both sides by 10
	$8 - 6x - 15x + 25 = -30$ oe			M1 A correct equation with no denominators or brackets
		3		A1 dep on M1
(b)	$(5y + 8)(y - 5)\ (\leq 0)$ or $(y =) \dfrac{--17 \pm \sqrt{(-17)^2 - 4 \times 5 \times -40}}{2 \times 5}$		3	M1 Correct method to solve 3 term quadratic – factorising or correct use of formula
	$-1.6, 5$ oe			A1 Correct critical values
		$-1.6 \leq y \leq 5$ oe		A1 Condone change of variable in place of *y* throughout this question.
				Total 6 marks

Question	Working	Answer	Mark	Notes
20	$(ASF =) \dfrac{13^2}{9^2}$ or $\dfrac{9^2}{13^2}$		4	M1 Correct SF for area. Accept 1.44^2 (= 2.07 or 2.09) or better for ASF or 0.69^2 (= 0.47 or 0.48) or better for ASF
	eg $A + "(\dfrac{13^2}{9^2})" A = 1800$			M1ft Dep on previous M1
	eg $"\dfrac{250}{81}" A = 1800$			M1ft
		583.2		A1 Awrt 583
				Total 4 marks

Question	Working	Answer	Mark	Notes
21 (a)	Factorising numerator as $(5x + 4)(2x + 3)$		3	M1
	Factorising denominator as $(2x + 3)(2x - 3)$			M1
		$\dfrac{5x+4}{2x-3}$		A1
(b)	$(8^{5y} =) \, 2^{15y}$ or $(4^n =) 2^{2n}$ or 2^{5y+2}		4	M1
	$2^{5y+2} = 2^{15y-2n}$ oe			M1 e.g. $2^{2n} = 2^{15y-5y-2}$
	$5y + 2 = 15y - 2n$ oe			M1 Correct equation using the powers
		$n = 5y - 1$		A1 Dep on M2 (accept $5y - 1$)
				Total 7 marks

22	$(2865 =) \dfrac{30}{2}(2 \times -6 + 29d)$		4	M1 Correct expression for sum of 30 terms
	$d = 7$			A1 Correct value for d
	$-6 + 8 \times \text{"7"}$ or $(n\text{th term} =) \, -6 + \text{"7"}(n - 1)$			M1 ft their d. Dep on M1
		50		A1
				Total 4 marks

Question	Working	Answer	Mark	Notes
23	$-2(x^2 + 6x - 3.5)$ or $-2(x^2 + 6x) + 7$		3	M1 Factorising by -2
	$-2[(x+3)^2 - 9 - 3.5]$ or $-2[(x+3)^2 - 9] + 7$			M1 Completing the square
		$25 - 2(x+3)^2$		A1
	Alt : $a + b(x^2 + 2cx + c^2)$			
	$2bc = -12$ or $a + bc^2 = 7$ or $b = -2$			M1 Equating coefficients or stating value of b
	$2 \times -2 \times c = -12$ or $c = 3$			M1 Equating coefficients or stating value of c
	$a + -2 \times (3)^2 = 7$ or $a = 25$ seen			A1 Equating coefficients or stating value of a
				Special Cases: SC B2 for answer of $-2(x+3)^2 + $ constant or $25 - 2(x + $ positive constant$)^2$ SC B1 for answer of $-2(x-3)^2 + $ constant
				Total 3 marks

Question	Working	Answer	Mark	Notes
24	Gradient of $\mathbf{L_2} = -10 \div -5) (= 2)$		5	M1 Method to find gradient of $\mathbf{L_2}$
	$6 = 2 \times 8 + c \rightarrow c = -10$ $y = 2x - 10$ oe			A1 Equation for $\mathbf{L_2}$
	$0 = 2x - 10 \rightarrow x = 5$ or $(5, 0)$ $y = 2 \times -3 - 10 \rightarrow y = -16$ or $(-3, -16)$			A1 Finding point A and point B
	(Area =) $0.5 \times 5 \times 16$ or $(0.5 \times 5 \times 10) + (0.5 \times 10 \times 3)$ or $0.5 \times 5 \times \sqrt{265} \times \sin 100.6°$ or $0.5 \times \sqrt{320} \times \sqrt{265} \times \sin 15.9°$			M1 Method to find area of triangle
		40		A1 cao Dep on M2
				Total 5 marks

Question	Working	Answer	Mark	Notes
25	$(N + 1)^2 = (N^2 + 2N + 1)$ and $(N − 1)^2 = (N^2 − 2N + 1)$		3	M1
	$(N^2 + 2N + 1) − (N^2 − 2N + 1) = 4N$			M1 — Must reach $4N$ correctly
		$N = 5x$ oe Therefore $4N = 20x$		A1 — Dep. on M2. A correct conclusion (i.e. 20 "x") following fully correct working
	Alt: $N = 5x$ oe in both A and B			M1
	$(5x + 1)^2 = (25x^2 + 10x + 1)$ and $(5x − 1)^2 = (25x^2 − 10x + 1)$			M1
		$(25x^2 + 10x + 1) −$ $(25x^2 − 10x + 1)$ $= 20x$		A1 — Dep. on M2. Subtraction of two correct brackets to reach 20 "x"
	Alt: $A^2 − B^2 = (A + B)(A − B)$ $A + B = 2N$ and $A − B = 2$			M1
	$A^2 − B^2 = 2N \times 2 = 4N$			M1
		$N = 5x$ oe Therefore $4N = 20x$		A1 — Dep. on M2. A correct conclusion (i.e. 20 "x") following fully correct working
				Total 3 marks

Question	Working	Answer	Mark	Notes	
26	$OC = 3\mathbf{a} + 4\mathbf{b}$		5	B1	Correct expression for OC
	$ON = t(3\mathbf{a} + 4\mathbf{b})$			M1	Correct expressions for ON
	$ON = 3\mathbf{a} + s(-3\mathbf{a} + 6\mathbf{b})$			M1	
	$t(3\mathbf{a} + 4\mathbf{b}) = 3\mathbf{a} + s(-3\mathbf{a} + 6\mathbf{b})$ $\rightarrow t = 0.6,\ s = 0.4$			A1	t or s value correct
		$ON = 1.8\mathbf{a} + 2.4\mathbf{b}$ oe		A1	e.g. $ON = \frac{3}{5}(3\mathbf{a} + 4\mathbf{b})$
	Alt:				
	$AB = -3\mathbf{a} + 6\mathbf{b}$			B1	Correct expression for AB
	$AN = s(-3\mathbf{a} + 6\mathbf{b})$			M1	Correct expressions for AN
	$AN = -3\mathbf{a} + t(3\mathbf{a} + 4\mathbf{b})$			M1	
	$-3\mathbf{a} + t(3\mathbf{a} + 4\mathbf{b}) = s(-3\mathbf{a} + 6\mathbf{b})$ $\rightarrow t = 0.6,\ s = 0.4 \rightarrow AN = -1.2\mathbf{a} + 2.4\mathbf{b}$ $ON = 3\mathbf{a} + AN$			A1	t or s value correct
		$ON = 1.8\mathbf{a} + 2.4\mathbf{b}$ oe		A1	e.g. $ON = \frac{3}{5}(3\mathbf{a} + 4\mathbf{b})$
	Alt:				
	$OC = 3\mathbf{a} + 4\mathbf{b}$			B1	Correct expression for OC
	$ON : NC = 6 : 4$ (i.e 3:2)			M1	
	$ON = \frac{3}{5}OC$			M2	
		$ON = 1.8\mathbf{a} + 2.4\mathbf{b}$ oe		A1	e.g. $ON = \frac{3}{5}(3\mathbf{a} + 4\mathbf{b})$
					Total 5 marks
					Total: 100 marks