Questions taken from the AQA Practice Paper 2 Set 1 (AS)

Q	Marking instructions	AO	Marks	Typical solution
1	Circles correct answer	AO1.1b	B1	$a^{19}b^4$
	Total		**1**	
2	Circles correct answer	AO1.1b	B1	$x<-4$ $x>3$
	Total		**1**	
3 (a)	Uses the binomial theorem to expand bracket – can be left unsimplified	AO1.1a	M1	${}^8C_0(3)^8+{}^8C_1(3)^7\left(-\frac{x}{2}\right)^1+{}^8C_2(3)^6\left(-\frac{x}{2}\right)^2$ $=6561-8748x+5103x^2$
	Obtains the correct first term and third term	AO1.1b	A1	
	Obtains a fully correct expansion NMS = 3 marks	AO1.1b	A1	
	Total		**3**	
3 (b)	Deduces the correct value of x	AO2.2a	R1	$3-\frac{x}{2}=2.995 \quad x=0.01$
	Substitutes 'their' x into 'their' expansion to obtain the estimate required, correct to at least 3 sf	AO1.1b	B1F	$6561-8748(0.01)+5103(0.01)^2$ Estimate = 6474.0303
	Total		**5**	

Q	Marking instructions	AO	Marks	Typical solution
5	Selects an appropriate method by finding the midpoint of AB and the gradient of AB	AO3.1a	M1	Mid-point of $AB = (3, 2)$ Gradient of $AB = 2$ Hence gradient of perpendicular bisector $= -\frac{1}{2}$ Equation of perpendicular bisector is $y-2=-\frac{1}{2}(x-3)$ $p+6=-\frac{1}{2}(p-3)$ $p=-3$
	Finds the correct gradient of the perpendicular bisector of AB ft 'their' gradient of AB	AO1.1b	A1F	
	Forms an appropriate equation and substitutes the given coordinate into 'their' equation to find p	AO1.1a	M1	
	Finds the correct value of p	AO1.1b	A1	
	Total		**4**	

5 (Alt)	Selects an appropriate method by using the distance between two points formula to form an expression for the distance between A or B and the point with coordinates $(p, p + 8)$	AO3.1a	M1	Distances are $\sqrt{(p-1)^2+(p+10)^2}$ $\sqrt{(p-5)^2+(p+2)^2}$ $\sqrt{(p-1)^2+(p+10)^2}=\sqrt{(p-5)^2+(p+2)^2}$ $(p-1)^2+(p+10)^2=(p-5)^2+(p+2)^2$ $2p^2+18p+101=2p^2-6p+29$ $p=-3$
	Forms a correct equation using equal distances between the points A and B and the given point.	AO1.1b	A1	
	Expands brackets correctly to solve the equation	AO1.1a	M1	
	Finds the correct value of p	AO1.1b	A1	
	Total		**4**	

Q	Marking instructions	AO	Marks	Typical solution
6	Forms an expression for the gradient of the chord for the function $f(x) = 3x^4$	AO2.1	B1	Gradient of the chord = $\frac{3(x+h)^4 - 3x^4}{h}$ $(x+h)^4 = x^4 + 4x^3h + \left(6x^2h^2 + 4xh^3 + h^4\right)$ Gradient of chord equals $\frac{12x^3h + (18x^2h^2 + 12xh^3 + 3h^4)}{h}$ $= 12x^3 + 18x^2h + 12xh^2 + 3h^3$ As $h \to 0$ the gradient of the chord approaches the gradient of the tangent at that point = $12x^3$ $f'(x) = 12x^3$
	Expands $(x+h)^4$ with first two terms clearly correct	AO1.1b	M1	
	Obtains a correct simplified expression for the gradient of the chord	AO1.1b	A1	
	Uses correct notation for $h \to 0$ or equivalent language	AO2.5	B1	
	Completes the rigorous proof by explaining that as $h \to 0$ the gradient of the chord approaches the gradient of the tangent at that point	AO2.4	R1	
	Total		**5**	

Q	Marking instructions	AO	Marks	Typical solution
9 (a)	Forms a volume equation using volume of a cylinder added to the volume of a hemisphere	AO3.1a	M1	Volume $\pi r^2 h + \frac{2\pi r^3}{3} = 200$ Surface area $A = 2\pi rh + \pi r^2 + 2\pi r^2$ $A = 2\pi r\left[\frac{200}{\pi r^2} - \frac{2r}{3}\right] + \pi r^2 + 2\pi r^2$ $A = \frac{400}{r} - \frac{4\pi r^2}{3} + 3\pi r^2$ $A = \frac{400}{r} + \frac{5\pi r^2}{3}$
	Forms an area equation using surface area of a cylinder and hemisphere	AO1.1a	M1	
	Substitutes the rearranged volume formula into the surface area formula to eliminate h	AO1.1a	M1	
	Completes the rigorous verification of the given equation by expanding and simplifying correctly	AO2.1	R1	
	Total		**4**	

Q	Marking instructions	AO	Marks	Typical solution
9 (b)	Differentiates the expression for A	AO1.1a	M1	$\frac{dA}{dr} = -\frac{400}{r^2} + \frac{10\pi r}{3}$ $-\frac{400}{r^2} + \frac{10\pi r}{3} = 0$ $\frac{10\pi r}{3} = \frac{400}{r^2}$ $r^3 = \frac{120}{\pi}$ $r = 3.4$ $h = \frac{200}{\pi(3.36...)^2} - \frac{2(3.36)}{3} = 3.4$ Radius = 3.4cm, height = 3.4cm $\frac{d^2A}{dr^2} = \frac{800}{r^3} + \frac{10\pi}{3}$ When $r = 3.4$, $\frac{d^2A}{dr^2} > 0$ Hence it is a minimum value
	Obtains the correct derivative and sets the derivative equal to 0	AO1.1b	A1	
	Solves the equation to find the value of r	AO1.1b	A1	
	Substitutes to find the value of h	AO1.1a	M1	
	Finds the correct value of h	AO1.1b	A1F	
	Uses the second derivative or investigates the gradient around $r = 3.4$	AO1.1a	M1	
	Completes a rigorous and correct verification	AO2.1	R1	
	Total		**7**	

9 (c)	States one limitation of the model and comments on the accuracy of their answer	AO3.5b	E1	The thickness of the material has not been taken into account so the dimensions are smaller than they would be in reality. Flour shakers are very unlikely to be the exact shape that the model describes so using a more realistic shape which includes the thickness of the material.
	Explains one improvement to the model	AO3.5c	E1	
	Total		**2**	

12 (a)	Uses $P(A \cup B) = P(A) + P(B)$ to achieve correct answer	AO1.2	B1	0.9
	Total		**1**	
12 (b)(i)	Uses $P(C \cap D) = P(C) \times P(D)$ for independent events (PI by working)	AO1.2	M1	$P(C \cap D) = 0.8 \times 0.3 = 0.24$
	Uses $P(C \cup D) = P(C) + P(D) - P(C \cap D)$	AO1.1a	M1	$P(C \cup D) = 0.8 + 0.3 - 0.24$ $= 0.86$
	Finds correct value of $P(C \cup D)$	AO1.1b	A1	
	Total		**3**	
12 (b)(ii)	Uses $P(C' \cap D') = P(C') \times P(D')$ or uses $1 - P(C \cup D)$ ft 'their' $P(C \cup D)$ to obtain correct answer	AO1.1b	B1F	$P(C') \times P(D') = 0.6 \times 0.5$ $= 0.3$
	Total		**1**	

14	Uses first statement to find the value of b	AO1.1b	B1	$b = 0.1 + 0.15 = 0.25$
	Forms one equation in a and c using given statement and $\Sigma p = 1$	AO1.1a	M1	$a = c - 0.1$ $a + b + c + 0.25 = 1$ $a = 0.2$, $b = 0.25$, $c = 0.3$
	Forms two correct equations (b could be replaced by 0.25)	AO1.1b	A1	
	Solves equations to get correct a and c	AO1.1b	A1	
	Total		**4**	

Q	Marking instructions	AO	Marks	Typical solution
15 (a)	Forms an equation using binomial probabilities with at least one side correct	AO3.1a	M1	$\binom{5}{3}p^3(1-p)^2 = \binom{5}{4}p^4(1-p)$
	Obtains a fully correct equation	AO1.1b	A1	$10p^3(1-p)^2 = 5p^4(1-p)$ $p = \frac{2}{3}$
	Solves equation to get correct value of p	AO1.1b	A1	
	Total		**1**	
15 (b)	States that $p = 0$ and $p = 1$ are solutions of the equation but have been discounted or cancelled Accept would imply division by zero in solving equations OE	AO2.3	R1	$p = 0$ and $p = 1$ are solutions of the equation but have been discounted
	Total		**1**	

Q	Marking instructions	AO	Marks	Typical solution
16 (a)	States one correct assumption in terms of validity of the binomial model **in context**	AO3.3	E1	Any 2 from: Assumption 1: One seed flowering yellow has no effect on any other seed flowering yellow
	States second correct assumption in terms of validity of the binomial model **in context**	AO3.3	E1	Assumption 2: Probability of flowering yellow is constant from seed to seed Assumption 3: There are only two possible states 'flower yellow' or 'not flower yellow'
	Total		**2**	
16 (b)	States both hypotheses correctly for a one-tailed test	AO2.5	B1	X is 'No of seeds that flower yellow' H_0: $p = 0.9$ H_1: $p < 0.9$
	States model used implied by 0.0264, 0.0419, 0.0155	AO3.3	M1	Under H_0: $X \sim B(40, 0.9)$ ()
	Evaluates using calculator = 0.0419	AO1.1b	A1	$P(X \leq 32) = 0.0419$ As $0.0419 < 0.05$
	Compares to significance level of test	AO3.5a	M1	Reject H_0
	Infers H_0 is rejected	AO2.2b	A1F	There is sufficient evidence to suggest that the garden centre is overstating the proportion of seeds that flower yellow.
	Concludes correctly in context 'sufficient evidence' OE required	AO3.2a	E1	
	Total		**6**	