| Question number | | Scheme | | Marks |
|---|---|---|---|---|
| **1.** | | $(2 + 3x)^6 = 2^6 + 6.2^5 \times 3x + \binom{6}{2} 2^4 (3x)^2$ | >1 term correct | M1 |
| | | $= 64, + 576x, + 2160x^2$ | | B1 A1 A1 |
| | | | | **(4 marks)** |
| **2.** | | $r = \sqrt{(8-3)^2 + (-8-4)^2}$, = 13 | Method for $r$ or $r^2$ | M1 A1 |
| | | Equation: $(x - 3)^2 + (y - 4)^2 = 169$ | ft their $r$ | M1 A1ft |
| | | | | **(4 marks)** |
| **3.** | (a) | $(x = 2.5)$ $y = 4.077$ $(x = 3)$ $y = 5.292$ | | B1 B1 (2) |
| | (b) | $A \approx \frac{1}{2} \times \frac{1}{2} [1.414 + 5.292 + 2(2.092 + 3.000 + 5.292)]$ | For $\frac{1}{2} \times \frac{1}{2}$ | B1 |
| | | | ft their $y$ values | M1 A1ft |
| | | = 6.261 = 6.26 (2 d.p.) | | A1 (4) |
| | | | | **(6 marks)** |
| **4.** | | $3(1 - \cos^2 x) = 1 + \cos x$ | Use of $s^2 + c^2 = 1$ | M1 |
| | | $0 = 3\cos^2 x + \cos x - 2$ | 3TQ in $\cos x$ | M1 |
| | | $0 = (3\cos x - 2)(\cos x + 1)$ | Attempt to solve | M1 |
| | | $\cos x = \frac{2}{3}$ or $-1$ | Both | A1 |
| | | $\cos x = \frac{2}{3}$ gives $x = 48°, 312°$ | | B1, B1ft |
| | | $\cos x = -1$ gives $x = 180°$ | | B1 |
| | | | | **(7 marks)** |
| **5.** | (a) | Arc length = $r\theta = 8 \times 0.9 = 7.2$ | M1 for use of $r\theta$ | M1 |
| | | Perimeter = $16 + r\theta$ = 23.2 (mm) | | A1 (2) |
| | (b) | Area of triangle = $\frac{1}{2}.8^2.\sin(0.9) = 25.066$ | | M1 |
| | | Area of sector = $\frac{1}{2}.8^2.(0.9) = 28.8$ | | M1 |
| | | Area of segment = 28.8 – 25.066 = 3.7(33..) | | A1ft |
| | | Area of badge = triangle – segment, = 21.3 ($mm^2$) | | M1, A1 (5) |
| | | | | **(7 marks)** |

| Question number | | Scheme | | Marks |
|---|---|---|---|---|
| **6.** | (a) | $15000 \times (0.8)^2 = 9600$ (*) | M1 for × by 0.8 | M1 A1 cso (2) |
| | (b) | $15000 \times (0.8)^n < 500$ | Suitable equation or inequality | M1 |
| | | $n\log(0.8) < \log(\frac{1}{30})$ | Take logs | M1 |
| | | $n$ > 15.(24…) | $n$ = is OK | A1 |
| | | So machine is replaced in 2015 | | A1 (4) |
| | (c) | $a$ = 1000, $r$ = 1.05, $n$ = 16 ($\geq$ 2 correct) | | M1 |
| | | $S_{16} = \dfrac{1000(1.05^{16} - 1)}{1.05 - 1}$ | | M1 A1 |
| | | = 23 657.49 = £23 700 or £23 660 or £23657 | | A1 (4) |
| | | | | **(10 marks)** |
| **7.** | (a) | f(–1) = –1 – 1 + 10 – 8 | f(+1) or f(–1) | M1 |
| | | = 0 so ($x$ + 1) is a factor | = 0 and comment | A1 (2) |
| | (b) | $x^3 - x^2 = 2(5x + 4)$ | Out of logs | M1 |
| | | i.e. $x^3 - x^2 - 10x - 8 = 0$ (*) | A1 cso (4) | M1 |
| | | $x$ = –1, –2, 4 | | A2(1, 0) (4) |
| | (c) | $\log_2 x^2 + \log_2(x-1) = 1 + \log_2(5x+4)$ | Use of $\log x^n$ | M1 |
| | | $\log_2\left(\dfrac{x^2(x-1)}{5x+4}\right) = 1$ | Use of $\log a + \log b$ | M1 |
| | (d) | $x$ = 4, since $x$ < 0 is not valid in logs | | B1, B1 (2) |
| | | | | **(12 marks)** |

| Question number | Scheme | | Marks |
|---|---|---|---|
| **8.** (a) | $x^2 - 3x + 8 = x + 5$ | Line = curve | M1 |
| | $x^2 - 4x + 3 = 0$ | 3TQ = 0 | M1 |
| | $0 = (x - 3)(x - 1)$ | Solving | M1 |
| | $A$ is (1, 6); $B$ is (3, 8) | | A1; A1 (5) |
| (b) | $\int (x^2 - 3x + 8)\,dx = \left[\frac{x^3}{3} - \frac{3x^2}{2} + 8x\right]$ | Integration | M1 A2(1,0) |
| | Area below curve $= (9 - \frac{27}{2} + 24) - (\frac{1}{3} - \frac{3}{2} + 8) = 12\frac{2}{3}$ | Use of Limits | M1 |
| | Trapezium $= \frac{1}{2} \times 2 \times (6 + 8) = 14$ | | B1 |
| | Area = Trapezium – Integral , $= 14 - 12\frac{2}{3} = 1\frac{1}{3}$ | | M1, A1 (7) |
| | | | **(12 marks)** |
| ALT (b) | $-x^2 + 4x - 3$ | Line – curve | M1 |
| | $\int (-x^2 + 4x - 3)\,dx = \left[-\frac{x^3}{3} + 2x^2 - 3x\right]$ | Integration | M1 A2(1,0) |
| | Area $= \int_1^3 (...)\,dx = (-9 + 18 - 9) - (-\frac{1}{3} + 2 - 3)$ | Use of limits | M1 |
| | $= 1\frac{1}{3}$ | | A2 (7) |

| Question number | Scheme | | Marks |
| --- | --- | --- | --- |
| **9.** (a) | $A = \frac{1}{2}(x + 1)(4 - x)^2 \sin 30°$ | Use of $\frac{1}{2}ab\sin C$ | M1 |
| | $= \frac{1}{4}(x + 1)(16 - 8x + x^2)$ | Attempt to multiply out. | M1 |
| | $= \frac{1}{4}(x^3 - 7x^2 + 8x + 16)$ (*) | | A1 cso (3) |
| (b) | $\frac{dA}{dx} = \frac{1}{4}(3x^2 - 14x + 8)$ | Ignore the $\frac{1}{4}$ | M1 A1 |
| | $\frac{dA}{dx} = 0 \Rightarrow (3x - 2)(x - 4) = 0$ | | M1 |
| | So $x = \frac{2}{3}$ or 4 | At least $x = \frac{2}{3}$ or… | A1 |
| | e.g. $\frac{d^2A}{dx^2} = \frac{1}{4}(6x - 14)$, when $x = \frac{2}{3}$ it is < 0, so maximum | Any full method | M1 |
| | So $x = \frac{2}{3}$ gives maximum area (*) | Full accuracy | A1 (6) |
| (c) | Maximum area = $\frac{1}{4}(\frac{5}{3})(\frac{10}{3})^2 = 4.6$ or 4.63 or 4.630 | | B1 (1) |
| (d) | Cosine rule: $QR^2 = (\frac{5}{3})^2 + (\frac{10}{3})^4 - 2 \times \frac{5}{3} \times (\frac{10}{3})^2 \cos 30°$ | M1 for $QR$ or $QR^2$ | M1 A1 |
| | $= 94.159\ldots$ | | |
| | $QR = 9.7$ or 9.70 or 9.704 | | A1 (3) |
| | | | **(13 marks)** |