| Question | Answer | Marks | Guidance |
|---|---|---|---|
| 9(a) | $e^{2y} = mx^2 + c$ | **B1** | May be implied by later work |
| | **Either**<br>$7.96 = 4m + c$<br>$3.76 = 2m + c$ | **M1** | |
| | $m = 2.1$ oe | **A1** | |
| | $c = -0.44$ oe | **A1** | |
| | $y = \frac{1}{2}\ln\left(2.1x^2 - 0.44\right)$ oe | **A1** | Do not isw |
| | **Or**<br>gradient = $2.1$ oe | **(B1)** | |
| | Use of either $7.96 = 4m + c$<br>or $3.76 = 2m + c$ | **(M1)** | For use with *their m* |
| | $c = -0.44$ oe | **(A1)** | |
| | $y = \frac{1}{2}\ln\left(2.1x^2 - 0.44\right)$ oe | **(A1)** | Must be bracketed correctly |
| 9(b) | $y = \frac{1}{2}\ln\left(their\,2.1x^2 - their\,0.44\right)$ oe | **M1** | Must use the form $y = k\ln\left(px^2 \pm q\right)$ $p \neq 1$ and $q \neq 0$<br>or $e^{2y} = mx^2 + c$ |
| | 0.253 | **A1** | |
| 9(c) | $their\,2.1x^2 - their\,0.44 > 0$ or = 0 or $\geq 0$ soi | **B1** | |
| | Correct attempt to obtain the critical value using $their\,2.1x^2 - 0.44 = 0$ | **M1** | Must be from the form $y = k\ln\left(px^2 - q\right)$, $p \neq 1$ and $q > 0$ |
| | $x > 0.458$ or $x > \sqrt{\frac{22}{105}}$ oe | **A1** | |

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|---|---|---|---|
| 10(a) | $\frac{dy}{dx} = (2x+3)^{\frac{1}{2}} + 5x(+c)$ | **B1** | For $(2x+3)^{\frac{1}{2}}$, allow unsimplified |
| | | **M1** | For $k(2x+3)^{\frac{1}{2}} + 5x$ |
| | $10 = 3 + 15 + c$ | **M1** | **Dep** for use of 10 and $x=3$ in *their* $\frac{dy}{dx}$ to obtain $c$ |
| | $\frac{dy}{dx} = (2x+3)^{\frac{1}{2}} + 5x - 8$ soi | **A1** | |
| | When $x = 11$, $\frac{dy}{dx} = 5 + 55 - 8$ oe<br>$= 52$ | **A1** | **AG –** need to see sufficient detail |
| 10(b) | $f(x) = \frac{1}{3}(2x+3)^{\frac{3}{2}} + \frac{5x^2}{2}(-8x+d)$ | **B1** | For $\frac{1}{3}(2x+3)^{\frac{3}{2}}$, must be $\int (2x+3)^{\frac{1}{2}}\,dx$ |
| | | **M1** | For $k(2x+3)^{\frac{3}{2}} + \frac{5x^2}{2}$ |
| | $\frac{19}{2} = \frac{27}{3} + \frac{45}{2} - 24 + d$<br>$d = 2$ | **M1** | For use of $y = \frac{19}{2}$ and $x = 3$ in *their y* |
| | $(f(x) =)\ \frac{1}{3}(2x+3)^{\frac{3}{2}} + \frac{5x^2}{2} - 8x + 2$ | **A1** | Allow $-8$ if obtained from using $\frac{dy}{dx} = 52$ in **(a)** rather than $\frac{dy}{dx} = 10$ |
| 11(a) | $\frac{dy}{dx} =$<br>$\frac{(x+1)\left(\frac{1}{3}\times 2x\times\left(x^2-5\right)^{-\frac{2}{3}}\right) - \left(x^2-5\right)^{\frac{1}{3}}}{(x+1)^2}$<br>or<br>$(x+1)^{-1}\left(\frac{1}{3}\times 2x\times\left(x^2-5\right)^{-\frac{2}{3}}\right)$<br>$+\left(x^2-5\right)^{\frac{1}{3}}\left(-(x+1)^{-2}\right)$ | **3** | **B1** for $\frac{1}{3}\times 2x\times\left(x^2-5\right)^{-\frac{2}{3}}$<br>**M1** for an attempt at a quotient or a correct product<br>**A1** for all other terms correct |
| | $\frac{-x^2+2x+15}{3(x+1)^2\left(x^2-5\right)^{\frac{2}{3}}}$ | **3** | **Dep on first 3 marks**<br>**A1** for $-x^2$ in a quadratic numerator<br>**A1** for $2x$ in a quadratic numerator<br>**A1** for 15 in a quadratic numerator |