| | | |
|---|---|---|
| | No other unrejected answers. Condone throughout if e.g., $x$ is used for $a$ | |
| | | **(3)** |
| | | **(Total 9 marks)** |

| Question Number | Scheme | Notes | Marks |
|---|---|---|---|
| **3** | **"In this question you must show all stages of your working. Solutions relying entirely on calculator technology are not acceptable."** $\mathrm{f}(x)=\dfrac{4x^2-14x+15}{x-3} \qquad x<3$ | | |
| **(a)** | $\mathrm{f}'(x)=\dfrac{(x-3)(8x-14)-(4x^2-14x+15)}{(x-3)^2}$ or e.g., $\dfrac{8x-14}{x-3}-\dfrac{4x^2-14x+15}{(x-3)^2}$<br>M1: Attempts the quotient rule to achieve the form $\dfrac{\pm(x-3)(\pm Ax\pm B)\pm(4x^2-14x+15)}{(x-3)^2}$ or $\dfrac{\pm(4x^2-14x+15)\pm(x-3)(\pm Ax\pm B)}{(x-3)^2}$<br>Alternatively, may use the product rule achieving the form $\pm(x-3)^{-2}\left(4x^2-14x+15\right)\pm(x-3)^{-1}\left(\pm Ax\pm B\right)$<br>Allow if there is a clear miscopy e.g. $15\to 5$<br>Allow if an incorrect rule is used/stated provided correct form achieved.<br>If $(x-3)(8x-14)$ is only seen expanded it must be correct and not $(x-3)"(8x-14)"$ but allow sign errors if a "-" is immediately applied to either $8x^2-38x+42$ or $4x^2-14x+15$.<br>If the denominator is only seen expanded it must the correct $x^2-6x+9$<br>A1: Correct unsimplified derivative **seen**. Bracketing must be correct unless recovered. | | **M1**<br>**A1** |
| | $=\dfrac{(x-3)(8x-14)-(4x^2-14x+15)}{(x-3)^2}=\dfrac{8x^2-24x-14x+42-4x^2+14x-15}{(x-3)^2}=\dfrac{4x^2-24x+27}{(x-3)^2}$<br>**d**M1: Multiplies out the numerator and simplifies it to a three-term quadratic or equivalent work following use of the product rule achieving $\dfrac{ax^2+bx+c}{(x-3)^2}$<br>A1: Correct expression. Only allow values for *a*, *b* and *c* if the expression on the question paper is seen in their answer. Allow all marks if the denominator is expanded correctly but isw following the correct expression above | | **dM1**<br>**A1** |
| **Alt by division first** | $\dfrac{4x^2-14x+15}{x-3}=\dfrac{(4x-2)(x-3)+9}{x-3}=4x-2+9(x-3)^{-1}\Rightarrow\dfrac{\mathrm{d}y}{\mathrm{d}x}=4-9(x-3)^{-2}$ (M1:correct form, A1)<br>$=4-\frac{9}{(x-3)^2}=\frac{4x^2-24x+27}{(x-3)^2}$ (**d**M1:correct form, A1) | | |
| | | | **(4)** |
| **(b)** | $4x^2-24x+27\{=(2x-9)(2x-3)\}=0\Rightarrow x=\dfrac{3}{2},\ y=-2$<br>M1: Sets their 3TQ equal to zero and obtains a real value/expression for *x*. Apply usual rules but if calculator used they must get a correct real root for their 3TQ which may be $\geqslant 3$<br>A1: $\left(\frac{3}{2},-2\right)$ **from correct work and a correct derivative in (a)**.<br>Allow coordinates given as $x=...,\ y=...$ No other unrejected solution offered. | | **M1**<br>**A1** |
| | | | **(2)** |
| **(c)** | $\left(\frac{5}{4},-7\right)$ and condone $\frac{5}{4},-7$<br>B1: One correct **d**B1: Both correct. Allow coordinates given as $x=...,\ y=...$ and accept any equivalents for $\frac{5}{4}$. Allow SC B1dB0 if just $\left(-7,\frac{5}{4}\right)$. B0**d**B0 for transforming the turning | | **B1**<br>**dB1** |

| | | |
|---|---|---|
| | point "$\left(\frac{3}{2}, -2\right)$" B1B0 if there are other unrejected answers but ignore coordinates that are clearly just part of their solution such as $\left(\frac{5}{4}, -10\right)$ from applying f($2x$) | |
| | | **(2)** |
| | | **(Total 8 marks)** |