| Q | Scheme | Marks | AOs | Pearson Progression Step and Progress descriptor |
|---|---|---|---|---|
| **5a** | Student completes the square twice. Condone sign errors.<br>$(x-4)^2-16+(y+5)^2-25+1=0$<br>$(x-4)^2+(y+5)^2=40$ | **M1** | 1.1b | 4th<br>Find the centre and radius of a circle, given the equation, by completing the square. |
| | So centre is (4, −5) | **A1** | 1.1b | |
| | and radius is $\sqrt{40}$ | **A1** | 1.1b | |
| | | **(3)** | | |
| **5b** | Substitutes $x$ = 10 into equation (in either form).<br>$10^2-8\times10+y^2+10y+1=0$ or $(10-4)^2+(y+5)^2=40$ | **M1** | 2.2a | 5th<br>Solve coordinate geometry problems involving circles in context. |
| | Rearranges to 3 term quadratic in $y$ $y^2+10y+21=0$<br>(could be in completed square form $(y+5)^2=4$) | **M1** | 1.1b | |
| | Obtains solutions $y=-3$, $y=-7$ (must give both). | **A1** | 1.1b | |
| | Rejects $y = -7$ giving suitable reason (e.g. $-7 < -5$) or 'it would be below the centre' or '$AQ$ must slope upwards' o.e. | **B1** | 2.3 | |
| | | **(4)** | | |
| **5c** | $m_{AQ}=\dfrac{-3-(-5)}{10-4}=\dfrac{1}{3}$ | **B1** | 1.1b | 5th<br>Find the equation of the tangent to a given circle at a specified point. |
| | $m_{l_2}=-3$ (i.e. −1 over their $m_{AQ}$) | **B1ft** | 2.2a | |
| | Substitutes their $Q$ into a correct equation of a line. For example,<br>$-3=(-3)(10)+b$ or $y+3=-3(x-10)$ | **M1** | 1.1b | |
| | $y = -3x + 27$ | **A1** | 1.1b | |
| | | **(4)** | | |

| | | | | |
|---|---|---|---|---|
| **5d** | $\overrightarrow{AQ} = \begin{pmatrix} 6 \\ 2 \end{pmatrix}$ o.e. (could just be in coordinate form). | **M1** | 3.1a | 5th<br>Solve coordinate geometry problems involving circles in context. |
| | $\overrightarrow{AP} = \begin{pmatrix} -2 \\ 6 \end{pmatrix}$ o.e. so student concludes that point $P$ has coordinates (2, 1). | **M1** | 3.1a | |
| | Substitutes their $P$ and their gradient $\frac{1}{3}$ ( $m_{AQ}$ from 5c) into a correct equation of a line. For example,<br>$1 = \left(\frac{1}{3}\right)(2) + b$ or $y - 1 = \left(\frac{1}{3}\right)(x - 2)$ | **M1** | 2.2a | |
| | $y = \frac{1}{3}x + \frac{1}{3}$ | **A1** | 1.1b | |
| | | **(4)** | | |
| **5e** | $PA = \sqrt{40}$ | **B1** | 3.1a | 5th<br>Solve coordinate geometry problems involving circles in context. |
| | Uses Pythagoras' theorem to find $EP = \sqrt{\frac{40}{9}}$ . | **B1** | 2.2a | |
| | Area of $EPA$ = $\frac{1}{2} \times \sqrt{40} \times \sqrt{\frac{40}{9}}$ (could be in two parts). | **M1** | 1.1b | |
| | Area = $\frac{20}{3}$ | **A1** | 1.1b | |
| | | **(4)** | | |
| | | | | **(19 marks)** |

**Notes**