| Question | | | Answer | Marks | AOs | Guidance | |
|---|---|---|---|---|---|---|---|
| 8 | | | $2x+3y=0$<br>$\Rightarrow y=-\frac{2}{3}x$ and gradient $-\frac{2}{3}$ | **M1** | **3.1a** | Identify gradient of line $\left(=-\frac{2}{3}\right)$ anywhere | Allow sign slip |
| | | | Hence, gradient of the tangent is $\frac{3}{2}$ | **A1FT** | **1.1** | Use $m_1m_2=-1$ anywhere $\left(=\frac{3}{2}\right)$ FT their gradient | |
| | | | | **M1** | **1.1a** | Attempt differentiation | The power must be seen to decrease |
| | | | $\frac{\mathrm{d}y}{\mathrm{d}x}=\frac{3}{2}kx^{\frac{1}{2}}$ | **A1** | **1.1** | Obtain $\frac{3}{2}kx^{\frac{1}{2}}$ | |
| | | | At $x=4$, $\frac{3}{2}k(4)^{\frac{1}{2}}=3k$ | **M1** | **1.1** | Substitute $x=4$ and equate to the normal gradient | Tangent gradients may also be used i.e. $-\frac{1}{3k}=-\frac{2}{3}$ |
| | | | Hence $3k=\frac{3}{2}$, so $k=\frac{1}{2}$ | **E1** | **1.1** | AG | |
| | | | At $P$, $y=\frac{1}{2}(4)^{\frac{3}{2}}=4$ so $P=(4,\,4)$ so equation of normal through $P$ is<br>$(y-4)=-\frac{2}{3}(x-4)$ | **M1** | **3.1a** | Identify coordinates, gradient of normal and form equation with their coordinates | Accept $y=4$ |
| | | | When $y=0$, $x=10$ so $Q=(10,\,0)$ | **A1** | **1.1** | Substitute $y=0$ and obtain $x=10$ | |
| | | | Using $P$ (4, 4) and $Q$ (10, 0)<br>$PQ^2=(10-4)^2+(0-4)^2$ | **M1** | **1.1** | Use Pythagoras to obtain length $PQ^2$ | |
| | | | Circle equation is $(x-4)^2+(y-4)^2=52$ | **A1FT** | **1.1** | Accept equivalent forms<br>FT their coordinates for $P$ and $Q$ | |
| | | | | **[10]** | | | |