## 2E Tangents \& Normals

1. The point $P$, where $x=2$, lies on the rectangular hyperbola $H$ with equation $x y=8$. Find:
a) The equation of the tangent $T$.
b) The equation of the normal $N$ to $H$ at the point $P$, giving your answer in the form $a x+b y+$ $c=0$.
2. The distinct points A and B , where $x=3$ lie on the parabola C with equation $y^{2}=27 x$.
a) The line $l_{1}$ is the tangent to C at A and the line $l_{2}$ is the tangent to C at B . Given that at $A, y>0$, find the coordinates of $A$ and $B$.
b) Draw a sketch showing the parabola C . Indicate $\mathrm{A}, \mathrm{B}, l_{1}$ and $l_{2}$.
c) Find equations for $l_{1}$ and $l_{2}$, giving your answer in the form $a x+b y+c=0$.
3. The point $P$ with coordinates $(75,30)$ lies on the parabola $C$ with equation $y^{2}=12 x$. Find the equation of the tangent to $C$ at $P$, giving your answer in the form $y=m x+c$
4. The point $P(4,8)$ lies on the parabola $C$ with equation $y^{2}=4 a x$. Find:
a) The value of $a$
b) An equation of the normal to $C$ at $P$

The normal to $C$ at $P$ cuts the parabola again at the point $Q$. Find:
c) The coordinates of $Q$
d) The length $P Q$, giving your answer as a simplified surd

