**2E Tangents & Normals**

1. The point $P$, where $x=2$, lies on the rectangular hyperbola $H$ with equation $xy=8$. Find:
2. The equation of the tangent $T$.
3. The equation of the normal $N $to $H$ at the point $P$, giving your answer in the form $ax+by+c=0$.
4. The distinct points A and B, where $x=3$ lie on the parabola C with equation $y^{2}=27x$.
5. 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.

1. Draw a sketch showing the parabola C. Indicate A, B, $l\_{1}$ and $l\_{2}$.
2. Find equations for $l\_{1}$ and $l\_{2}$, giving your answer in the form $ax+by+c=0$.
3. The point $P$ with coordinates $\left(75,30\right)$ lies on the parabola $C$ with equation $y^{2}=12x$.

Find the equation of the tangent to $C$ at $P$, giving your answer in the form $y=mx+c$

1. The point $P(4,8)$ lies on the parabola $C$ with equation $y^{2}=4ax$. Find:
2. The value of $a$
3. An equation of the normal to $C$ at $P$

The normal to $C$ at $P$ cuts the parabola again at the point $Q$. Find:

1. The coordinates of $Q$
2. The length $PQ$, giving your answer as a simplified surd