1. (a) Give the values of the two basic limits

$$\lim_{t \to 0} \frac{\sin(t)}{t} \qquad \lim_{t \to 0} \frac{1 - \cos(t)}{t}.$$

   (b) Using the definition of the derivative, the two limits in part a) and the addition formula for cos, find the derivative of $\cos(x)$. Try to justify each step.

2. Let PQ be a line segment of fixed length 10 cm. Suppose that one end of the line segment Q is allowed to slide back a forth along the x-axis. The other end, P, is attached to a circle of radius 4 cm which is centered at the origin and rotates counter-clockwise at 20 revolutions per minute.
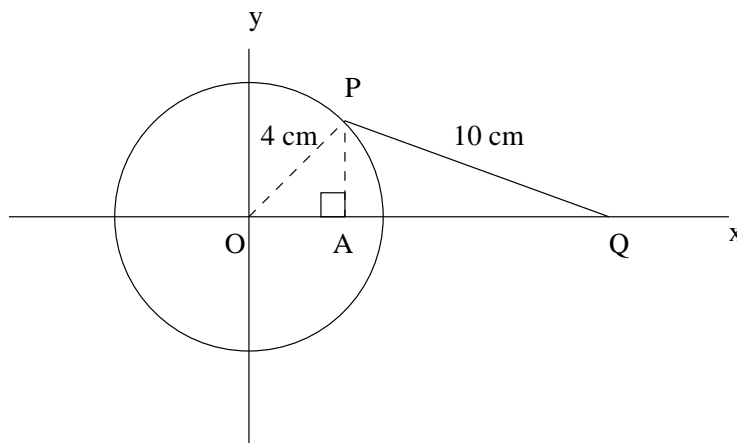
   (a) At time $t = 0$, the point P has coordinates $(4, 0)$. Find functions $x(t)$ and $y(t)$ which give the coordinates of P at time t where time is measured in minutes.

   (b) Give the location of P after 15 seconds.

   (c) Find a function $q(t)$ which gives the x coordinate of Q at time t. Find the velocity of the point Q as a function of t.

   (d) Give the velocity of Q 33 seconds after the point P is at $(4, 0)$.

   (e) At this time is Q moving towards the origin, away from the origin or is Q stationary?

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