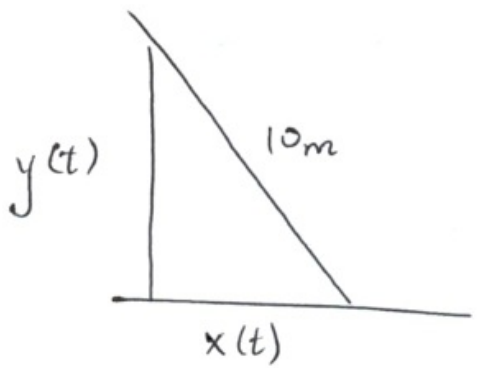
Lab Quiz 4.4 20 minutes

Name: Solutions Student ID:

Always justify your answers!

Q1]...[5 points] A ladder 10m in length is resting against a vertical wall. The bottom of the ladder starts sliding away from the wall at a rate of 3m/s. How fast is the top of the ladder sliding down the wall when the bottom of the ladder is 8m from the wall?

Picture



Given: $\frac{dx}{dt} = 3$.

Needed: $\frac{dy}{dt}$ when $x(t) = 8$.

When $x(t) = 8$, $y(t)$ is:

$y(t) = \sqrt{100 - 8^2}$

$= \sqrt{36} = 6$.

Quantities are related by

$$(y(t))^2 + (x(t))^2 = 10^2$$

differentiating

$$2y(t)\frac{dy}{dt} + 2x(t)\frac{dx}{dt} = 0$$

So $$\frac{dy}{dt} = \frac{1}{2y(t)} \cdot -2x(t)\frac{dx}{dt} = \frac{-8}{6} \cdot (3) = -4 \text{ m/s}.$$

Q2]... [5 points] Find the equation of the line tangent to $f(x) = x\ln(x^2)$ at the point $(1, 0)$.

Differentiate:

$$f'(x) = (x)'\ln(x^2) + x\cdot(\ln(x^2))'$$

$$= \ln(x^2) + x\cdot\frac{1}{x^2}\cdot 2x$$

$$= \ln(x^2) + 2$$

So $f'(1) = \ln(1) + 2 = 0 + 2 = 2$.

So the tangent line is $y = mx + b$ with $m = 2$ and b satisfying:

$$y = 2x + b \Rightarrow 0 = 2(1) + b$$

$$\Rightarrow b = -2$$

So the tangent line is

$$\boxed{y = 2x - 2}$$