MATH 1300 A, Summer 2015 Name: ______________________

Quiz 3 Student number: ______________________

Solution

1. *(50 points)* Find the global minimum and global maximum of $f(x) = x^3 - 12x^2 + 36x + 4$ with domain $I = [1, 3]$.

$$f'(x) = 3x^2 - 24x + 36$$
$$= 3(x^2 - 8x + 12)$$
$$= 3(x-2)(x-6)$$

$f'(x) = 0$ when $x = 2$ or $\boxed{x = 6}$.
↳ irrelevant because is not in the domain

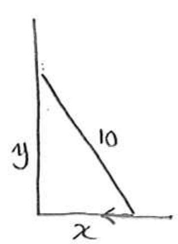
We find the values of the function at $x=2$, and at the extremal points of the interval I, $x=1$ and $x=3$, and compare:

$f(2) = 8 - 48 + 72 + 4 = \boxed{36}$ → global maximum

$f(1) = 1 - 12 + 36 + 4 = \boxed{29}$ → global minimum

$f(3) = 27 - 108 + 108 + 4 = 31$

2. *(50 points)* A 10 feet ladder is resting against the wall. The bottom is initially 7 feet away from the wall and is being pushed towards the wall at a rate of $\frac{1}{3}$ ft/sec. How fast is the top of the ladder moving up the wall 3 seconds after we start pushing?



Need to find $\frac{dy}{dt}$ after 3 seconds.

$\frac{dx}{dt} = -\frac{1}{3}$ ft/sec (negative because x is decreasing)

After 3 seconds the ladder has been pushed $(\frac{1}{3}) \cdot 3 = 1$ feet, so $\boxed{x = 6}$ and $\boxed{y = \sqrt{10^2 - 6^2} = \sqrt{64} = 8}$

Taking the derivative of $x^2 + y^2 = 10^2$;

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

$$x \frac{dx}{dt} + y \frac{dy}{dt} = 0$$

After 3 sec: $6\left(-\frac{1}{3}\right) + 8 \frac{dy}{dt} = 0$

$$\boxed{\frac{dy}{dt} = \frac{2}{8} = \frac{1}{4}} \text{ ft/sec}$$