Name: $\qquad$
Applications of Derivatives - Quiz 1 (2019)

## In order to receive full marks for the questions, you must show all pertinent work.

1. Solve one of the two problems:

- A rectangular box, with two square ends has a total surface area of $150 \mathrm{~cm}^{2}$. Find the dimensions of the box if it is to have a maximum volume.
- Find the points on $y=x^{2}-3$ that are closest to the point $P(0,2)$.

$$
d=\sqrt{\left(x_{2}-x_{1}\right)^{2}+\left(y_{2}-y_{1}\right)^{2}}
$$


2. You are given a sphere with a radius 12 cm . You want to inscribe the largest cone or largest cylinder in your sphere. Find the exact radius and height of your maximum inscribed shape.


$$
V_{\text {cone }}=\frac{1}{3} \pi r^{2} h \quad V_{\text {sphere }}=\frac{4}{3} \pi r^{3} \quad V_{\text {cylinder }}=\pi r^{2} h
$$


displacement as a function of time $=s(t)$
velocity: $v(t)=\frac{d}{d t}(s)=\frac{d s}{d t}=s^{\prime}(t)$
acceleration $=\frac{d}{d t}(v)=\frac{d v}{d t}=\frac{d}{d t}\left(\frac{d}{d t}(s)\right)=s^{\prime \prime}(t)$
3. A particle is travelling on a horizontal line according to $s(t)=\frac{1}{3} t^{3}-5 t^{2}$. At a time of 6.0 seconds determine if the particle is:
a) moving away or towards the origin.
b) slowing down or speeding up at that time.

