Math 121 F09N05 - Quiz 3 | Name: SOLUTIONS.
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(1) [7 points] Use the definition of the derivative to determine $g'(x)$ if $g(x) = \sqrt{2+3x}$.

$$g'(x) = \lim_{h\to 0} \frac{g(x+h) - g(x)}{h}$$

$$= \lim_{h\to 0} \frac{1}{h} \left[\frac{\sqrt{2+3(x+h)} - \sqrt{2+3x}}{1} \cdot \frac{\sqrt{2+3(x+h)}+\sqrt{2+3x}}{\sqrt{2+3(x+h)}+\sqrt{2+3x}} \right]$$

$$= \lim_{h\to 0} \frac{1}{h} \left[\frac{2+3(x+h) - 2 - 3x}{\sqrt{2+3(x+h)} + \sqrt{2+3x}} \right]$$

$$= \lim_{h\to 0} \frac{1}{\cancel{h}} \left[\frac{3\cancel{h}}{\sqrt{2+3(x+h)} + \sqrt{2+3x}} \right]$$

$$= \boxed{\frac{3}{2\sqrt{2+3x}}}$$

(2) [3 points] Differentiate $z = \dfrac{A}{y^{10}} + B\cos y$ (here A and B are constants.)

$$z = Ay^{-10} + B\cos y$$

$$\boxed{\frac{dz}{dy} = -10Ay^{-11} - B\sin y}$$

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(3) **[5 points]** The equation of motion of a particle is $s = t^3 - 3t$, where s is in meters and t in seconds. Determine the acceleration of the particle when the velocity is zero.

$$s' = 3t^2 - 3$$

$$s'' = 6t$$

When velocity is zero, $s' = 0$

$$3t^2 - 3 = 0$$

$$t^2 = 1$$

$$t = 1, \underbrace{\cancel{-1}}_{\text{since } t \geq 0}$$

$$\therefore s''\Big|_{t=1} = 6(1) = \boxed{6 \ \frac{m}{s^2}}$$