Math 112 - Quiz 14 Name Key
November 7, 2018

Label each of the following derivatives appropriately. And use the variables that are given. For example, differentiate $z = t^2$. The answer is $z' = 2t$ or $\frac{dz}{dt} = 2t$.

1. Differentiate $f(x) = 5.2x + 2.3$ with respect to x. (2 pts.)

$$f'(x) = \frac{d}{dx}(5.2x + 2.3)$$
$$= 5.2\frac{d}{dx}x + \frac{d}{dx}(2.3)$$
$$= 5.2(1) + 0$$
$$= \boxed{5.2}$$

2. Differentiate $R(t) = (3t+1)^2$ with respect to t. (2 pts.)

$$R(t) = (3t+1)^2 = 9t^2 + 6t + 1.$$

So

$$R'(t) = 9\frac{d}{dt}t^2 + 6\frac{d}{dt}t + \frac{d}{dt}1$$
$$= 9(2t) + 6(1) + 0$$
$$= 18t + 6$$

Remark. Memorize that

$(a \pm b)^2 = a^2 \pm 2ab + b^2$.

So,

$$(3t+1)^2 = (3t)^2 + 2(3t)(1) + 1^2$$
$$= 9t^2 + 6t + 1.$$

3. Differentiate $S(p) = \sqrt{p} - p$ with respect to p. (2 pts.)

$$S'(p) = \frac{d}{dp}\sqrt{p} - \frac{d}{dp}p$$
$$= \frac{d}{dp}p^{1/2} - 1$$
$$= \frac{1}{2}p^{-1/2} - 1$$
$$= \frac{1}{2}\left(\frac{1}{\sqrt{p}}\right) - 1$$
$$\therefore S'(p) = \frac{1}{2\sqrt{p}} - 1$$

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4. Differentiate $y = \dfrac{x^2+4x+3}{\sqrt{x}}$ with respect to x. (2 pts.)

$$y = x^{-\frac{1}{2}}(x^2+4x+3) = x^{\frac{3}{2}} + 4x^{\frac{1}{2}} + 3x^{-\frac{1}{2}}$$

So,

$$\frac{dy}{dx} = \frac{3}{2}x^{\frac{1}{2}} + 2x^{-\frac{1}{2}} - \frac{3}{2}x^{-\frac{3}{2}}$$

$$= \frac{3}{2}\sqrt{x} + \frac{2}{\sqrt{x}} - \frac{3}{2(\sqrt{x})^3}$$

5. The position of a particle is $s = t^3 - 4t$, where s is in centimeters and t is in seconds. Find the acceleration of the particle after 5 seconds. Include units in your answer. (2 pts.)

Velocity: $v = \frac{ds}{dt} = \frac{d}{dt}(t^3-4t) = 3t^2-4$

Acceleration: $a = \frac{dv}{dt} = \frac{d}{dt}(3t^2-4) = 6t$

When $t = 5$ seconds,

$$a = \left.\frac{dv}{dt}\right|_{t=5} = 6(5) = 30\ \frac{cm}{s^2}$$

or (30 centimeters per sec per sec)

Extra credit. (1 pt.)

Give an example of a function $f(x)$ that is continuous at $x=0$ but not differentiable at $x=0$.

$f(x) = |x|$

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