MATH 14-3D2 Spring 2014
Quiz 4 SOLUTIONS

Show all work clearly and in order (on this sheet or an attached sheet) and circle your final answers.
Justify your answers algebraically whenever possible. Work without justification may not receive credit.
You have 25 minutes to take this 10 point quiz.

1. (*3 points*) Compute $\frac{d}{d\clubsuit}\left[\sin(\sqrt[3]{\clubsuit})\right]$.
Solution: Compute directly via the chain rule

$$\begin{aligned}\frac{d}{d\clubsuit}\left[\sin\left(\clubsuit^{\frac{1}{3}}\right)\right] &= \cos\left(\clubsuit^{\frac{1}{3}}\right)\frac{d}{d\clubsuit}\left[\clubsuit^{\frac{1}{3}}\right] \\ &= \frac{1}{3}\clubsuit^{-\frac{2}{3}}\cos\left(\clubsuit^{\frac{1}{3}}\right).\end{aligned}$$

2. (*3 points*) Compute $\frac{d}{dz}\left[\frac{z^2}{\sin(\cos(z))}\right]$.
Solution: Compute directly via the quotient and chain rules

$$\begin{aligned}\frac{d}{dz}\left[\frac{z^2}{\sin(\cos(z))}\right] &= \frac{2z\sin(\cos(z)) - z^2\cos(\cos(z))(-\sin(z))}{\sin^2(\cos(z))} \\ &= \frac{2z\sin(\cos(z)) + z^2\cos(\cos(z))\sin(z)}{\sin^2(\cos(z))}.\end{aligned}$$

3. (*4 points*) Suppose that a projectile has position function measuring its height at time t:

$$s(t) = -16t^2 + 48t.$$

This function starts at time $t = 0$ and is measured in feet.

1. What is the velocity of the projectile at time t?

   Solution: $v(t) = s'(t) = -32t + 48$

2. What is the acceleration of the projectile at time t?

   Solution: $a(t) = v'(t) = -32$

3. What time does the object hit the ground?

   Solution: Hitting the ground means that its height is zero, i.e. $s(t) = 0$ yielding equation

   $$-16t^2 + 48t = 0$$

   which has solutions

   $$t = 0, 3.$$

   Since the launch of the object occurs at time $t = 0$, we muts conclude that the object hits the ground at time $t = 3$.

4. What is the velocity of the projectile when it hits the ground?

   Solution: According to our answer in part c.), this would be the velocity of the projectile at time $t = 3$, hence we must compute

   $$v(3) = -32(3) + 48 = -96 + 48 = -48\frac{ft}{s}.$$