MATH 113 – QUIZ 6 – 16 OCTOBER 2012

Answer all of the following questions in the space provided. Show all work as partial credit may be given. Answers without justification, even if they are correct, will earn no credit.

1. (5 pts.) Find $f'(x)$ if $f(x) = \dfrac{x\cos(x)}{1+x^3}$.

$$f'(x) = \frac{(1+x^3)\frac{d}{dx}(x\cos(x)) - x\cos(x)(3x^2)}{(1+x^3)^2}$$

$$= \frac{(1+x^3)(-x\sin(x)+\cos(x)) - 3x^3\cos(x)}{(1+x^3)^2}$$

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

2. (5 pts.) The height in meters, s, of a feather from a height of 20 meters above the surface of the moon is given by $s = 20 - 0.8t^2$ where t is measured in seconds. Find the velocity and acceleration of the feather the moment it strikes the ground.

$s'(t) = -1.6t$

$s''(t) = -1.6$

$20 - .8t^2 = 0$

$.8t^2 = 20$

$t^2 = 25$

$t = 5$ sec

$s'(5) = -8$ m/sec

$s''(5) = -1.6$ m/sec^2

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1. (5 pts.) Find $f'(x)$ if $f(x) = \dfrac{2\cos(x)}{1+\sin(x)}$.

$$f'(x) = \frac{(1+\sin(x))(-2\sin(x)) - 2\cos(x)(\cos(x))}{(1+\sin(x))^2}$$

$$= \frac{-2\sin(x) - 2\sin^2(x) - 2\cos^2(x)}{(1+\sin(x))^2}$$

$$= \frac{-2\sin(x) - 2}{(1+\sin(x))^2} = \frac{-2(1+\sin(x))}{(1+\sin(x))^2} = \frac{-2}{(1+\sin(x))^2}$$

2. (5 pts.) Suppose that the position, s, in meters of a marble rolling up a curved incline is given by $s = \dfrac{100t}{t+1}$ where t is measured in seconds and $s = 0$ is the starting point. Find the velocity and acceleration of the marble. Is the marble speeding up or slowing down for $t \geq 0$?

$$s'(t) = \frac{(t+1)(100) - 100t(1)}{(t+1)^2} = \frac{100}{(t+1)^2} //$$

$$s''(t) = \frac{-200}{(t+1)^3} //$$

Marble is slowing down since the velocity $s'(t)$ is decreasing for $t \geq 0$

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Answer all of the following questions in the space provided. Show all work as partial credit may be given. Answers without justification, even if they are correct, will earn no credit.

1. (5 pts.) Find $f'(x)$ if $f(x) = x\cos(x)\sin(x)$.

$$f'(x) = x\frac{d}{dx}(\cos(x)\sin(x)) + (1)\cos(x)\sin(x)$$

$$= x(\cos(x)\cos(x) + \sin(x)(-\sin(x))) + \cos(x)\sin(x)$$

$$= x(\cos^2(x) - \sin^2(x)) + \cos(x)\sin(x)$$

2. (5 pts.) Suppose that the position in meters, s, of a particle moving horizontally after t seconds is given by $s(t) = 18t - 3t^2$, $0 \le t \le 8$. Find all points at which the velocity of the particle is zero and find its acceleration at those points.

$v(t) = s'(t) = 18 - 6t$ $\quad a(t) = v'(t) = s''(t) = -6$

$18 - 6t = 0$

$t = 3$ sec

$a(3) = -6$ m/sec^2