MATH 151 **QUIZ 4A** NAME Answers
Mrs. Bonny Tighe 25 points
3.9,3.10 SECTION _____ Fri 3/10/06

1. Water is being pumped into a conical tank. The tank has height of 6 m and the radius of the base is 3 m. How fast is the volume of the water increasing when the height of the water is rising at 0.5 m per minute, and the water is 3 m deep? $V = \frac{1}{3}\pi r^2 h$

Given $dh/dt = 1/2$ m/min
Find: dV/dt
when: $h = 3$m

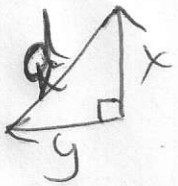
So $V = \frac{1}{3}\pi(\frac{1}{2}h)^2 h$ $r = 1/2\,h$

$V = \frac{1}{3}\pi\frac{1}{4}h^3 = \frac{\pi}{12}h^3$

$dV/dt = \frac{\pi}{4}h^2\, dh/dt$

$dV/dt = \frac{\pi}{4}(3)^2(\frac{1}{2}) = \frac{9\pi}{8}$ m/min

2. Two hikers start walking from the same point. One is walking north at 4 mph and the other is walking west at 5 mph. At what rate is the distance between the two hikers increasing after 1 hour?



Given: $dx/dt = 4$ mph
$dy/dt = 5$ mph
Find dd/dt
when $x = 4$ + $y = 5$ miles

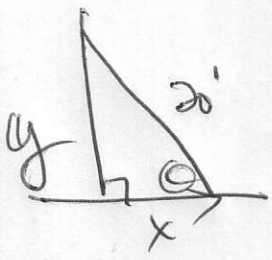
$d^2 = x^2 + y^2$

$2d\,dd/dt = 2x\,dx/dt + 2y\,dy/dt$

$2(\sqrt{41})\,dd/dt = 2(4)(4) + 2(5)(5)$

$dd/dt = \frac{32+50}{2\sqrt{41}} = \sqrt{41}$ mph

3. A 20-foot ladder rests against a vertical wall. If the bottom of the ladder slides away from the wall at a speed of 5 ft/sec, how fast is the angle between the bottom of the ladder and the ground decreasing when the top of the ladder is 10 feet from the ground?



Given: $dx/dt = 5$ ft/sec
Find: $d\theta/dt$
when $y = 10'$

$\cos\theta = \frac{x}{20}$

$-\sin\theta\, d\theta/dt = \frac{1}{20}\, dx/dt$

$-\frac{10}{20}(d\theta/dt) = \frac{1}{20}(5)$

$\frac{d\theta}{dt} -\frac{1}{2} = \frac{1}{4}$ $= \frac{-1}{2}$ rad/sec $= d\theta/dt$

4. A spherical snowball is melting so that its volume is decreasing at a rate of $10\ cm^3/sec$. Find the rate at which the radius is decreasing when the radius is 5 cm.

$V = \frac{4}{3}\pi r^3$

Given $dV/dt = 10\ cm^3/sec$

Find: dr/dt when $r = 5$

$dV/dt = 4\pi r^2 \, dr/dt$

$10 = 4\pi(5)^2 \, dr/dt$

$\frac{10}{100\pi} = \frac{1}{10\pi}\ cm/sec = dr/dt$

5. Use linear approximation to estimate $\sqrt{35.5}$ (use 36)

$y - y_1 = m(x - x_1)$

$y - 6 = \frac{1}{12}(35.5 - 36) =$

$y = 6 + \frac{1}{12}\left(-\frac{1}{2}\right) = 6 - \frac{1}{24} = 5\frac{23}{24}$

$f(x) = \sqrt{x}$, 6

$f'(x) = \frac{1}{2\sqrt{x}}$, $\frac{1}{12}$

6. Use linear approximation to estimate $\sin(30.5^\circ)$ $\left(\frac{\pi}{6} + \frac{\pi}{360}\right)$ use $30^\circ = \pi/6$

$y - \frac{1}{2} = \sqrt{3}/2\left(\frac{\pi}{6} + \frac{\pi}{360} - \frac{\pi}{6}\right)$

$y = \frac{1}{2} + \frac{\sqrt{3}}{2}\left(\frac{\pi}{360}\right)$

$f(x) = \sin x$, $1/2$

$f'(x) = \cos x$, $\sqrt{3}/2$

7. Find the linearization, L(x), for f(x) at a when $f(x) = \cos^3 x$ and $a = \pi/6$.

$L(x) = f(a) + f'(a)(x - a)$

$L(x) = 3\sqrt{3}/8 - \frac{9}{8}(x - \pi/6)$

$f'(x) = 3\cos^2 x(-\sin x)$

$f(\pi/6) = (\sqrt{3}/2)^3 = 3\sqrt{3}/8$

$f'(\pi/6) = 3(\sqrt{3}/2)^2(-1/2)$

$\frac{-9}{8}$