Quiz # 7 Solutions

1.

$$2x\frac{dx}{dt} + 2y\frac{dy}{dt} = 0$$

so

$$\frac{dx}{dt} = \frac{-y \cdot \frac{dy}{dt}}{x} = \frac{-4 \cdot 6}{3} = -8$$

because if $y = 4$ then $x = 3$ so $x^3 + y^2 = 25$.

2. The surface area is a function of the radius, and the diameter is a function of the radius:

$$A = 4\pi r^2 \qquad \text{and} \qquad D = 2r.$$

Thus

$$A = 4\pi r^2 = \pi(2r)^2 = \pi D^2$$

and

$$\frac{dA}{dt} = 2\pi D\frac{dD}{dt}.$$

We want dD/dt:

$$\frac{dD}{dt} = \frac{\frac{dA}{dt}}{2\pi D} = \frac{-1}{2\pi \cdot 10} = -\frac{1}{20\pi} \approx -1/60 \text{ cm/min}.$$

That is, the diameter decreases at $1/(20\pi)$ cm/min.

3. *by LINEARIZATION*:
$f(x) = x^4$ and $a = 2$ gives

$$L(x) = f(a) + f'(a)(x - a) = 16 + 4 \cdot 8(x - 2) = 16 + 32(x - 2)$$

because $f'(x) = 4x^3$. Thus

$$(2.01)^4 = f(2.01) \approx L(2.01) = 16 + 32(2.01 - 2) = 16 + 32(.01) = 16.32.$$

by DIFFERENTIALS:
$f(x) = x^4$ so

$$dy = f'(x)\,dx = 4x^3\,dx$$

Here $x = 2$ and $dx = .01$ so

$$dy = 4 \cdot 8 \cdot .01 = .32$$

and

$$(2.01)^4 = 2^4 + \Delta y \approx 2^4 + dy = 16 + .32 = 16.32.$$

[*Note that* $(2.01)^4 = 16.32240801$ *exactly.*]

4.
A: local maximum *OR* neither
B: neither
C: local maximum
D: absolute maximum
E: local minimum

[*On point "A" the book's definition of "local maximum/minimum" implies that the correct answer is* neither*, but based on what I had said in class you would be correct to write* local maximum*. I will accept either answer at endpoints, in the future.*]