Classroom Voting Questions: Calculus I

3.9 Linear Approximation and the Derivative

1. If $e^{0.5}$ is approximated by using the tangent line to the graph of $f(x) = e^x$ at (0,1), and we know $f'(0) = 1$, the approximation is

   (a) 0.5
   (b) $1 + e^{0.5}$
   (c) $1 + 0.5$

2. The line tangent to the graph of $f(x) = \sin x$ at (0,0) is $y = x$. This implies that

   (a) $\sin(0.0005) \approx 0.0005$
   (b) The line $y = x$ touches the graph of $f(x) = \sin x$ at exactly one point, (0,0).
   (c) $y = x$ is the best straight line approximation to the graph of f for all x.

3. The line $y = 1$ is tangent to the graph of $f(x) = \cos x$ at (0,1). This means that

   (a) the only x-values for which $y = 1$ is a good estimate for $y = \cos x$ are those that are close enough to 0.
   (b) tangent lines can intersect the graph of f infinitely many times.
   (c) the farther x is from 0, the worse the linear approximation is.
   (d) All of the above

4. Suppose that $f''(x) < 0$ for x near a point a. Then the linearization of f at a is

   (a) an over approximation
   (b) an under approximation
   (c) unknown without more information.

5. Peeling an orange changes its volume V. What does ΔV represent?

   (a) the volume of the rind
   (b) the surface area of the orange
   (c) the volume of the "edible part" of the orange

(d) $-1\times$ (the volume of the rind)

6. You wish to approximate $\sqrt{9.3}$. You know the equation of the line tangent to the graph of $f(x) = \sqrt{x}$ where $x = 9$. What value do you put into the tangent line equation to approximate $\sqrt{9.3}$?

   (a) $\sqrt{9.3}$
   (b) 9
   (c) 9.3
   (d) 0.3

7. We can use a tangent line approximation to $\sqrt{x}$ to approximate square roots of numbers. If we do that for each of the square roots below, for which one would we get the smallest error?

   (a) $\sqrt{4.2}$
   (b) $\sqrt{4.5}$
   (c) $\sqrt{9.2}$
   (d) $\sqrt{9.5}$
   (e) $\sqrt{16.2}$
   (f) $\sqrt{16.5}$