Worksheet: Lesson 3.5 Name: _____

Remember - Finding a local linear approximation at a given point is finding the equation of the tangent line at that point.

1. a. Find the local linear approximation of $f(x) = x^3 - 2x + 3$ at the point where $x = 2$.

   b. Use your approximation to estimate $f(2.1), f(1.9), f(1.99)$.

2. a. Find the local linear approximation of $f(x) = \sqrt{x^2 + 9}$ at the point where $x = -4$.

   b. Use your approximation to estimate $f(-4.1), f(-3.9), f(-3.99)$.

3. a. Find the local linear approximation of $f(x) = x + \frac{1}{x}$ at the point where $x = 1$.

   b. Use your approximation to estimate $f(1.1), f(1.11), f(0.9)$.

4. a. Find the local linear approximation of $f(x) = \ln(x + 1)$ at the point where $x = 0$.

   b. Use your approximation to estimate $f(0.1), f(0.11), f(-.1)$.

5. a. Find the local linear approximation of $f(x) = \tan x$ at the point where $x = \pi$.

b. Use your approximation to estimate $f(3.1), f(3.2), f(3.3)$.

6. a. Find the local linear approximation of $f(x) = e^x$ at the point where $x = 1$.

b. Use your approximation to estimate $f(.9), f(.99), f(1.1)$.

Recall $dy = f'(x)\,dx$ and $\Delta y = f(x + \Delta x) - f(x)$

7. Find dy and Δy for $f(x) = 3x^4 - 5x$ at $x = 2$ and $dx = \Delta x = .01$.

8. Find dy and Δy for $f(x) = 2x^3 - x^2$ at $x = -2$ and $dx = \Delta x = .01$.

9. Find dy and Δy for $f(x) = \dfrac{-1}{x^2}$ at $x = 1$ and $dx = \Delta x = .01$.

10. Find dy and Δy for $f(x) = \sqrt{x}$ at $x = 4$ and $dx = \Delta x = -.01$.

Worksheet: Lesson 3.5 Name: ANS KEY

Remember - Finding a local linear approximation at a given point is finding the equation of the tangent line at that point.

1. a. Find the local linear approximation of $f(x) = x^3 - 2x + 3$ at the point where $x = 2$.

$f'(2) = 10$ $f(2) = 7$

$Y = 10(x-2) + 7$

b. Use your approximation to estimate $f(2.1)$, $f(1.9)$, $f(1.99)$.

$f(2.1) \approx Y(2.1) = 8$ $f(1.9) \approx Y(1.9) = 6$

$f(1.99) \approx Y(1.99) = 6.9$

2. a. Find the local linear approximation of $f(x) = \sqrt{x^2+9}$ at the point where $x = -4$.

$f'(-4) = -.8$ $f(-4) = 5$

$Y = -\frac{4}{5}(x+4) - 5$

$\frac{x}{\sqrt{x^2+9}} = f'$

$f'(-4) = \frac{-4}{5}$

b. Use your approximation to estimate $f(-4.1)$, $f(-3.9)$, $f(-3.99)$.

$f(-4.1) \approx Y(-4.1) = -4.92$ $f(-3.9) \approx Y(-3.9) = -5.04$

$f(-3.99) \approx Y(-3.99) = -5.008$

3. a. Find the local linear approximation of $f(x) = x + \frac{1}{x}$ at the point where $x = 1$.

$f'(1) = 0$ $f'(1) = 2$

$Y = 2$

b. Use your approximation to estimate $f(1.1)$, $f(1.11)$, $f(0.9)$.

$f(1.1) \approx Y(1.1) = 2$, $f(1.11) \approx Y(1.11) = 2$, $f(0.9) \approx Y(0.9) = 2$

4. a. Find the local linear approximation of $f(x) = \ln(x+1)$ at the point where $x = 0$.

$f'(0) = 1$ $f(0) = 0$

$Y = x$

b. Use your approximation to estimate $f(0.1)$, $f(0.11)$, $f(-.1)$.

$f(0.1) \approx Y(0.1) = 0.1$, $f(0.11) \approx Y(0.11) = 0.11$

$f(-.11) \approx Y(-.1) = -.1$

5. a. Find the local linear approximation of $f(x) = \tan x$ at the point where $x = \pi$.

$f'(\pi) = 1$ $\qquad f(\pi) = 0$

$y = x - \pi$

b. Use your approximation to estimate $f(3.1), f(3.2), f(3.3)$.

$f(3.1) \approx y(3.1) \approx -.0416$, $f(3.2) \approx y(3.2) \approx 0.584$

$f(3.3) \approx y(3.3) \approx 0.158$

6. a. Find the local linear approximation of $f(x) = e^x$ at the point where $x = 1$.

$f'(1) = e$ $\qquad f(1) = e$

$y = e(x-1) + e$ $\qquad y = x$

b. Use your approximation to estimate $f(.9), f(.99), f(1.1)$.

$f(0.9) \approx y(0.9) = 0.9$, $f(0.99) \approx y(0.99) = 0.99$

$f(1.1) \approx y(1.1) = 1.1$

Recall $dy = f'(x)\,dx$ and $\Delta y = f(x + \Delta x) - f(x)$

7. Find dy and Δy for $f(x) = 3x^4 - 5x$ at $x = 2$ and $dx = \Delta x = .01$.

8. Find dy and Δy for $f(x) = 2x^3 - x^2$ at $x = -2$ and $dx = \Delta x = .01$.

9. Find dy and Δy for $f(x) = \dfrac{-1}{x^2}$ at $x = 1$ and $dx = \Delta x = .01$.

10. Find dy and Δy for $f(x) = \sqrt{x}$ at $x = 4$ and $dx = \Delta x = -.01$.