

MAT4-120 Calculus of a Single Variable II

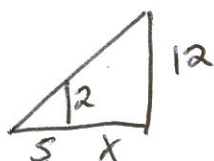
Team Quiz 3 December 3, 2015

Solution

name and team number

You must show your work for full credit on this quiz.

1. (4 pts.) Suppose a child who is 2 feet tall is running towards a street light (at night) that is 12 feet tall at a rate of 3 ft. per second. When the child is 12 feet from the light, how fast is the child's shadow shortening? Draw and label a picture as part of your solution.



$$\frac{s}{2} = \frac{x+s}{12}$$

$$12s = 2x + 2s$$

$$10s = 2x$$

$$5s = x$$

$$5s' = x'$$

$$s' = \frac{3}{5}$$

2. (4 pts.) Given an initial guess of $x_0 = 1$ compute one iterate using Newton's method to approximate the root of the function $f(x) = x^5 + 4x - 3$ on the interval $[0,1]$. Compare your answer to the solution given by your calculator.

$$x_0 = 1 \quad x_1 = x_0 - \frac{f(x_0)}{f'(x_0)} \quad f'(x) = 5x^4 + 4$$

$$x_1 = 1 - \frac{2}{9} = \frac{7}{9}$$

$$f(1) = 2$$

$$f'(1) = 9$$

$$.70611491577415 = .7$$

3. (4 pts.) Give the linear and quadratic Taylor polynomial approximations to the function $f(x) = \ln x$ at base point $a = 1$. Show all your work.

$$p_1(x) = 0 + 1 \cdot (x-1)$$

$$p_2(x) = (x-1) + \frac{-1(x-1)^2}{2}$$

$$f(x) = \ln x$$

$$f(1) = 0$$

$$f'(x) = \frac{1}{x}$$

$$f'(1) = 1$$

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

$$f''(1) = -1$$