Calculus 1 Workbook

Derivative theorems

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MEAN VALUE THEOREM

1. Find the value(s) of c that satisfy the Mean Value Theorem for the function in the interval $[1,5]$.

$$f(x) = x^3 - 9x^2 + 24x - 18$$

2. Find the value(s) of c that satisfy the Mean Value Theorem for the function in the interval $[1,4]$.

$$g(x) = \frac{x^2 - 9}{3x}$$

3. Find the value(s) of c that satisfy the Mean Value Theorem for the function in the interval $[0,5]$.

$$h(x) = -\sqrt{25 - 5x}$$

ROLLE'S THEOREM

1. Use Rolle's Theorem to show that the function has a horizontal tangent line in the interval $[-1,2]$. Find the value(s) of c in the interval that satisfy Rolle's Theorem.

$$f(x) = x^3 - 2x^2 - x - 3$$

2. Use Rolle's Theorem to show that the function has a horizontal tangent line in the interval $[-3,5]$. Find the value(s) of c in the interval that satisfy Rolle's Theorem.

$$g(x) = \frac{x^2 - 2x - 15}{6 - x}$$

3. Use Rolle's Theorem to show that the function has a horizontal tangent line in the interval $[-\pi/2,\pi/2]$. Find the value(s) of c in the interval that satisfy Rolle's Theorem.

$$h(x) = \sin(2x)$$

NEWTON'S METHOD

■ 1. Use four iterations of Newton's method to approximate the root of $g(x) = x^3 - 12$ in the interval $[1,3]$. Give the answer to the nearest three decimal places.

■ 2. Use four iterations of Newton's method to approximate the root of $f(x) = x^4 - 15$ in the interval $[-2, -1]$. Give the answer to the nearest four decimal places.

■ 3. Use four iterations of Newton's method to approximate the root of $h(x) = 3e^{x-3} - 4 + \sin x$ in the interval $[2,4]$. Give the answer to the nearest four decimal places.

L'HOSPITAL'S RULE

■ 1. Use L'Hospital's Rule to evaluate the limit.

$$\lim_{x \to 0} \frac{2\sqrt{x+4} - 4 - \frac{1}{2}x}{x^2}$$

■ 2. Use L'Hospital's Rule to evaluate the limit.

$$\lim_{x \to \frac{\pi}{2}} \frac{\sec x}{3 + \tan x}$$

■ 3. Use L'Hospital's Rule to evaluate the limit.

$$\lim_{x \to \infty} \frac{\ln x}{4\sqrt{x}}$$

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