

Multiple Choice

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

KEY

Non-Calculator

$$f'(2) = \frac{1(4) - 2}{(2-1)^2} = 2$$

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

1. What is the instantaneous rate of change at $x = 2$ of the function f given by $f(x) = \frac{x^2-2}{x-1}$?

D

(A) -2

(B) $\frac{1}{6}$

(C) $\frac{1}{2}$

(D) 2

(E) 6

Calculator

$$f'(x) = 6e^{2x}$$

$$g'(x) = 18x^2 \text{ intersect}$$

C

2. Let f be a function given by $f(x) = 3e^{2x}$ and let g be the function given by $g(x) = 6x^3$. At what value of x do the graphs of f and g have parallel tangent lines?

(A) -0.701

(B) -0.567

(C) -0.391

(D) -0.302

(E) -0.258

C

3. Let f be the function defined by $f(x) = x + \ln x$. What is the value of c for which the instantaneous rate of change of f at $x = c$ is the same as the average rate of change of f over $[1, 4]$?

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

$$\text{avg} = \frac{f(4) - f(1)}{4 - 1} = 1.462$$

(A) 0.456

(B) 1.244

(C) 2.164

(D) 2.342

(E) 2.452

A

4. Let f be a function given by $f(x) = 2e^{4x^2}$. For what value of x is the slope of the line tangent to the graph of f at $(x, f(x))$ equal to 3?

$$1 + \frac{1}{x} = A \text{ intersect}$$

$$f'(x) = 2e^{4x^2} \cdot 8x = 3$$

(A) 0.168

(B) 0.276

(C) 0.318

(D) 0.342

(E) 0.551

A

5. Let $f(x) = \sqrt{x}$. If the rate of change of f at $x = c$ is twice its rate of change at $x = 1$, then $c =$

(A) $\frac{1}{4}$

(B) 1

(C) 4

(D) $\frac{1}{\sqrt{2}}$

(E) $\frac{1}{2\sqrt{2}}$

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

$$f'(c) = \frac{1}{2\sqrt{c}}$$

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

$$\frac{1}{2\sqrt{c}} = 1$$

$$2\sqrt{c} = 1$$

$$\sqrt{c} = \frac{1}{2}$$

$$c = \frac{1}{4}$$

2004 AB/BC 1

1. Traffic flow is defined as the rate at which cars pass through an intersection, measured in cars per minute. The traffic flow at a particular intersection is modeled by the function F defined by

$$F(t) = 82 + 4 \sin\left(\frac{t}{2}\right) \text{ for } 0 \leq t \leq 30,$$

where $F(t)$ is measured in cars per minute and t is measured in minutes.

- (a) To the nearest whole number, how many cars pass through the intersection over the 30-minute period?

(b) Is the traffic flow increasing or decreasing at $t = 7$? Give a reason for your answer.
rate

- (c) What is the average value of the traffic flow over the time interval $10 \leq t \leq 15$? Indicate units of measure.

(d) What is the average rate of change of the traffic flow over the time interval $10 \leq t \leq 15$? Indicate units of measure.

b) $F'(7) = -1.872$ or -1.873 decreasing b/c $F'(7)$ is neg.

d) $\frac{F(15) - F(10)}{15 - 10} = 1.517$ or 1.518 cars/min²
2004 Form B AB 2

2. For $0 \leq t \leq 31$, the rate of change of the number of mosquitoes on Tropical Island at time t days is modeled by $R(t) = 5\sqrt{t} \cos\left(\frac{t}{5}\right)$ mosquitoes per day. There are 1000 mosquitoes on Tropical Island at time $t = 0$.

- (a) Show that the number of mosquitoes is increasing at time $t = 6$.

(b) At time $t = 6$, is the number of mosquitoes increasing at an increasing rate, or is the number of mosquitoes increasing at a decreasing rate? Give a reason for your answer.
(not rate)

- (c) According to the model, how many mosquitoes will be on the island at time $t = 31$? Round your answer to the nearest whole number.

- (d) To the nearest whole number, what is the maximum number of mosquitoes for $0 \leq t \leq 31$? Show the analysis that leads to your conclusion.

a) $R(6) = 4.437$ or 4.438 Since $R(6)$ is pos, the # of mosquitoes is increasing

b) $R'(6) = -1.913$
Since $R'(6)$ is negative, # of mosquitoes is inc at a dec rate