

Key

Multiple Choice

Non-Calculator

$$f'(x) = (x-1)(2x) - (x^2-2)(1)$$

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

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

- (A) -2
- (B) $\frac{1}{6}$
- (C) $\frac{1}{2}$
- (D) 2
- (E) 6

Calculator

$$f'(x) = 3e^{2x} \cdot 2 = 6e^{2x}$$

$$g'(x) = 18x^2$$

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

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 $[1, 4]$?

- (A) 0.456
- (B) 1.244
- (C) 2.164
- (D) 2.342
- (E) 2.452

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? $f'(x) = 2e^{4x^2} \cdot 8x = 16xe^{4x^2} = 3$

- (A) 0.168
- (B) 0.276
- (C) 0.318
- (D) 0.342
- (E) 0.551

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

$$3) \frac{f(4) - f(1)}{4 - 1} = \frac{4 + \ln 4 - (1 + \ln 1)}{3} = \frac{4 + \ln 4 - 1}{3} = \frac{3 + \ln 4}{3}$$

$$f'(x) = 1 + \frac{1}{x} = \frac{3 + \ln 4}{3}$$

$$5) f'(x) = \frac{1}{2\sqrt{x}} = 2\left(\frac{1}{2}\right)$$

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

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

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

$$\left(\sqrt{x}\right)^2 = \left(\frac{1}{2}\right)^2 \quad x = \frac{1}{4}$$

The multiple choice answers are 1D, 2C, 3C, 4A, 5A

1.

- (b) $F'(7) = -1.872$ or -1.873
Since $F'(7) < 0$, the traffic flow is decreasing at $t = 7$.

1 : answer with reason

(d) $\frac{F(15) - F(10)}{15 - 10} = 1.517$ or 1.518 cars/min²

1 : answer

2.

- (a) Since $R(6) = 4.438 > 0$, the number of mosquitoes is increasing at $t = 6$.

1 : shows that $R(6) > 0$

- (b) $R'(6) = -1.913$
Since $R'(6) < 0$, the number of mosquitoes is increasing at a decreasing rate at $t = 6$.

2 : $\begin{cases} 1 : \text{considers } R'(6) \\ 1 : \text{answer with reason} \end{cases}$