

1. $\lim_{x \rightarrow 2} \frac{x^2 + x - 6}{x^2 - 4}$ is

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

(B) 0

(C) 1

(D) $\frac{5}{4}$

(E) nonexistent

$$\frac{2x+1}{2x} \rightarrow \frac{5}{4}$$

2. If $f(x) = x^3 - x^2 + x - 1$, then $f'(2) =$

- (A) 10 (B) 9 (C) 7 (D) 5 (E) 3

$$f'(x) = 3x^2 - 2x + 1$$

$$\begin{aligned} f'(2) &= 12 - 4 + 1 \\ &= 9 \end{aligned}$$

3. Which of the following definite integrals has the same value as $\int_0^4 xe^{x^2} dx$?

(A) $\frac{1}{2} \int_0^4 e^u du$

(B) $\frac{1}{2} \int_0^{16} e^u du$

(C) $2 \int_0^2 e^u du$

(D) $2 \int_0^4 e^u du$

(E) $2 \int_0^{16} e^u du$

$$u = x^2$$

$$du = 2x dx$$

$$\frac{1}{2} du = x dx$$

$$x=0 \quad u=0$$

$$x=4 \quad u=16$$

$$\frac{1}{2} \int_0^{16} e^u du$$

4. Which of the following is an equation of the line tangent to the graph of $x^2 - 3xy = 10$ at the point $(1, -3)$?

(A) $y + 3 = -11(x - 1)$

(B) $y + 3 = -\frac{7}{3}(x - 1)$

(C) $y + 3 = \frac{1}{3}(x - 1)$

(D) $y + 3 = \frac{7}{3}(x - 1)$

(E) $y + 3 = \frac{11}{3}(x - 1)$

$$2x - 3\left[x \frac{dy}{dx} + y\right] = 0$$

$$2x - 3x \frac{dy}{dx} - 3y = 0$$

$$\frac{dy}{dx} = \frac{3y - 2x}{-3x}$$

$$y + 3 = \frac{11}{3}(x - 1)$$

$$\frac{-9 - 2}{-3}$$
$$\frac{11}{3}$$

5. If g is the function given by $g(x) = \frac{1}{3}x^3 + \frac{3}{2}x^2 - 70x + 5$, on which of the following intervals is g decreasing?

(A) $(-\infty, -10)$ and $(7, \infty)$

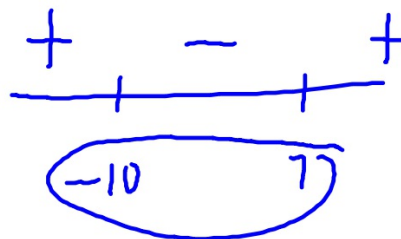
(B) $(-\infty, -7)$ and $(10, \infty)$

(C) $(-\infty, 10)$

(D) $(-10, 7)$

(E) $(-7, 10)$

$$g'(x) = x^2 + 3x - 70$$
$$(x+10)(x-7)$$
$$x = -10 \quad x = 7$$



6. $\int_2^4 \frac{dx}{5-3x} =$

- (A) $-\ln 7$ (B) $-\frac{\ln 7}{3}$ (C) $\frac{\ln 7}{3}$ (D) $\ln 7$ (E) $3\ln 7$

$$u = 5 - 3x$$

$$-\frac{1}{3} \ln |5 - 3x| \Big|_2^4$$

$$\left(-\frac{1}{3} \ln 7\right) - \left(-\frac{1}{3} \ln 1\right)$$

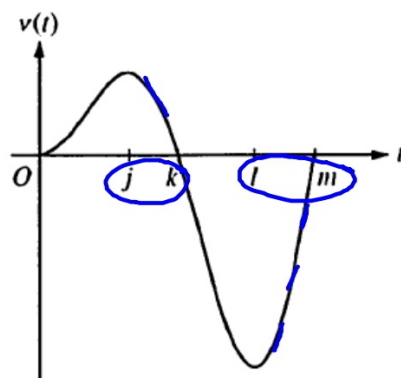
7. Let f be the function given by $f(x) = x^3 - 6x^2 + 8x - 2$. What is the instantaneous rate of change of f at $x = 3$?

- (A) -5 (B) $-\frac{15}{4}$ (C) -1 (D) 6 (E) 17

$$f'(x) = 3x^2 - 12x + 8$$

$$f'(3) = 27 - 36 + 8$$

$$= -1$$



$v' = a$
 accel is 'slope
 of graph of v

8. A particle moves along a straight line. The graph of the particle's velocity $v(t)$ at time t is shown above for $0 \leq t \leq m$, where j , k , l , and m are constants. The graph intersects the horizontal axis at $t = 0$, $t = k$, and $t = m$ and has horizontal tangents at $t = j$ and $t = l$. For what values of t is the speed of the particle decreasing?

(A) $j \leq t \leq l$

(B) $k \leq t \leq m$

(C) $j \leq t \leq k$ and $l \leq t \leq m$

(D) $0 \leq t \leq j$ and $k \leq t \leq l$

(E) $0 \leq t \leq j$ and $l \leq t \leq m$

9. Let f be the function given by $f(x) = \frac{(x-2)^2(x+3)}{(x-2)(x+1)}$. For which of the following values of x is f not continuous?

(A) -3 and -1 only

(B) -3 , -1 , and 2

(C) -1 only

(D) -1 and 2 only

(E) 2 only

2 -1

10. A particle moves along the x -axis with velocity given by $v(t) = 3t^2 - 4$ for time $t \geq 0$. If the particle is at position $x = -2$ at time $t = 0$, what is the position of the particle at time $t = 3$?

(A) 13

(B) 15

(C) 16

(D) 17

(E) 25

$$-2 + \int_0^3 [3t^2 - 4] dt$$

$$-2 + [t^3 - 4t]_0^3$$

$$-2 + [(27 - 12) - (0)]$$

$$-2 + 15$$

$$(13)$$

11. Let f be the function defined by $f(x) = \int_0^x (2t^3 - 15t^2 + 36t) dt$. On which of the following intervals is the graph of $y = f(x)$ concave down?

(A) $(-\infty, 0)$ only

(B) $(-\infty, 2)$

(C) $(0, \infty)$

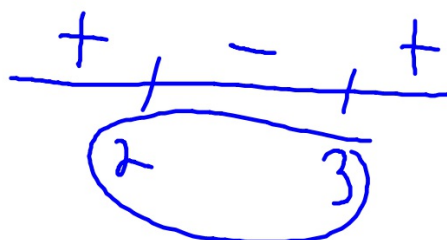
(D) $(2, 3)$ only

(E) $(3, \infty)$ only

$$f'(x) = 2x^3 - 15x^2 + 36x$$

$$f''(x) = 6x^2 - 30x + 36$$

$$x^2 - 5x + 6$$
$$(x-3)(x-2)$$
$$x=3 \quad x=2$$



12. For which of the following does $\lim_{x \rightarrow \infty} f(x) = 0$?

I. $f(x) = \frac{\ln x}{x^{99}}$

II. ~~$f(x) = \frac{e^x}{\ln x}$~~

III. $f(x) = \frac{x^{99}}{e^x}$

(A) I only

(B) II only

(C) III only

(D) I and II only

(E) I and III only

$\frac{N}{D} \leftarrow$ grow faster

$$\frac{\cancel{X} \text{ qqqqqqqq}}{e^x} \rightarrow 0$$