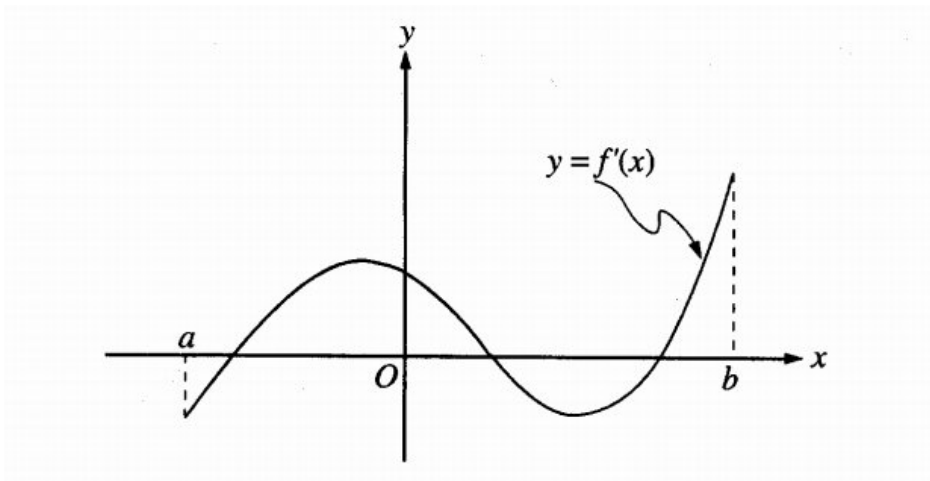


Complete all the following on notebook paper.

_____ 1.



The graph of f' , the derivative of f , is shown in the figure above. Which of the following describes all relative extrema of f on the open interval (a,b) ?

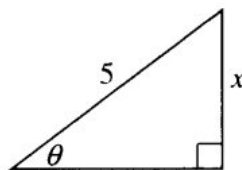
- (A) One relative maximum and two relative minima
- (B) Two relative maxima and one relative minimum
- (C) Three relative maxima and one relative minimum
- (D) One relative maximum and three relative minima
- (E) Three relative maxima and two relative minima

_____ 2.

A particle moves along the x -axis so that its acceleration at any time t is $a(t) = 2t - 7$. If the initial velocity of the particle is 6, at what time t during the interval $0 \leq t \leq 4$ is the particle farthest to the right?

- (A) 0
- (B) 1
- (C) 2
- (D) 3
- (E) 4

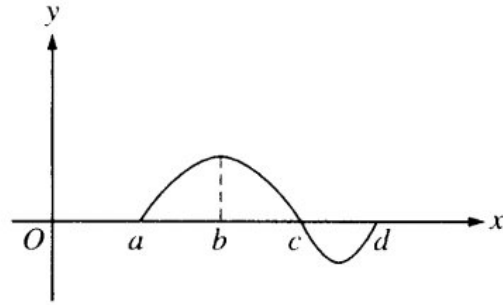
_____ 3.



In the triangle shown above, if θ increases at a constant rate of 3 radians per minute, at what rate is x increasing in units per minute when x equals 3 units?

- (A) 3
- (B) $\frac{15}{4}$
- (C) 4
- (D) 9
- (E) 12

4.



The graph of f is shown in the figure above. If $g(x) = \int_a^x f(t) dt$, for what value of x does $g(x)$ have a maximum?

- (A) a
- (B) b
- (C) c
- (D) d
- (E) It cannot be determined from the information given.

5.

The closed interval $[a, b]$ is partitioned into n equal subintervals, each of width Δx , by the numbers x_0, x_1, \dots, x_n where $a = x_0 < x_1 < x_2 < \dots < x_{n-1} < x_n = b$. What is $\lim_{n \rightarrow \infty} \sum_{i=1}^n \sqrt{x_i} \Delta x$?

- (A) $\frac{2}{3} \left(b^{\frac{3}{2}} - a^{\frac{3}{2}} \right)$
- (B) $b^{\frac{3}{2}} - a^{\frac{3}{2}}$
- (C) $\frac{3}{2} \left(b^{\frac{3}{2}} - a^{\frac{3}{2}} \right)$
- (D) $b^{\frac{1}{2}} - a^{\frac{1}{2}}$
- (E) $2 \left(b^{\frac{1}{2}} - a^{\frac{1}{2}} \right)$

_____ 6.

When the region enclosed by the graphs of $y = x$ and $y = 4x - x^2$ is revolved about the y -axis, the volume of the solid generated is given by

- (A) $\pi \int_0^3 (x^3 - 3x^2) dx$
- (B) $\pi \int_0^3 \left(x^2 - (4x - x^2)^2 \right) dx$
- (C) $\pi \int_0^3 (3x - x^2)^2 dx$
- (D) $2\pi \int_0^3 (x^3 - 3x^2) dx$
- (E) $2\pi \int_0^3 (3x^2 - x^3) dx$

_____ 7.

$\lim_{h \rightarrow 0} \frac{\ln(e+h) - 1}{h}$ is

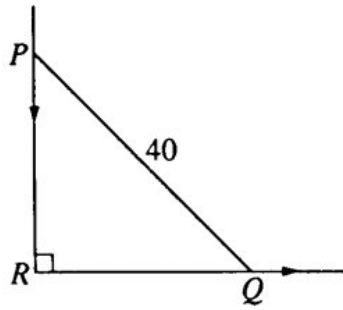
- (A) $f'(e)$, where $f(x) = \ln x$
- (B) $f'(e)$, where $f(x) = \frac{\ln x}{x}$
- (C) $f'(1)$, where $f(x) = \ln x$
- (D) $f'(1)$, where $f(x) = \ln(x+e)$
- (E) $f'(0)$, where $f(x) = \ln x$

_____ 8.

Consider all right circular cylinders for which the sum of the height and circumference is 30 centimeters. What is the radius of the one with maximum volume?

- (A) 3 cm
- (B) 10 cm
- (C) 20 cm
- (D) $\frac{30}{\pi^2}$ cm
- (E) $\frac{10}{\pi}$ cm

9.



In the figure above, PQ represents a 40-foot ladder with end P against a vertical wall and end Q on level ground. If the ladder is slipping down the wall, what is the distance RQ at the instant when Q is moving along the ground $\frac{3}{4}$ as fast as P is moving down the wall?

- (A) $\frac{6}{5}\sqrt{10}$ (B) $\frac{8}{5}\sqrt{10}$ (C) $\frac{80}{\sqrt{7}}$ (D) 24 (E) 32

10.

Let $f(x) = \int_{-2}^{x^2-3x} e^{t^2} dt$. At what value of x is $f(x)$ a minimum?

- (A) For no value of x (B) $\frac{1}{2}$ (C) $\frac{3}{2}$ (D) 2 (E) 3

11. 2002—AB3 (Calculator Permitted)

An object moves along the x -axis with initial position $x(0) = 2$. The velocity of the object at time $t \geq 0$ is given by $v(t) = \sin\left(\frac{\pi}{3}t\right)$.

- (a) What is the acceleration of the object at time $t = 4$?
 (b) Consider the following two statements.

Statement I: For $3 < t < 4.5$, the velocity of the object is decreasing.

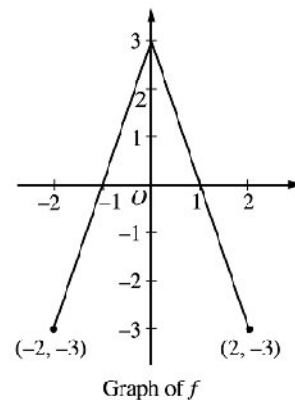
Statement II: For $3 < t < 4.5$, the speed of the object is increasing.

Are either or both of these statements correct? For each statement provide a reason why it is correct or not correct.

- (c) What is the total distance traveled by the object over the time interval $0 \leq t \leq 4$?
 (d) What is the position of the object at time $t = 4$?

12. 2002—AB4 (No Calculator)

The graph of the function f shown above consists of two line segments. Let g be the function given by $g(x) = \int_0^x f(t)dt$.



- (a) Find $g(-1)$, $g'(1)$, and $g''(-1)$.
 (b) For what values of x in the open interval $(-2, 2)$ is g increasing? Explain your reasoning.
 (c) For what values of x in the open interval $(-2, 2)$ is the graph of g concave down? Explain your reasoning.
 (d) On the axes provided, sketch the graph of g on the closed interval $[-2, 2]$.