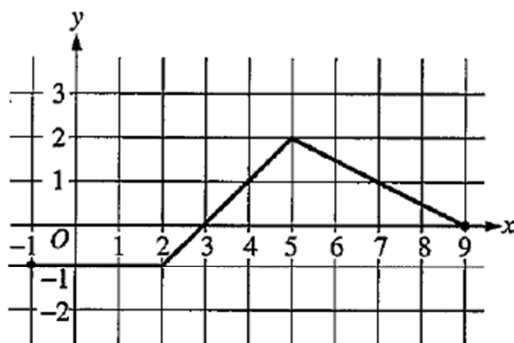
Graph of f

76. The function f , whose graph is shown above, is defined on the interval $-2 \leq x \leq 2$. Which of the following statements about f is false?

- (A) f is continuous at $x = 0$.
- (B) f is differentiable at $x = 0$.
- (C) f has a critical point at $x = 0$.
- (D) f has an absolute minimum at $x = 0$.
- (E) The concavity of the graph of f changes at $x = 0$.

77. Let f and g be the functions given by $f(x) = e^x$ and $g(x) = x^4$. On what intervals is the rate of change of $f(x)$ greater than the rate of change of $g(x)$?

- (A) $(0.831, 7.384)$ only
- (B) $(-\infty, 0.831)$ and $(7.384, \infty)$
- (C) $(-\infty, -0.816)$ and $(1.430, 8.613)$
- (D) $(-0.816, 1.430)$ and $(8.613, \infty)$
- (E) $(-\infty, \infty)$

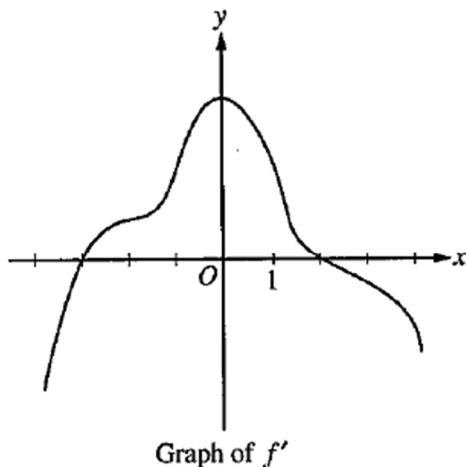
Graph of f

78. The graph of the piecewise linear function f is shown above. What is the value of $\int_{-1}^9 (3f(x) + 2) dx$?

- (A) 7.5 (B) 9.5 (C) 27.5 (D) 47 (E) 48.5

79. Let f be a function having derivatives of all orders for $x > 0$ such that $f(3) = 2$, $f'(3) = -1$, $f''(3) = 6$, and $f'''(3) = 12$. Which of the following is the third-degree Taylor polynomial for f about $x = 3$?

- (A) $2 - x + 6x^2 + 12x^3$
 (B) $2 - x + 3x^2 + 2x^3$
 (C) $2 - (x - 3) + 6(x - 3)^2 + 12(x - 3)^3$
 (D) $2 - (x - 3) + 3(x - 3)^2 + 4(x - 3)^3$
 (E) $2 - (x - 3) + 3(x - 3)^2 + 2(x - 3)^3$



80. The graph of f' , the derivative of the function f , is shown above. Which of the following statements must be true?

- I. f has a relative minimum at $x = -3$.
 II. The graph of f has a point of inflection at $x = -2$.
 III. The graph of f is concave down for $0 < x < 4$.
 (A) I only (B) II only (C) III only (D) I and II only (E) I and III only

	$0 < x < 1$	$1 < x < 2$
$f(x)$	Positive	Negative
$f'(x)$	Negative	Negative
$f''(x)$	Negative	Positive

81. Let f be a function that is twice differentiable on $-2 < x < 2$ and satisfies the conditions in the table above. If $f(x) = f(-x)$, what are the x -coordinates of the points of inflection of the graph of f on $-2 < x < 2$?

- (A) $x = 0$ only
 (B) $x = 1$ only
 (C) $x = 0$ and $x = 1$
 (D) $x = -1$ and $x = 1$
 (E) There are no points of inflection on $-2 < x < 2$.

82. What is the average value of $y = \sqrt{\cos x}$ on the interval $0 \leq x \leq \frac{\pi}{2}$?
- (A) -0.637 (B) 0.500 (C) 0.763 (D) 1.198 (E) 1.882
83. If the function f is continuous at $x = 3$, which of the following must be true?
- (A) $f(3) < \lim_{x \rightarrow 3} f(x)$
- (B) $\lim_{x \rightarrow 3^-} f(x) \neq \lim_{x \rightarrow 3^+} f(x)$
- (C) $f(3) = \lim_{x \rightarrow 3^-} f(x) = \lim_{x \rightarrow 3^+} f(x)$
- (D) The derivative of f at $x = 3$ exists.
- (E) The derivative of f is positive for $x < 3$ and negative for $x > 3$.
84. For $-1.5 < x < 1.5$, let f be a function with first derivative given by $f'(x) = e^{(x^4 - 2x^2 + 1)} - 2$. Which of the following are all intervals on which the graph of f is concave down?
- (A) $(-0.418, 0.418)$ only
- (B) $(-1, 1)$
- (C) $(-1.354, -0.409)$ and $(0.409, 1.354)$
- (D) $(-1.5, -1)$ and $(0, 1)$
- (E) $(-1.5, -1.354)$, $(-0.409, 0)$, and $(1.354, 1.5)$
85. The fuel consumption of a car, in miles per gallon (mpg), is modeled by $F(s) = 6e^{\left(\frac{s}{20} - \frac{s^2}{2400}\right)}$, where s is the speed of the car, in miles per hour. If the car is traveling at 50 miles per hour and its speed is changing at the rate of 20 miles/hour², what is the rate at which its fuel consumption is changing?
- (A) 0.215 mpg per hour
- (B) 4.299 mpg per hour
- (C) 19.793 mpg per hour
- (D) 25.793 mpg per hour
- (E) 515.855 mpg per hour

86. If $f'(x) > 0$ for all real numbers x and $\int_4^7 f(t) dt = 0$, which of the following could be a table of values for the function f ?

(A)

x	$f(x)$
4	-4
5	-3
7	0

(B)

x	$f(x)$
4	-4
5	-2
7	5

(C)

x	$f(x)$
4	-4
5	6
7	3

(D)

x	$f(x)$
4	0
5	0
7	0

(E)

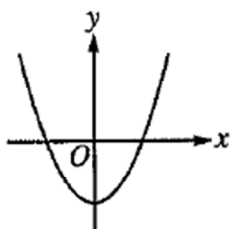
x	$f(x)$
4	0
5	4
7	6

87. Let R be the region in the first quadrant bounded above by the graph of $y = \ln(3 - x)$, for $0 \leq x \leq 2$. R is the base of a solid for which each cross section perpendicular to the x -axis is a square. What is the volume of the solid?

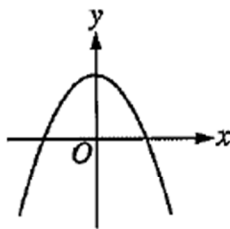
- (A) 0.442 (B) 1.029 (C) 1.296 (D) 3.233 (E) 4.071

88. The derivative of a function f is increasing for $x < 0$ and decreasing for $x > 0$. Which of the following could be the graph of f ?

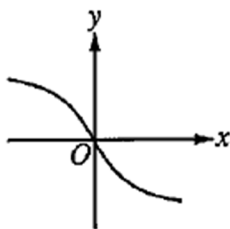
(A)



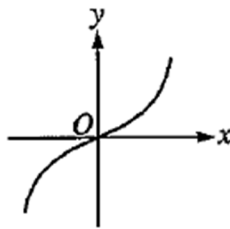
(B)



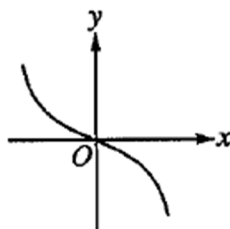
(C)



(D)



(E)



89. A particle moves along a line so that its acceleration for $t \geq 0$ is given by $a(t) = \frac{t+3}{\sqrt{t^3+1}}$. If the particle's velocity at $t = 0$ is 5, what is the velocity of the particle at $t = 3$?

(A) 0.713

(B) 1.134

(C) 6.134

(D) 6.710

(E) 11.710

90. If the series $\sum_{n=1}^{\infty} a_n$ converges and $a_n > 0$ for all n , which of the following must be true?

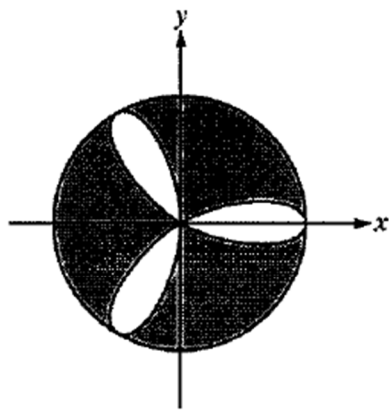
(A) $\lim_{n \rightarrow \infty} \left| \frac{a_{n+1}}{a_n} \right| = 0$

(B) $|a_n| < 1$ for all n

(C) $\sum_{n=1}^{\infty} a_n = 0$

(D) $\sum_{n=1}^{\infty} na_n$ diverges.

(E) $\sum_{n=1}^{\infty} \frac{a_n}{n}$ converges.



91. The figure above shows the graphs of the polar curves $r = 2\cos(3\theta)$ and $r = 2$. What is the sum of the areas of the shaded regions?

(A) 0.858 (B) 3.142 (C) 8.566 (D) 9.425 (E) 15.708

92. The function h is differentiable, and for all values of x , $h(x) = h(2 - x)$. Which of the following statements must be true?

I. $\int_0^2 h(x) dx > 0$

II. $h'(1) = 0$

III. $h'(0) = h'(2) = 1$

- (A) I only
 (B) II only
 (C) III only
 (D) II and III only
 (E) I, II, and III

25. $\int_1^{\infty} xe^{-x^2} dx$ is

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

26. What is the slope of the line tangent to the polar curve $r = 1 + 2\sin \theta$ at $\theta = 0$?

(A) 2 (B) $\frac{1}{2}$ (C) 0 (D) $-\frac{1}{2}$ (E) -2

27. For what values of p will both series $\sum_{n=1}^{\infty} \frac{1}{n^{2p}}$ and $\sum_{n=1}^{\infty} \left(\frac{p}{2}\right)^n$ converge?

(A) $-2 < p < 2$ only

(B) $-\frac{1}{2} < p < \frac{1}{2}$ only

(C) $\frac{1}{2} < p < 2$ only

(D) $p < \frac{1}{2}$ and $p > 2$

(E) There are no such values of p .

28. Let g be a continuously differentiable function with $g(1) = 6$ and $g'(1) = 3$. What is $\lim_{x \rightarrow 1} \frac{\int_1^x g(t) dt}{g(x) - 6}$?

(A) 0

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

(C) 1

(D) 2

(E) The limit does not exist.