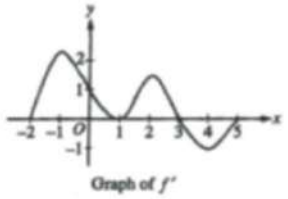
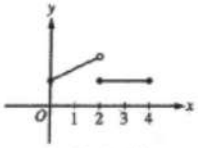
1.) The graph of f', the derivative of f, is shown for $-2 \le x \le 5$.
On what intervals is f increasing? (ME#76)

(A) $[-2,1]$ only (B) [-2,3] (C) [3, 5] only

(D) [0, 1.5] and [3, 5] (E) [-2,-1], [1,2], and [4,5]



Graph of f'



Graph of f

2.) The figure shows the graph of a function f with domain $0 \le x \le 4$.
Which of the following statements are true? (ME#77)

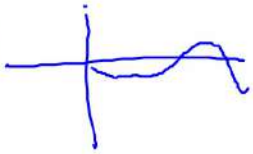
I. $\lim_{x \to 2^-} f(x)$ exists. II. $\lim_{x \to 2^+} f(x)$ exists. III. $\lim_{x \to 2} f(x)$ exists.

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

3.) The first derivative of the function f is defined by $f'(x) = \sin(x^3 - x)$ for $0 \le x \le 2$. On what intervals is f increasing? (ME#78)

(A) $1 \le x \le 1.445$ only (B) $1 \le x \le 1.691$ (C) $1.445 \le x \le 1.875$

(D) $0.577 \le x \le 1.445$ and $1.875 \le x \le 2$ (E) $0 \le x \le 1$ and $1.691 \le x \le 2$



4.) The derivative of the function f is given by $f'(x) = x^2 \cos(x^2)$. How many points of inflection does the graph of f have on the open interval (-2,2) ? (ME#80)

(A) One (B) Two (C) Three (D) Four (E) Five

5.) If $\int_{-5}^{2} f(x)dx = -17$ and $\int_{5}^{2} f(x)dx = -4$, what is the value of $\int_{-5}^{5} f(x)dx$? (ME#79)

(A) -21 (B) -13 (C) 0 (D) 13 (E) 21

$$\int_{-5}^{2} f(x)dx + \int_{2}^{5} f(x)dx = -17 + 4 = -13$$

6.) If $G(x)$ is an antiderivative for $f(x)$ and $G(2) = -7$, then $G(4) =$ (ME #81)

(A) $f'(4)$ (B) $-7 + f'(4)$ (C) $\int_2^4 f(t)\,dt$ (D) $\int_2^4 (-7 + f(t))\,dt$ (E) $-7 + \int_2^4 f(t)\,dt$

$$-7 + \int_2^4 f(t)dt = G(4) \qquad \int_2^4 f(t)dt = G(4) - G(2)$$

7.) A particle moves along a straight line with velocity given by $v(t) = 7 - (1.01)^{-t^2}$ at time $t \geq 0$. What is the acceleration of the particle at time $t = 3$? (ME#82)

(A) -0.914 (B) 0.055 (C) 5.486 (D) 6.086 (E) 18.087

$Y_1 = 7 - (1.01)^{(-t^2)}$

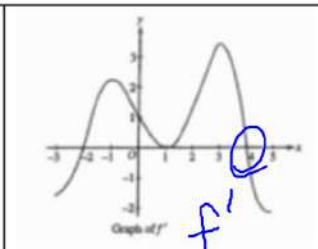
8.) What is the area enclosed by the curves $y = x^3 - 8x^2 + 18x - 5$ and $y = x + 5$? (ME#83)

(A) 10.667 (B) 11.833 (C) 14.583 (D) 21.333 (E) 32

9.) The graph of the derivative of a function f is shown in the figure. The graph has horizontal tangent lines at $x = -1$, $x = 1$, and $x = 3$. At which of the following values of x does f have a relative maximum? (ME #84)

(A) -2 only (B) 1 only (C) 4 only

(D) -1 and 3 only (E) -2, 1, and 4



f'

x	−4	−3	−2	−1
$f(x)$	0.75	−1.5	−2.25	−1.5
$f'(x)$	−3	−1.5	0	1.5

10.) The table gives values of a function f and its derivative f' at selected values of x. If f' is continuous on the interval [-4. -1], what is the value of $\int_{-4}^{-1} f'(x)\,dx$? (ME#85)

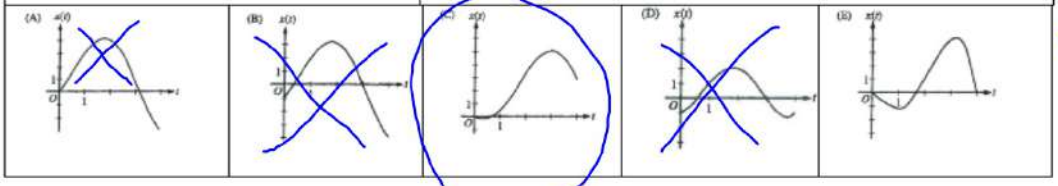
(A) -4.5 (B) -2.25 (C) 0 (D) 2.25 (E) 4.5

$\int_{-4}^{-1} f'(x)\,dx = f(-1) - f(-4)$

$-1.5 - .75$

t	0	1	2	3	4
$v(t)$	−1	2	3	0	−4

11.) The table gives selected values of the velocity, $v(t)$, of a particle moving along the x-axis. At time $t = 0$, the particle is at the origin. Which of the following could be the graph of the position, $x(t)$, of the particle for $0 \leq t \leq 4$? (ME#86)



$x(0) = 0$

12.) An object traveling in a straight line has position $x(t)$ at time t. If the initial position is $x(0) = 2$ and the velocity of the object is $v(t) = \sqrt[3]{1 + t^2}$, what is the position of the object at time $t = 3$? (ME#87)

(A) 0.431 (B) 2.154 (C) 4.512 (D) 6.512 (E) 17.408

$\int_0^3 v(t)\,dt = x(3) - x(0)$

$4.5115 = x(3) - 2$

13.) What is the average value of $y = \dfrac{\cos x}{x^2 + x + 2}$ on the closed interval [-1, 3] ? (ME#91)

A) -0.085 (B) 0.090 (C) 0.183 (D) 0.244 (E) 0.732

$\frac{1}{(3 - -1)} \int_{-1}^{3} y\,dx$

14.) The radius of a sphere is decreasing at a rate of 2 centimeters per second. At the instant when the radius of the sphere is 3 centimeters, what is the rate of change, in square centimeters per second, of the surface area of the sphere? (The surface area S of a sphere with radius r is $S = 4\pi r^2$.) (ME #88)

(A) -108π	(B) -72π	(E) -16π
(C) -48π	(D) -24π	

$S = 4\pi r^2$ $\quad \frac{dr}{dt} = -2\frac{cm}{s}$

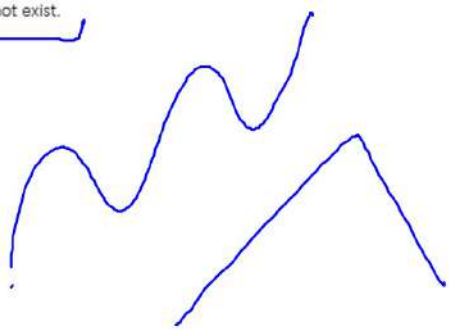
$\frac{dS}{dt} = 4\pi 2r \frac{dr}{dt}$ $\quad r = 3\,cm$

$4\pi 2(3)(-2) = -48\pi$

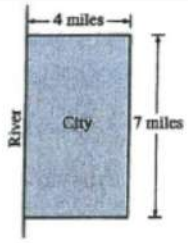
15.) The function f is continuous for $-2 \le x \le 2$ and $f(-2) = f(2) = 0$. If there is no c, where $-2 < c < 2$, for which $f'(c) = 0$, which of the following statements must be true? (ME#89)

(A) For $-2 < k < 2$, $f'(k) > 0$. (B) For $-2 < k < 2$, $f'(k) < 0$. (C) For $-2 < k < 2$, $f'(k)$ *exists*.

(D) For $-2 < k < 2$, $f'(k)$ exists, but f' is not continuous. (E) For some k, where $-2 < k < 2$, $f'(k)$ does not exist.



16.) A city located beside a river has a rectangular boundary as shown in the figure above. The population density of the city at any point along a strip x miles from the river's edge is $f(x)$ persons per square mile. Which of the following expressions gives the population of the city? (ME#92)



(A)	(B)	(C)	(D)	(E)
$\int_0^4 f(x)dx$	$7\int_0^4 f(x)dx$	$28\int_0^4 f(x)dx$	$\int_0^7 f(x)dx$	$4\int_0^7 f(x)dx$

density · area

$f(x) \cdot \Delta x \cdot$ height

$\int_0^4 f(x)dx \cdot 7$

17.) The function f is continuous on the closed interval $[2, 4]$ and twice differentiable on the open interval $(2, 4)$. If $f'(3) = 2$ and $f''(x) < 0$ on the open interval $(2, 4)$, which of the following could be a table of values for f? (ME#90)

(A)

x	$f(x)$
2	2.5
3	5
4	6.5

(B)

x	$f(x)$
2	2.5
3	5
4	7

(C)

x	$f(x)$
2	3
3	5
4	6.5

(D)

x	$f(x)$
2	3
3	5
4	7

(E)

x	$f(x)$
2	3.5
3	5
4	7.5