1. The graph of $y = 3x^5 + 10x^4 + 10x^3 - 3x - 7$

(A) has points of inflection at $x = -1$ and $x = 0$

(B) is concave down on the interval $(0,\infty)$

(C) has a point of inflection at $x = -1$ only

(D) has a point of inflection at $x = 0$ only

(E) is concave up on the interval $(-\infty, -1)$

2. $$\lim_{x \to -\infty} \left(\frac{3x^2 + 1}{x} - \frac{3x^2 + x}{x + 1} \right) =$$

(A) ∞ (B) -1 (C) 2 (D) $-\infty$ (E) 0

3. The graph of $y = \dfrac{x^2 - 2x + 1}{x^2}$ most closely resembles

(A) (B) (C)

(D) (E)

4. The asymptotes of the graph of $y = \dfrac{x^3 - 3x^2 + 3x - 1}{x^2 + x - 2}$ are

(A) $x = 1$ and $y = x$

(B) $x = -2$ and $y = x - 3$

(C) $x = -2$ and $y = x - 4$

(D) $x = 1$ and $x = -2$

(E) $x = 1$, $x = -2$, and $y = x - 4$

5. An open–top tank is made of sheet metal, with a square horizontal base and four vertical sides. The total amount of metal is 300 square feet. The largest volume of water the tank could possibly hold is (in cubic feet)

(A) 472 (B) 625 (C) 750 (D) 500 (E) 468

6. The Acme Baking Company makes and sell pies. Each pie costs \$1.00 to make. Market research shows that, if the company sells its pies for x dollars each, it can sell $21 - x^2$ thousand pies per day. The socially conscious president of the company refuses to sell the pies for more than \$4.50 each. Maximum profit will be obtained by setting the price per pie at

(A) \$4.50 (B) \$4.00 (C) \$2.00 (D) \$2.50 (E) \$3.00

7. Suppose $f(x) = \sqrt{x^3 + 2x + 1}$. Linearization at $x = 1$ shows that $f(1.2)$ is approximately equal to

(A) 0.25 (B) 2.25 (C) 2.05 (D) 1.25 (E) 2.50

8. A function $y = f(x)$ has a graph as shown on the right

A solution of the differential equation $\frac{dy}{dx} = f(x)$ will have a graph resembling

(A) (B) (C)

(D) (E)

9. The acceleration of a body moving along a coordinate line is given by the equation $a = t + \frac{3}{t^2}$. When $t = 1$, its velocity is 2. When $t = 2$, its velocity is

(A) 4 (B) 5 (C) $\frac{19}{4}$ (D) 6 (E) $\frac{11}{4}$

10. A function $y = f(x)$ has a graph in the xy-plane which passes through the point $(-2, 1)$ with slope 3. If

$$\frac{d^2y}{dx^2} = 3x ,$$

then the graph also passes through the point

(A) (0, –1) (B) (0,1) (C) (0,0) (D) (0,2) (E) (0,–2)

11. The velocity of an object moving along a line is measured every two seconds, with the following results.

Time t (sec)	0	2	4	6	8
Velocity v (ft/sec)	7	5	4	5	6

From this information, one can estimate the distance traveled by the object in the 10 seconds from $t = 0$ to $t = 10$ to be approximately

(A) 540 ft (B) 270 ft (C) 54 ft (D) 360 ft (E) 27 ft

12. The area shown in the diagram

is equal to

(A) $\frac{1}{3}\left(\sqrt{2} + 1\right)$ (B) $\frac{1}{3}$ (C) $3\sqrt{2} + 3$ (D) 3 (E) $3\sqrt{2}$

13. $\int_{1}^{2} \left(x - \frac{1}{x}\right)\left(1 + \frac{1}{x^2}\right)\, dx \ =$

(A) $\frac{7}{6}$ (B) $\frac{5}{4}$ (C) $\frac{7}{8}$ (D) $\frac{9}{8}$ (E) $\frac{9}{4}$

14. It is guessed that $x_0 = 0$ is close to a solution of the equation
$2 \sin x + \pi \cos x = 0$.

The approximation to the solution given by applying Newton's method twice is x_2 =

(A) $\frac{\pi}{4} - \frac{1}{\pi}$ (B) $\frac{2}{\pi} - \frac{\pi}{2}$ (C) $2 - \pi$ (D) $4 - \pi^2$ (E) $\frac{\pi}{2} - 1$

15. If

$$h(x) = \int_0^{x^2} \sin\left(\sqrt{t}\right)\, dt \quad (x > 0),$$

then the derivative $h'(x)$ =

(A) $\frac{\sin\left(\sqrt{x}\right)}{2x}$ (B) $-2x \cos x$ (C) $2x \sin x$ (D) $\sin x$ (E) $\frac{\cos x}{x}$

16. Let P be a partition of the interval [0,1] into n parts, and let $c_1, c_2, \ldots, c_n$ be numbers chosen in the subintervals of the partition. Then

$$\lim_{\|P\| \to 0} \sum_{k=1}^{n} c_k^2 \, \Delta x_k =$$

(A) $\frac{2}{3}$ (B) $\frac{1}{2}$ (C) 0 (D) 1 (E) $\frac{1}{3}$