1. The function $f(x) = -x^5 - 5x^4 + 200$ has

(a) a relative minimum at $x = -4$

(b) a relative maximum at $x = -4$

(c) a relative maximum at $x = 4$

(d) a relative minimum at $x = 0$

(e) a relative maximum at $x = -1$

2. The function $f(x) = \dfrac{x^3 - 1}{2 - x - x^2}$ has

(a) an oblique asymptote $y = 1 - x$

(b) two vertical asymptotes $x = 1$ and $x = -2$

(c) only one vertical asymptote $x = 1$

(d) an oblique asymptote $y = x + 1$

(e) one horizontal asymptote $y = -2$.

3. The graph of the function $f(x) = x^{1/3} + 2$

(a) is concave up on $(-\infty, 0)$

(b) is concave down on $(-\infty, 0)$

(c) is concave up on $(0, \infty)$

(d) is concave down on $(-\infty, \infty)$

(e) has no inflection point

4. The dimensions of a rectangle with perimeter 100 feet and area as large as possible are

(a) $25, 25$

(b) $15, 35$

(c) $20, 30$

(d) $10, 40$

(e) $5, 45$

5. For the demand equation $p = 20 + 4q - \frac{q^2}{3}$, the number q whcih maximizes the marginal-revenue is

(a) $q = 4$

(b) $q = 8$

(c) $q = 10$

(d) $q = 12$

(e) $q = 7$

6. The function $f(x) = \frac{2x^2 + x + 12}{x + 2}$ has

(a) relative maximum at $x = -5$

(b) relative maximum at $x = 1$

(c) relative minimum at $x = -2$

(d) two relative maxima at $x = 1$ and $x = -5$

(e) two relative minima at $x = 1$ and $x = -5$

7. A cylindrical can, open at the top, is to be made from a fixed amount of material equal to 27. Suppose that r is the radius and h is the height of the cylinder. If the volume of the cylinder is maximum, then $rh =$

(a) $\frac{9}{\pi}$

(b) $\frac{7}{\pi}$

(c) 3π

(d) $\frac{\pi}{2}$

(e) $\frac{3}{\pi}$

8. Let $f(x) = \ln[1 - \ln x]$. Using differentials, the estimated value of $f(0.997)$ is

(a) 0.003

(b) -0.003

(c) -1.003

(d) 1.003

(e) -0.997

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

(a) decreasing on $(-\infty, -4)$

(b) increasing on $(-2, 1)$

(c) decreasing on $(1, \infty)$

(d) increasing on $(-1, 1)$

(e) decreasing on $(0, \infty)$

10. Let $y = e^{\sqrt{x-1}}$. Using dy to approximate Δy when x changes from 2 to 2.02, one can show that the approximate value of Δy is

(a) $\frac{e}{100}$

(b) $\frac{e}{10}$

(c) $\frac{e}{200}$

(d) $\frac{e}{20}$

(e) e

11. The sum of all critical numbers of the function

$f(x) = \dfrac{3x^2 - 5x - 1}{x - 2}$ is

(a) 4

(b) $\dfrac{2}{\sqrt{3}}$

(c) $\sqrt{3}$

(d) $\dfrac{1}{3}$

(e) 2

12. The function $f(x) = xe^{-x^2}$ on $[-1, 2]$ has

(a) absolute maximum at $x = \dfrac{1}{\sqrt{2}}$

(b) absolute minimum at $x = -1$

(c) absolute maximum at $x = 2$

(d) absolute maximum at $x = -\dfrac{1}{\sqrt{2}}$

(e) absolute maximum at $x = -1$

13. Let $f(x) = \ln\left(x^3+1\right)$. Then

(a) $\sqrt[3]{2}$ is an inflection point

(b) -1 is an inflection point

(c) f has no inflection point

(d) 0 is the only inflection point

(e) 2 and 0 are both inflection points

14. $\int \frac{(x^4+2)^2}{x^3} dx =$

(a) $\frac{x^6}{6} - \frac{2}{x^2} + 2x^2 + c$

(b) $\frac{x^6}{4} - \frac{1}{x} + 4x^2 + c$

(c) $\frac{x^6}{4} - \frac{14}{x^2} + 4x^2 + c$

(d) $\frac{x^2}{2} - \frac{1}{x} + \frac{x^6}{4} + c$

(e) $\frac{2}{x} - 4x^3 + \frac{x^6}{2} + c$

15. If $y'' = e^x - x + 10,\ y'(1) = e$ and $y(0) = 1$, then $y(1) =$

(a) $e - \frac{14}{3}$

(b) $e + \frac{1}{3}$

(c) $e - \frac{28}{3}$

(d) $e + \frac{7}{3}$

(e) $e - \frac{13}{3}$

16. $\int \left(\frac{2}{x} - \frac{e^x}{3} + \frac{1}{\sqrt{x}}\right) dx =$

(a) $\ln(x^2) - \frac{e^x}{3} + 2\sqrt{x} + c$

(b) $2\ln|x| - \frac{e^x}{3} + \sqrt{x} + c$

(c) $2\ln|x| - \frac{e^x}{3} - 2\sqrt{x} + c$

(d) $2\ln|x| - 3e^x - x + c$

(e) $\ln(x^2) - e^{x/3} + 2\sqrt{x} + c$

17. $\int x^{-2/3}\left(\frac{x^3-1}{\sqrt{x}}\right)dx =$

(a) $\frac{6}{17}x^{17/6} + 6x^{-1/6} + c$

(b) $\frac{6}{17}x^{17/6} - 6x^{-1/6} + c$

(c) $\frac{6}{17}x^{-17/6} + 6x^{-1/6} + c$

(d) $6x^{-1/6}\left(1 - \frac{x^3}{17}\right) + c$

(e) $\frac{6}{17}x^{17/6} + 6x^{1/6} + c$

18. Suppose that for a certain company total fixed costs are \$ 100 and the marginal-cost is

$$\frac{dc}{dq} = \frac{1}{q-1} + 10.$$

Then the average cost when 2 units are produced is

(a) 60

(b) 10

(c) 100

(d) 110

(e) 120