

- 1) Let  $f(x) = \frac{1}{3}x^3 + \frac{1}{2}x^2 - 6x + 8$ . The value of  $x$  for which  $f$  has a local maximum is
- a)  $-2$                       b)  $2$                       c)  $-3$                       d)  $3$                       e) none of these
- 2) A sheet of paper for a poster is to be  $18 \text{ ft}^2$  in area. The margins at the top and bottom are to be 9 inches and the margins at the sides are to be 6 inches. One of the dimensions of the sheet that would maximize the printed area in feet is
- a)  $3\sqrt{2}$                       b)  $2\sqrt{2}$                       c)  $\sqrt{3}$                       d)  $3\sqrt{3}$                       e) none of these
- 3) The price for widgets is \$30 per thousand for orders of 50,000 or less. The price decreases by 37.5 cents for each thousand above 50,000. What is the second digit in the order size that would maximize the revenue?
- a) 2                      b) 3                      c) 4                      d) 5                      e) none of these
- 4) Consider the function  $f(x) = x^4 - 6x^3 + 12x^2 - 8x$ . The slope of one of the tangent lines to the graph at one of the inflection points is
- a)  $-2$                       b)  $2$                       c)  $-\frac{1}{2}$                       d)  $\frac{1}{2}$                       e) none of these
- 5) Given  $f(x) = \sqrt{x}$  and  $f(1) = 2$ . The constant term in  $f(x)$  is
- a) 1                      b) 2                      c)  $\frac{2}{3}$                       d)  $\frac{4}{3}$                       e) none of these
- 6)  $\frac{d}{dx}(2^{4x})$  can be written as the product of two factors. One is a power of two and the other is a natural logarithm. The power of 2 contains a constant term. The constant is
- a) 0                      b) 1                      c) 2                      d) 4                      e) none of these
- 7)  $\lim_{x \rightarrow 1} \frac{x-1}{\sqrt{x^2+3}-2}$
- a) 0                      b) 1                      c)  $-1$                       d) does not exist                      e) none of these
- 8) Consider the function defined by  $y = x^2 - x + 3$ . The numerator of the  $y$ -intercept ( $b$  in lowest terms) of the line perpendicular (the normal) to the tangent line of the graph at  $(2,5)$  is
- a)  $-1$                       b)  $2$                       c)  $-5$                       d)  $5$                       e) none of these
- 9) Consider the number which exceeds its square by the greatest amount. The numerator (in lowest terms) of the absolute value of the difference of this number and its square is
- a) 1                      b) 2                      c) 4                      d) 8                      e) none of these

- 10) A rectangular field is to be fenced next to a river. The river side will not contain a fence. The cost of material for the two ends has a cost of \$2 per foot and the cost for the side parallel to the river has a cost of \$3 per foot. \$900 is available for the cost of the fencing material. What is the measure of the fence parallel to the river that will result in the greatest area of the rectangle.
- a) 50 feet                      b) 100 feet                      c) 112.5 feet                      d) 150 feet                      e) none of these
- 11) A sheet of cardboard that is 20 inches on a side is to be made into a open top box by cutting squares out of the corners and bending up the sides. The denominator (in lowest terms) of the height of the box that results in the maximum volume is
- a) 1                                  b) 3                                  c) 5                                  d) 7                                  e) none of these
- 12) One of the terms of the integral  $\int \frac{\cos^2 x}{1 - \sin x} dx$  is
- a)  $2x$                               b)  $\cot x$                               c)  $\sin x$                               d)  $-\cos x$                               e) none of these
- 13) A definition of  $e$  is
- a)  $\lim_{n \rightarrow \infty} (1 + \frac{1}{n})^n$               b)  $\lim_{n \rightarrow 0} (1 + \frac{1}{n})^n$               c)  $\lim_{n \rightarrow \infty} (1 - \frac{1}{n})^n$               d)  $\lim_{n \rightarrow \infty} (\frac{n^2+1}{n})^n$               e) none of these
- 14) The absolute maximum value of the function  $f(x) = 3x^4 - 2x^3$  on the interval  $[-1, 2]$  is
- a) 0                                  b) 5                                  c) 32                                  d) 48                                  e) none of these
- 15) An interval for which  $f = 4x^3 - 12x$  is increasing is
- a)  $(-\infty, -1)$               b)  $(-1, 0)$                       c)  $(0, \frac{1}{2})$                       d)  $(\frac{1}{2}, 1)$                       e) none of these
- 16) An interval for which  $f = 4x^3 - 12x$  is concaved down is
- a)  $(-\infty, -1)$               b)  $(0, \frac{1}{2})$                       c)  $(\frac{1}{2}, 1)$                       d)  $(1, \infty)$                       e) none of these
- 17) The area bounded by the graphs of  $f(x) = x^2 - x$  and  $g(x) = 2x$  is
- a) 4                                  b)  $4\frac{1}{2}$                                   c)  $4\frac{1}{3}$                                   d) 9                                  e) none of these
- 18) The radius of a spherical balloon is expanding at three feet per minute. How fast is the volume changing when the radius is one foot? (in  $\text{ft}^3/\text{min}$ )
- a) 12                                  b)  $12\pi$                                   c)  $12\pi^2$                                   d)  $24\pi$                                   e) none of these
- 19) The sixth derivative of  $f(x) = x^6$  is
- a) 360                                  b)  $360x$                                   c) 720                                  d)  $720x$                                   e) none of these

- 20) The value of  $\lim_{x \rightarrow +\infty} \frac{3x-2}{5x+4}$  is
- a)  $-\frac{1}{2}$                       b)  $\frac{1}{2}$                       c) 1                      d) does not exist                      e) none of these
- 21) The minimum value of the function  $y = \frac{x^3}{3} - \frac{5x^2}{2} + 6x + 4$  is
- a) -1                      b) 1                      c)  $8\frac{1}{2}$                       d)  $8\frac{2}{3}$                       e) none of these
- 22) A ship sailing a distance  $d$  incurs two costs. There is a fixed cost of \$60 per hour and the fuel cost which varies directly as the square of the ship's speed. The fuel cost is \$100 per hour when the ship speed is 10 mph. What is the most economical speed in mph?
- a) 5                      b) 10                      c)  $\sqrt{15}$                       d)  $2\sqrt{15}$                       e) none of these
- 23) The value of  $\lim_{x \rightarrow 0} \frac{\sin x}{x}$  is: (Where  $x$  is measured in degrees)
- a) 0                      b) 1                      c)  $\sqrt{2}$                       d)  $\frac{\pi}{2}$                       e) none of these
- 24)  $f(x) = x^2 + 3$ . Find the exact value of  $\Delta y$  when  $x = 2$  and  $\Delta x = 0.5$
- a) 6.75                      b) 3.0                      c) 2.75                      d) 2.25                      e) none of these
- 25) Use the differential to approximate the value of  $\Delta y$  when  $x = 2$  and  $\Delta x = 0.5$  for the function  $f(x) = x^2 + 3$
- a) 2.0                      b) 2.1                      c) 2.2                      d) 2.4                      e) none of these

