

Directions: Evaluate and/or calculate as indicated.

- Find the point on the graph of  $y = x^2 + 1$  that is closest to the point  $(3, 1)$ .
- Find the point on the graph of  $y = x^3$  that is closest to the point  $(4, 0)$ .
- A wire 36 cm long is cut into two pieces. One of the pieces will be bent into the shape of an equilateral triangle and the other into the shape of a rectangle whose length is twice its width. Where should the wire be cut if the combined area of the triangle and rectangle is (a) minimized? (b) maximized?
- A window has the shape of a rectangle surmounted by a semicircle. If the perimeter of the window is 15 ft, find the dimensions that will allow the maximum amount of light to enter.

Find the differential  $dy$  for the given function.

5.  $y = x \cos x$

6.  $y = x^5 + \sqrt{x^2 + 5}$

7.  $y = \frac{\tan 3x}{2x}$

8.  $y = \frac{x^2 \sec x}{x - 3}$

9.  $y = x\sqrt{x^2 - 1}$

10.  $y = \frac{x - 5}{\sqrt{x + 4}}$

11.  $y = \frac{1}{x^3}$

12.  $y = \csc x$

13.  $y = \tan^3 x$

14.  $y = \frac{\cot 5x}{x}$

Tips:  $\int cf(x) dx = c \int f(x) dx,$

$$\int [f(x) \pm g(x)] dx = \int f(x) dx \pm \int g(x) dx$$

$$\int x^n dx = \frac{x^{n+1}}{n+1} + C, \text{ if } n \neq -1$$

“What function’s derivative is the integrand?”

15.  $\int (4x^3 + 3x^2) dx$

16.  $\int (-8x^3 + 15x^5) dx$

17.  $\int (6x^2 - 3 \cos x) dx$

18.  $\int (\sec^2 x) dx$

19.  $\int (\sec x \tan x) dx$

20.  $\int 2 \sin x dx$

21.  $\int \frac{\cos x}{3} dx$

22.  $\int (x^3 - 3x + \sqrt[4]{x} - 5) dx$

23.  $\int x(x + \sqrt{x}) dx$

24.  $\int \left( \frac{x^2 + \sqrt{x} + 1}{x^2} \right) dx$

25.  $\int \left( \frac{x^2 + 3x - 1}{x^4} \right) dx$

26.  $\int (3 - 4x^3)^2 dx$

27.  $\int (2x^2 + 5)^2 dx$