

1) In each case, find the general antiderivative:

(a)  $\int 3x^4 - 4\sqrt{x} + \frac{7}{x^2} dx,$

(b)  $\int \frac{1}{\sqrt{1-x^2}} dx$

(c)  $\int \frac{1}{2x^3} + \csc x \cot x dx$

(d)  $\int (\sec^2 x + \frac{3}{\sqrt{x}} - \pi) dx$

(e)  $\int \frac{x^2-3}{2x} dx$

(f)  $\int \frac{x^2}{x^2+1} dx$

2) In each case, find the most general form of  $f$  satisfying the given condition.

(a)  $f'(x) = x(3x + 4)$

(b)  $f''(x) = \sqrt[3]{x} + 1$

3) Solve the following initial value problems:

(a)  $\frac{dy}{dx} = 6e^x, y(0) = 2$

(b)  $\frac{dy}{dx} = \sqrt{x}(6 + 5x), y(1) = 0$

4) A particle is moving on a straight line with the given data. Find the position  $s(t)$  of the particle at time  $t$ .

(a)  $v(t) = -32t + 100, s(0) = 20,$

(b)  $a(t) = 2 \cos t + \sin t, v(0) = 1, s(0) = 0.$

5) A stone is dropped from the top of a tower 800 ft above the ground.

(a) Find the height  $s(t)$  of the stone above the ground at  $t$  seconds since it was dropped. Assume the initial velocity is 0 and assume constant acceleration during the motion  $g = -32ft/s^2$  (this is the gravitational acceleration at the surface of the Earth).

(b) How long does it take the stone to reach the ground?

(c) With what velocity does it strike the ground?

6) A car braked with constant deceleration of  $16ft/s^2$ , producing skid marks measuring 200ft before coming to a stop. How fast was the car traveling when the brakes were applied?

7) Compute the following integrals using integration by substitution and the given substitution:

(a)  $\int \frac{2x+1}{x^2+x} dx$  using  $u = x^2 + x$

(b)  $\int \frac{1}{x(\ln x)^2} dx$  using  $u = \ln x$

(c)  $\int \sin^4(3x) \cos(3x) dx$  using  $w = \sin(3x)$

8) Compute the following integrals using integration by substitution:

(a)  $\int e^{5x} dx$

(b)  $\int \cos^6 x \sin x dx$

(c)  $\int \sqrt{3x+7} dx$

(d)  $\int (x^2 + 4x + 7)^9 (x + 2) dx$

(e)  $\int x^2 \sec(x^3) \tan(x^3) dx$

9) Compute the following integrals using integration by substitution.

(a)  $\int \frac{e^{2x}}{1+e^{2x}} dx$

(b)  $\int \frac{e^x}{1+e^{2x}} dx$

(c)  $\int \frac{\cos(4\sqrt{t}+5)}{\sqrt{t}} dt$

(d)  $\int \frac{t}{\sqrt{1-t^4}} dt$

(e)  $\int \frac{\sin \theta}{1+\cos^2 \theta} d\theta$

(f)  $\int \frac{1}{x \ln x} dx$

(g)  $\int x\sqrt{2x+1} dx$

(h)  $\int \frac{\cos(1/x)}{3x^2} dx$