

② Find  $f(x)$  if  $f'(x) = \frac{1}{x} + 3x$  and  $f(1) = 5$ .

$$f(x) = \int \left( \frac{1}{x} + 3x \right) dx = \ln|x| + \frac{3}{2}x^2 + C$$

$$\text{Then } 5 = f(1) = \ln|1| + \frac{3}{2} \cdot 1^2 + C$$

$$5 = 0 + \frac{3}{2} + C$$

$$\text{Thus } C = 5 - \frac{3}{2} = \frac{10}{2} - \frac{3}{2} = \frac{7}{2}$$

$$\text{So } \boxed{f(x) = \ln|x| + \frac{3}{2}x^2 + \frac{7}{2}}$$

⑫ A falling object has velocity  $-32t - 16$  ft/sec  $t$  seconds after being dropped. It hits ground after 10 seconds. From what height was it dropped?

Solution: Velocity at time  $t$  is  $v(t) = -32t - 16$ .

Let  $S(t)$  be object's height at time  $t$ .

The height at which it was dropped is its height at time  $t=0$ , which is  $S(0)$ .

Strategy: Find  $S(t)$ . Answer will be  $S(0)$ .

Know  $S'(t) = v(t) = -32t - 16$ , so  $S(t) =$

$\int (-32t - 16) dt = -16t^2 - 16t + C$ . We know object hits ground at time  $t=10$ , so  $S(10) = 0$ .

i.e.  $0 = S(10) = -16(10)^2 - 16 \cdot 10 + C$ , so  $C = 1760$ .

Thus  $S(t) = -16t^2 - 16t + 1760$ . ANS: Height = 1760 feet