

1. Evaluate (a) $\int \sin^2 x \cos^3 x \, dx$

(b) $\int \tan^2 x \sec^4 x \, dx$

(c) $\int \frac{1}{3x^2 + 4} \, dx$

(d) $\int \frac{x}{\sqrt{1-x^4}} \, dx$

2. The tank of a fuel truck is a cylinder of radius 3 ft and length 30 ft. The tank sits horizontally with the lower side at an altitude of 2 ft above the ground (wheels of the truck are 2 ft high). Assuming that the tank is initially half-full, set up an integral that represents the total work required to completely fill up the tank by pumping up gasoline from ground level. The density of gasoline is $\rho = 45 \text{ lb/ft}^3$. (Just set up. The calculation of the integral is not required. Make sure to show on a picture what variable(s) you are using.)

3. Suppose you have to drill a narrow but deep pit into the ground. The pit is cylindrical, with a radius of 1ft and with a depth of 1000ft. The density of the rock encountered varies, so assume that at a depth of x ft from the ground, the density is given by some function $\rho(x)$ lbs/ft³.

(a) Write a formula to express the total mass of the material removed during drilling.

(b) Write a formula to express the total work done in removing the drilled material to the ground level.