

Calculus Quiz 17

1. (5 pts)

- a. Find the volume of solid of revolution obtained by rotating the region bounded by $y = (x^2 + 3x + 2)^{-1}$ and $x = 0$, $x = 1$ about the x -axis and the y -axis respectively.
- b. What values of p have the following property: The area of the region between the curve $y = x^{-p}$, $1 \leq x < \infty$, and the x -axis is infinite but the volume of the solid generated by rotating the region about the x -axis is finite.

2. (5 pts)

- a. Find the *escape velocity* v_0 that is needed to propel a rocket of mass m out of the gravitational field of a planet with mass M and radius R . Use Newton's Law of Gravitation and the fact that the initial kinetic energy of $\frac{1}{2}mv_0^2$ supplies the needed work.
- b. The *average speed* of molecules in an ideal gas is

$$\bar{v} = \frac{4}{\sqrt{\pi}} \left(\frac{M}{2RT} \right)^{3/2} \int_0^{\infty} v^3 e^{-\frac{Mv^2}{2RT}} dv$$

where M , R , T and v are molecular weight, gas constant, temperature, and molecular speed respectively. Show that

$$\bar{v} = \sqrt{\frac{8RT}{\pi M}}$$