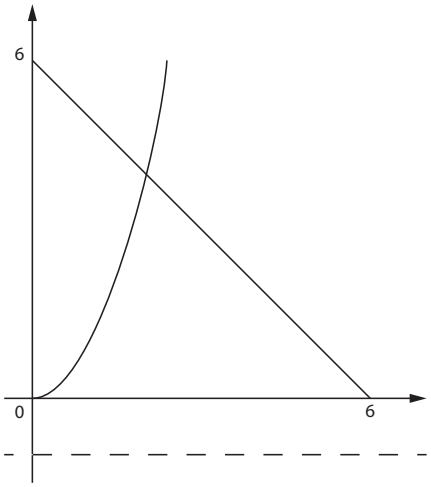
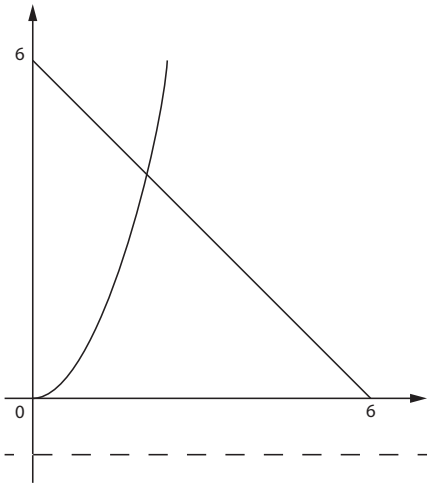
Math 10360 – Example Set 04A

6.3/6.4 - Volumes of Revolution & The Method of Cylindrical Shells

1a. Find the volume of the solid obtained by rotating the region bounded by the curves

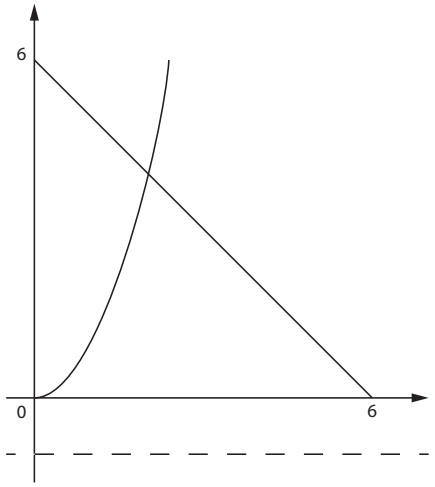
$y = x^2, \quad y = 6 - x, \quad$ and $\quad y = 0 \quad$ about the line $y = -1$.

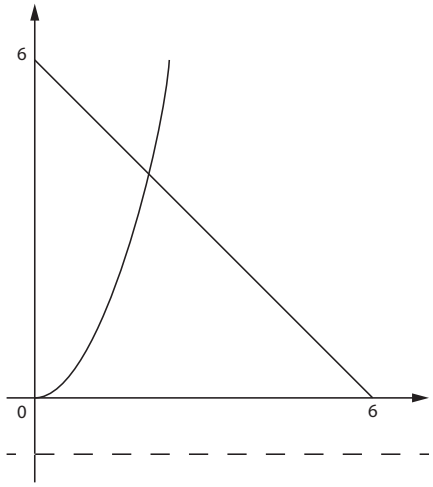




1b. Find the volume of the solid obtained by rotating the region bounded by the curves

$y = x^2, \quad y = 6 - x, \quad$ and $\quad x = 0 \quad$ about the line $y = -1$.





6.5 - Work and Energy

The work done W by a **constant** force F Newton applied to displace an object S meters (constant) is given by

$$W = F \times S \quad \text{Nm (or Joules).}$$

The work done measures the amount of energy expended in carrying out this task.

2. A 300 kg **uniform** chain 100 m in length is attached at one end to a crank on the top of a 300 m building, and the rest of the chain is allowed to hang freely on the side of the building from the crank. (a) How much work is done **against gravity** when the whole chain is cranked up to the top of the tower? (b) If a 20 kg weight is attached to the bottom end of the chain, how would the amount of work change?

You may take the acceleration due to gravity as $g = 10$ m/s^2.

Math 10360 – Example Set 04B
Section 6.5 - Work and Energy

1a. (SI units) A cistern is shaped like a cylinder of height 6 m and radius 10 m. The circular opening (10 m in radius) of the cistern is at ground level and the rest of the cistern is buried below ground. Compute the amount of work done against gravity (in Nm (Joules)) in pumping all the water out of the cistern from ground level if it is filled completely with water. Mass density of water is 1000 kg/m^3.

1b. How would you change your answer in 1(a) if all the water is pumped to a level 2 m above the opening of the cistern?

1c. How would you change your answer in 1(a) if the cistern is a regular inverted cone?

You may take the acceleration due to gravity as $g = 10$ m/s^2.

Math 10360 – Example Set 04C
Section 6.5 - Work and Energy

1. A 300 kg **uniform** chain 100 m in length is attached at one end to a crank on the top of a 300 m building, and the rest of the chain is allowed to hang freely on the side of the building from the crank. A 20 kg weight is also attached to the free end of the chain. How much work is done against gravity to crank **three quarter** of the chain to the top of the tower, with rest of the chain and the attached weight freely dangling by the side of the building?

You may take the acceleration due to gravity as $g = 10$ m/s^2.

2. A 10 m long uniform chain weighing 30 kg lies on the ground at the foot of a 50 m building. The chain is wrenched at one end and lifted up towards the top of the building. Find the work done to lift the chain in each of the following scenario:

(a) The work done against gravity to lift the chain if the wrenched end is at the top of the building with the rest of the chain dangling free from the wrenched end.

(b) The work done against gravity to lift the chain if the wrenched end of the chain is 5 m above ground (with the rest of the chain left on the ground)?

You may take the acceleration due to gravity as $g = 10$ m/s^2.