





6. Consider the following related rates questions involving vessels of water. Each question below should be treated as separate from one another.
- a. A conical container which is pointing downwards has water poured into it at the rate of  $12 \text{ cm}^3/\text{s}$ . Further, the cone has a perpendicular height of  $40 \text{ cm}$  and a base radius of  $8 \text{ cm}$ . How quickly is the water level rising when the water is  $6 \text{ cm}$  deep, measured vertically from the apex? State your answer exactly.
- b. A hemispherical bowl has radius  $18 \text{ cm}$ . Water is added to the bowl at a constant  $10 \text{ cm}^3/\text{s}$ . Calculate the rate at which the depth of water is increasing when the depth of water is  $12 \text{ cm}$ . Include a derivation for the volume of water in the unfilled bowl, assuming at capacity its total volume is  $V = \frac{2}{3}\pi r^2$ .

7. A  $1.75\text{ m}$  tall man walks at  $1\text{ m/s}$  away from a light which is  $7\text{ m}$  above the ground.

a. At what rate is the tip of his shadow moving?

b. At what rate is the length of his shadow increasing?