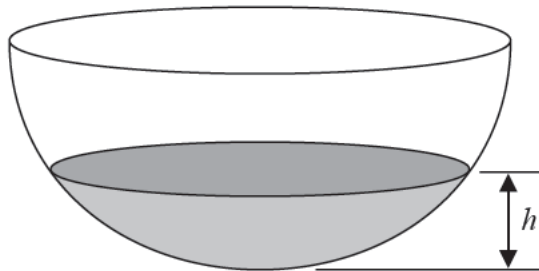**8.**

Figure 3

A bowl is modelled as a hemispherical shell as shown in Figure 3.

Initially the bowl is empty and water begins to flow into the bowl.

When the depth of the water is h cm, the volume of water, V cm³, according to the model is given by

$$V = \frac{1}{3} \pi h^2 (75 - h), \qquad 0 \leqslant h \leqslant 24$$

The flow of water into the bowl is at a constant rate of 160π cm³ s⁻¹ for $0 \leqslant h \leqslant 12$

(a) Find the rate of change of the depth of the water, in cm s⁻¹, when $h = 10$

(5)

Given that the flow of water into the bowl is increased to a constant rate of 300π cm³ s⁻¹ for $12 < h \leqslant 24$

(b) find the rate of change of the depth of the water, in cm s⁻¹, when $h = 20$

(2)