Related-rate problems

6 questions | 12 marks

Equivalent correct methods earn the corresponding marks.

1. The side of a square grows at 2 cm/s. Find its area rate when the side is 7 cm. [2 marks]

$A = s^2$ gives $\dot{A} = 2s\dot{s}$.

At $s = 7$, $\dot{A} = 2(7)(2) = 28$.

Answer: 28 cm^2/s

2. A cube edge grows at 0.4 cm/s. Find its volume rate at edge 3 cm. [2 marks]

$V = s^3$ gives $\dot{V} = 3s^2\dot{s}$.

$3(9)(0.4) = 10.8$.

Answer: 10.8 cm^3/s

3. A circle area shrinks at 12π cm^2/s. Find $\frac{dr}{dt}$ at $r = 3$ cm. [2 marks]

$\dot{A} = 2\pi r\dot{r}$.

$-12\pi = 6\pi\dot{r}$, so $\dot{r} = -2$.

Answer: -2 cm/s

4. A 13 m ladder has foot distance 5 m and foot rate 0.6 m/s away from the wall. Find the top rate. [2 marks]

The height is $\sqrt{169-25}=12$ m.

$\dot{y}=-\frac{x\dot{x}}{y}=-\frac{5(0.6)}{12}=-0.25.$

Answer: -0.25 m/s

5. Water enters a cylinder of radius 2 m at 3 m^3/min. Find the depth rate. [2 marks]

$V=4\pi h$, since the cylinder radius is fixed.

$\dot{V}=4\pi\dot{h}$, giving $\dot{h}=\frac{3}{4\pi}$.

Answer: $\frac{3}{4\pi}$ m/min

6. A spherical balloon radius is 6 cm when its volume grows at 72π cm^3/s. Find its radius rate. [2 marks]

$\dot{V}=4\pi r^2\dot{r}$.

$72\pi=144\pi\dot{r}$, so $\dot{r}=\frac{1}{2}$.

Answer: $\frac{1}{2}$ cm/s