كاس

(1) The radius, r cm, of a circle is increasing at the constant rate of 3 cm s^{-1}.

Find the rate at which the area of the circle is increasing when its radius is 13.5 cm.

(2) The side of a cube of length x cm, is increasing at the constant rate of 1.5 cm s^{-1}.

Find the rate at which the volume of the cube is increasing when its side is 6 cm.

(3) The surface area, $S \text{ cm}^2$, of a sphere is increasing at the constant rate of $512 \text{ cm}^2\text{s}^{-1}$.

The surface area of a sphere is given by

$$S = 4\pi r^2,$$

where r cm is its radius.

Find the rate at which the radius r of the sphere is increasing, when the sphere's radius has reached 8 cm.

(4)

$$x = 4\sin\theta + 7\cos\theta.$$

The value of θ is increasing at the constant rate of 0.5, in suitable units.

Find the rate at which x is changing, when $\theta = \frac{\pi}{2}$.

(5) Fine sand is dropping on a horizontal floor at the constant rate of $4 \text{ cm}^3\text{s}^{-1}$ and forms a pile whose volume, $V \text{ cm}^3$, and height, h cm, are connected by the formula

$$V = -8 + \sqrt{h^4 + 64}.$$

Find the rate at which the height of the pile is increasing, when the height of the pile has reached 2 cm.

(6) Two variables x and y are related by

$$y = \frac{1}{4}\pi x^2(4 - x).$$

The variable y is changing with time t, at the constant rate of 0.2, in suitable units.

Find the rate at which x is changing with respect to t, when $x = 2$.

wls

Liquid is pouring into a container at the constant rate of $30\ \text{cm}^3\text{s}^{-1}$.

The container is initially empty and when the height of the liquid in the container is h cm the volume of the liquid, $V\ \text{cm}^3$, is given by

$$V = 36h^2.$$

a) Find the rate at which the height of the liquid in the container is rising when the height of the liquid reaches 3 cm.

b) Determine the rate at which the height of the liquid in the container is rising 12.5 minutes after the liquid started pouring in.

8 The radius R of a circle, in cm, at time t seconds is given by

$$R = 10\left(1 - e^{-kt}\right),$$

where k is a positive constant and $t > 0$.

Show that if A is the area of the circle, in cm^2, then

$$\frac{dA}{dt} = P\ k\left(e^{-kt} - e^{-2kt}\right).$$ State the exact value of P

C = 7π
B = 18π
J = 81π
L = 127
M = 219
I = 162
P = 2.55
T = 126
A = 200π
I = $-7/2$
P = $\frac{5}{36}, \frac{1}{60}$
W = $\frac{7}{36}, \frac{1}{30}$

A = $\frac{1}{5\pi}$
C = $7/2$
V = $\sqrt{7}$
J = $\sqrt{5}$
N = 400π
A = $\frac{1}{4\pi}$
K = 20π
P = $\frac{7}{36}, \frac{1}{60}$
A =
T = $\frac{5}{36}, \frac{1}{30}$
Y = $\sqrt{11}$

The correct letters spell, in order, a South American city.

1) $\boxed{81\pi \approx 254 \text{ cm}^2\,\text{s}^{-1}}$ J

2) $\boxed{162 \text{ cm}^3\,\text{s}^{-1}}$ I

3) $\boxed{\frac{8}{\pi} \approx 2.55 \text{ cm s}^{-1}}$ P

4) $\boxed{-\frac{7}{2}}$ I

5) $\boxed{\sqrt{5} \approx 2.24 \text{ cm s}^{-1}}$ J

6) $\boxed{\frac{1}{5\pi} \approx 0.0637}$ A

7) $\boxed{\frac{5}{36} = 0.139 \text{ cm s}^{-1}}$, $\boxed{\frac{1}{60} = 0.0167 \text{ cm s}^{-1}}$ P

8) 200π A