

SHEET-2 CHAIN RULE

1. Find $\frac{dy}{dx}$ in each of the following

(a) $y = \sqrt{2-x^4}$, (b) $y = \frac{1}{(4-x)^2}$, (c) $y = (x^2 + x + 1)^3$, (d) $y = (x^3 - 1)^{0.1}$.

2. The pressure, p , and volume, v , of a certain gas are known to obey Boyle's law, $pv = c$, where c is a constant. Suppose that the volume is given by $v = 0.04t^2 + 0.32t + 0.6$ at time t , find the rate of change of pressure.

3. The velocity of a particle is given by $v = \frac{1}{1+s^2}$, where s is the displacement from a fixed point. Find the velocity and acceleration when $s = 2$.

4. A car has a petrol tank whose faces are rectangular and which has a square base $50\text{cm}^3 \times 50\text{cm}^3$. It holds petrol to a depth of h cm. A petrol pump is delivering petrol at a rate of 0.5 litres per second. How fast is h changing?

5. The surface area of a sphere, S , of radius r is given by $S = 4\pi r^2$. If r is increasing by 1.5 mm per second, find the rate of increase of S when $r = 25\text{cm}$.

6. The surface area of a sphere is increasing at a rate of $2.4\text{cm}^2 / \text{s}$. Find the rate of increase of the radius when the radius is 12 cm.

7. A current I flows through a resistance R . The power P developed is given by $P = I^2 R$. Find the rate of change of power if $I = 1 + \frac{1}{1+t}$, where t is time and you may assume R is constant.

8. A conveyer belt drives coal into a stockpile at the rate of 0.25m^3 per second. The coal forms a conical heap whose height is equal to the radius. How fast is the height of the cone increasing when it consists of 20m^3 of coal? (Note the volume of a cone, height h , radius r , is given by $V = \frac{1}{3}\pi r^2 h$.)

9. A cone has a vertical height h which is five times its base radius. Show that the volume is given by $V = \frac{1}{75}\pi h^3$. The cone is supported with its vertex lowermost and the axis of symmetry vertical. It is being filled by water at a rate of 0.02 litres per second. The depth of water in the cone is w . Find an expression for the rate of change of w in cm/s .

10. The velocity v (m/s) of a particle is given by $v = \frac{1}{2s+1}$, where s (m) is the displacement from a fixed point. Find the acceleration in terms of s . What is the acceleration when $s = 1\text{m}, 10\text{m}, 100\text{m}$. What happens to the acceleration as s increases?