

## SAMPLE PAPER 5: PAPER 1

### QUESTION 3 (25 MARKS)

#### Question 3 (a) (i)

$$f(x) = \frac{b^x + b^{-x}}{b^x - b^{-x}}$$

$$f(a) = 3 \Rightarrow \frac{b^a + b^{-a}}{b^a - b^{-a}} = 3$$

$$b^a + b^{-a} = 3b^a - 3b^{-a}$$

$$4b^{-a} = 2b^a$$

$$\frac{4}{2} = \frac{b^a}{b^{-a}}$$

$$\therefore 2 = b^{2a}$$

#### Question 3 (a) (ii)

$$f(2a) = \frac{b^{2a} + b^{-2a}}{b^{2a} - b^{-2a}} = \frac{b^{2a} + \frac{1}{b^{2a}}}{b^{2a} - \frac{1}{b^{2a}}} = \frac{2 + \frac{1}{2}}{2 - \frac{1}{2}} = \frac{\frac{5}{2}}{\frac{3}{2}} = \frac{5}{3}$$

#### Question 3 (b)

$$\log_b \sqrt{x} = \sqrt{\log_b x}$$

$$\log_b x^{\frac{1}{2}} = \sqrt{\log_b x}$$

$$\frac{1}{2} \log_b x = \sqrt{\log_b x} \quad [\text{Square both sides.}]$$

$$\frac{1}{4} (\log_b x)^2 = \log_b x$$

$$(\log_b x)^2 - 4 \log_b x = 0$$

$$\log_b x (\log_b x - 4) = 0$$

$$\therefore \log_b x = 0 \Rightarrow x = b^0 = 1$$

$$\therefore \log_b x = 4 \Rightarrow x = b^4$$

$$b^4 + 1 = 17 \quad [\text{The roots add to 17.}]$$

$$b^4 = 16$$

$$b = \pm 2$$

$$\therefore b = 2 \text{ as } b > 0$$


---