1) (a) If \( a \) is any real number and \( n \) is a positive integer, what is meant by the \( n \)th power of \( a \)?

(b) Describe what laws of exponents is being used in each case for real numbers \( a \) and \( b \) (bases) and positive integers (exponents) \( n \) and \( m \).

(i) \( a^m \cdot a^n = a^{m+n} \)

(ii) \( \frac{a^m}{a^n} = a^{m-n} \)

(iii) \( (a^n)^m = a^{nm} \)

(iv) \( (ab)^n = a^n b^n \)

(v) \( \left( \frac{a}{b} \right)^n = \frac{a^n}{b^n} \)

(vi) \( (a^n)^0 = 1 \)

(vii) \( a^{-n} = \frac{1}{a^n} \)

(c) Simplify and eliminate any negative exponents: \( (\frac{-2x}{3y})^4 \cdot (\frac{2xy^3}{x^3})^5 \)

2) (a) If \( a \) is a real number and \( n \) is a positive integer, what is meant by the principal \( n \)th root of \( a \) and how is it written?

What condition must we have on \( a \) if (i) \( n \) is even? (ii) \( n \) is odd?

(b) Fill in the blank space. (i) \( \sqrt[n]{x^n} = x \) if \( n \) is \( \underline{\text{______}} \)

(ii) \( \sqrt[n]{x^n} = |x| \) if \( n \) is \( \underline{\text{______}} \)

(c) Simplify: (i) \( \sqrt[3]{27x^4y^5} \)

(ii) \( \sqrt[5]{81x^6y^5} \)

3) (a) What happens to the \( n \)th root of 3 as \( n \) gets large?

(b) What happens to the \( n \)th (\( n \) fixed) power of \( a \) as \( a \) gets large?

(c) Without using a calculator, determine which number is larger.

(i) \( \sqrt[3]{3} \) or \( \sqrt[3]{7} \)

(ii) \( \sqrt[3]{3} \) or \( \sqrt[5]{3} \)

(iii) \( \frac{1}{\sqrt[3]{3}} \) or \( \frac{2}{1 + \sqrt[3]{3}} \)