INDICES (ADVANCED) – PRACTICE QUESTIONS
NON-CALCULATOR

1.
Find x.

$2^{2x-3} = 8$

$2^{2x-3} = 2^3$

$2x - 3 = 3$

$2x = 6$

$x = 3$

2.
Find x.

$3^{3x} \times 3^x = 81$

$3^{4x} = 3^4$

$4x = 4$

$x = 1$

3.
Find x.

$2^x \times 2^{x+1} = 32$

$2^{2x+1} = 2^5$

$2x + 1 = 5$

$2x = 4$

$x = 2$

4.
Find x.

$4^{x-1} = \frac{1}{64}$

$4^{x-1} = 4^{-3}$

$x - 1 = -3$

$x = -2$

5.
Find x.

$$5^{3x+5} = \frac{1}{25}$$

$5^{3x+5} = 5^{-2}$

$3x+5 = -2$

$3x = -7$

$x = -\frac{7}{3}$

6.
Find x.

$$2^{4x-1} = \frac{1}{16}$$

$2^{4x-1} = 2^{-4}$

$4x-1 = -4$

$4x = -3$

$x = -\frac{3}{4}$

7.
Find x.

$$\frac{3^x}{9} = 3^{5x}$$

$3^x \div 3^2 = 3^{5x}$

$x-2 = 5x$

$-2 = 4x$

$x = -\frac{2}{4}$

$x = -\frac{1}{2}$

8.
Find x.

$$\frac{2^{3x+5}}{8} = 2^{2x}$$

$2^{3x+5} \div 2^3 = 2^{2x}$

$3x+5-3 = 2x$

$3x+2 = 2x$

$x = -2$

9.
Find x.

$$\frac{8^{2x+1}}{2^x} = 4$$

$$\frac{(2^3)^{2x+1}}{2^x} = 2^2$$

$$2^{6x+3} \div 2^x = 2^2$$

$$6x+3-x = 2$$

$$5x+3 = 2$$

$$5x = -1$$

$$x = -\frac{1}{5}$$

10.
Find x.

$$\frac{9^{x+2}}{3^x} = 27$$

$$(3^2)^{x+2} \div 3^x = 3^3$$

$$3^{2x+4} \div 3^x = 3^3$$

$$2x+4-x = 3$$

$$x+4 = 3$$

$$x = -1$$

11.
Find x.

$$\frac{16^{2x-3}}{64^x} = 4^{x+1}$$

$$(4^2)^{3x-3} \div (4^3)^x = 4^{x+1}$$

$$4^{6x-6} \div 4^{3x} = x+1$$

$$6x-6-3x = x+1$$

$$3x-6 = x+1$$

$$5x = 7$$

$$x = \frac{7}{5}$$

12.
Find x.

$$\sqrt{5} \times 25^x = 125$$

$5^{\frac{1}{2}} \times (5^2)^x = 5^3$

$5^{\frac{1}{2}} \times 5^{2x} = 5^3$

$\frac{1}{2} + 2x = 3$

$2x = \frac{5}{2}$

$x = \frac{5}{4}$

13.
Find x.

$$\frac{8^{2x+1}}{\sqrt{2}} = 4^x$$

$(2^3)^{2x+1} \div 2^{\frac{1}{2}} = (2^2)^x$

$2^{6x+3} \div 2^{\frac{1}{2}} = 2^{2x}$

$6x + 3 - \frac{1}{2} = 2x$

$6x + \frac{5}{2} = 2x$

$4x = -\frac{5}{2}$

$x = -\frac{5}{8}$

14.
Find x.

$$3^{2x} \times \sqrt{27} = 81$$

$3^{2x} \times 3^{\frac{3}{2}} = 3^4$

$2x + \frac{3}{2} = 4$

$2x = \frac{5}{2}$

$x = \frac{5}{4}$

15.
Find x.

$$\frac{2^{2x}}{\sqrt{32}} = \sqrt{8}$$

$2^{2x} \div 2^{\frac{5}{2}} = 2^{\frac{3}{2}}$

$2x - \frac{5}{2} = \frac{3}{2}$

$2x = 4$

$x = 2$

16.
Solve

$$\frac{64^{x+1}}{4^x} = 16^{2x-1}$$

$(4^3)^{x+1} \div 4^x = (4^2)^{2x-1}$

$4^{3x+3} \div 4^x = 4^{4x-2}$

$3x+3-x = 4x-2$

$2x+3 = 4x-2$

$5 = 2x$

$x = \frac{5}{2}$

17.
Solve

$$\frac{\sqrt{125}}{5^{3x}} = 25^{x-1}$$

$5^{\frac{3}{2}} \div 5^{3x} = (5^2)^{x-1}$

$5^{\frac{3}{2}} \div 5^{3x} = 5^{2x-2}$

$\frac{3}{2} - 3x = 2x-2$

$\frac{7}{2} = 5x$

$x = \frac{7}{10}$

18.
Solve

$$\frac{100^{x-1}}{\sqrt{1000}} = 1$$

$100^{x-1} = \sqrt{1000}$

$(10^2)^{x-1} = 10^{\frac{3}{2}}$

$10^{2x-2} = 10^{\frac{3}{2}}$

$2x - 2 = \frac{3}{2}$

$2x = \frac{7}{2}$

$x = \frac{7}{4}$

19.
Solve

$$9^{x+1} = 3\sqrt{27}$$

$(3^2)^{x+1} = 3^1 \times 3^{\frac{3}{2}}$

$3^{2x+2} = 3^{\frac{5}{2}}$

$2x + 2 = \frac{5}{2}$

$2x = \frac{1}{2}$

$x = \frac{1}{4}$

20.
Solve

$$4^{2x-1} = 2\sqrt{32}$$

$$(2^2)^{2x-1} = 2^1 \times 2^{\frac{5}{2}}$$

$$2^{4x-2} = 2^{\frac{7}{2}}$$

$$4x-2 = \frac{7}{2}$$

$$4x = \frac{11}{2}$$

$$x = \frac{11}{8}$$

21.
Solve

$$\frac{25^{2x-1}}{5^x} = 25\sqrt{5}$$

$$(5^2)^{2x-1} \div 5^x = 5^2 \times 5^{\frac{1}{2}}$$

$$5^{4x-2} \div 5^x = 5^{\frac{5}{2}}$$

$$4x-2-x = \frac{5}{2}$$

$$3x-2 = \frac{5}{2}$$

$$3x = \frac{9}{2}$$

$$x = \frac{3}{2}$$

22.

$81^a \times 9^{2b}$ can be written in the form 3^Y.

Find an equation for Y in terms of a and b.

$(3^4)^a \times (3^2)^{2b} = 3^Y$

$3^{4a} \times 3^{4b} = 3^Y$

$Y = 4a + 4b$

23.

$\sqrt{10^x} \times 1000^y$ can be written in the form 10^z.

Find an equation for x in terms of y and z.

$(10^x)^{\frac{1}{2}} \times (10^3)^y = 10^z$

$10^{\frac{x}{2}} \times 10^{3y} = 10^z$

$\frac{x}{2} + 3y = z$

$\frac{x}{2} = z - 3y$

$x = 2z - 6y$

24.

$6^r = \frac{1}{36}$ $\quad$ $6^t = \sqrt[4]{36}$ $\quad$ $6^u = \sqrt{216}$

Work out the value of r + t + u.

$6^r = 6^{-2}$ $\quad$ $6^t = 6^{\frac{2}{4}}$ $\quad$ $6^u = 6^{\frac{3}{2}}$

$r = -2$ $\quad$ $t = \frac{1}{2}$ $\quad$ $u = \frac{3}{2}$

$-2 + \frac{1}{2} + \frac{3}{2} = 0$

$r + t + u = 0$