Foundation stage 1:

- 1. Evaluate without using a calculator:
 - (a) 3^4

(b) $\left(\frac{2}{5}\right)^3$

JE MATHS

IB MATHS

JE MATHS

2. Evaluate without using a calculator:

JE MATHS

(a) 1^0

- JE MATHS
- (b) 0.9^1
- JE MATHS
- 3. Evaluate involving negative indices without using a calculator:
 - (a) 7^{-1}

(b) $\left(\frac{2}{5}\right)^{-1}$



(c) 6⁻³

- $\begin{array}{c}
 \text{JE MATHS} \\
 \text{(d)} \left(\frac{3}{4}\right)^{-3}
 \end{array}$
- JE MATHS
- 4. Simplify the following involving multiplication in index form:
 - (a) $4^8 \times 4^4$

(b) $x^5 \times x^7$

(c) $9^3 \times 9^{-8}$

(d) $x^8 \times x^{-4} \times x^{2ATHS}$

JE MATHS

- 5. Simplify the following involving division in index form:
 - (a) $4^8 \div 4^4$

(b) $x^5 \div x^7$

JE MATHS

JE MATHS



(d) $x^8 \div x^{-4} \div x^2$

- 6. Expand the following involving power of power in index form:
 - (a) $x^2 \times x^2 \times x^2$

(b) $x^{-3} \times x^{-3} \times x^{-3}$

(c) $(x^3)^9$ JE MATHS

(d) $(x^{-4})^3$ JE MATHS

JE MATHS

(e) $(x^{-5})^4$

- JE MATHS
- (f) $(x^{-8})^{-3}$
- JE MATHS

- 7. Expand the following expressions in index form:
 - (a) $(4x)^3$

(b) $(3xy)^5$
B MATHS

JE MATHS

- JE MATHS
- (c) $\left(\frac{1}{x}\right)^3$

 $\int (d)^{A} \left(\frac{2y}{3x}\right)^{4}$

JE MATHS

JE MATHS

8. Solve the following index equations:

JE MATHS

- (a) $4^x = 64$
- JE MATHS
- (b) $4^x = \frac{1}{64}$

(c) $16^x = 32$

(d) $16^x = \frac{1 \text{ JB MATHS}}{32}$

- - (e) $(\frac{1}{2})^x = 81$

(f) $(\frac{4}{9})^x = \frac{27}{8}$

Foundation stage 2:

- 1. Simplify the following into a fraction, if necessary:
 - (a) $9^{\frac{1}{2}}$

(b) $\left(\frac{1}{25}\right)^{\frac{1}{2}}$

JE MATHS

JE MATHS

JE MATHS

(c) $10000000^{\frac{1}{3}}$

(d) $\left(\frac{16}{81}\right)^{\frac{1}{4}}$

JE MATHS

JE MATHS

(e) $125^{\frac{2}{3}}$

(f) $\left(\frac{125}{8}\right)^{\frac{4}{3}}$

IB MATHS

JE MATHS

- 2. Evaluate the following by using the calculator, correct to 3 significant figures:
 - (a) $7^{\frac{1}{3}}$

(b) $\left(\frac{2}{5}\right)^{-\frac{5}{2}}$

JE MATHS

- JE MATHS
- 3. Simplify the following expressions by using index laws:
 - (a) $x^{\frac{1}{2}} \times x^{\frac{1}{2}}$

- JE MATHS
 - (b) $x^{1\frac{1}{2}} \div x^{\frac{1}{2}}$

(c) $x^{1\frac{1}{2}} \div x^{-\frac{1}{2}}$

(d) $x^{\frac{3}{2}} \div x^{-\frac{1}{2}} \times x^{\frac{1}{2}}$ IB MATHS

JE MATHS

(e) $(x^{\frac{1}{2}})^{\frac{1}{2}}$

(f) $(x^{\frac{1}{2}})^{-\frac{6}{5}}$

JE MATHS

JE MATHS

JE MATHS

(g) $(x^{-\frac{2}{3}})^6$

(h) $(x^{-1\frac{1}{2}})^{-\frac{1}{2}}$

- 4. Change the following index numbers into surds:
 - (a) $x^{\frac{1}{2}}$

(b) $6x^{\frac{1}{3}}$

(c) $x^{\frac{5}{8}MATHS}$

 $J(d) ATHS_{\frac{1}{2}}$

JE MATHS

- 5. Change the following surds into index numbers:

(a) \sqrt{x}

(b) $\sqrt[3]{x}$

(c) $3\sqrt{x}$

(d) $\sqrt{3x}$ JE MATHS

JE MATHS

JE MATHS

(e) $\frac{3}{\sqrt{x}}$

 $\int (\mathbf{f})^{1/4} \frac{1}{\sqrt[3]{3x}}$

JE MATHS

JE MATHS

JE MATHS

- 6. Solve the following index equations:
 - (a) $16^x = 2$

JE MATHS

(b) $\left(\frac{1}{9}\right)^x = \frac{1}{243}$

IB MATHS

JE MATHS

(c) $25^x = \sqrt{5}$

 $(d) \left(\frac{1}{36}\right)^x = \sqrt[3]{6}$

- JE MATHS

- JE MATHS

Foundation stage 3:

- 1. Change the following into index form and then find the value of x:
 - (a) $\log_2 8 = x$

(b) $\log_{10} \frac{1}{10} = x$

IE MATHS

JE MATHS

JE MATHS

(c) $\log_3 1 = x$

(d) $\log_8 32 = x$

...

JE MATHS

JE MATHS

JE MATHS

(e) $x = \log_9 9$

(f) $x = \log_{32} \sqrt{64}$

N-11

IE MATHS

JE MATHS

JE MATHS

- JE MATHS
- 2. Change the following into index form and then find the value of x:
 - (a) $\log_8 x = 3$

JE MATHS

(b) $\log_x 8 = 3$

(c) $\log_6 x = -2$

(d) $\log_x \frac{JE1^{MATHS}}{27} = 3$

(e) $\log_4 x = -\frac{5}{2}$

 $_{\text{JB MA}}$ (f) $\log_x \frac{1}{64} = \frac{3}{2}$

JE MATHS

JE MATHS

3. Use the log law $\log_a x + \log_a y = \log_a xy$, $\log_a x - \log_a y = \log_a \frac{x}{y}$ and $\log_a x^n = n \log_a x$

to simplify:

(a) $\log_6 54 + \log_6 4$

(b) $\log_8 128 - \log_8 2$

· vay

g--

(c) $\log_4 \frac{1}{9} + \log_4 9$

(d) $\log_2 4 + \log_2 6 - \log_2 \frac{3}{4}$

JE MATHS

JE MATHS

4. Write the following in terms of $\log_a 2$:

(a) $\log_a 4$

 $_{\text{JB MA}}$ (b) $\log_a \frac{1}{2}$

JE MATHS

JE MATHS

- (c) $\log_a \frac{1}{64}$
- JE MATHS

JE MATHS

(d) $\log_a \frac{1}{\sqrt{32}}$

5. Express the following in terms of $\log_2 3$ and $\log_2 5$: (hint: $\log_2 2 = 1$)

(a) $\log_2 15$

(b) log₂ 6

(c) $\log_2 30$

JE MATHS (d) log₂ 7.5

Foundation stage 1:

- 1. (a)
 - 81

- (b)
- 8/125

- 2. (a)
 - 1 JE MATHS

(b) 0.9 JE MATHS

- 3. (a)
 - 1/7

(b) 5/2

(c) 1/216

- JE MATHS
- (d)
- JE MATHS $(4/3)^3$ = 64/27

JE MATHS

- 4. (a)
 - 412

- (b) x^{12}
- JE MATHS

JE MATHS (c) 9-5

(d) χ^6

JE MATHS

JE MATHS

5. (a) 4^{12}

(b) JX M2 THS

93-(18)MATHS (c) $= 9^{11}$

- (d) $\chi^{8-(-4)-2}$ $= \chi^{10}$
- JE MATHS

6. (a) *x*⁶

- JE MATHS
- (b) x^{-9}

(c) x^{27}

(d) x^{-12}

- (e) x^{-20}
- JE MATHS

(f) x^{24}

- 7. (a)
 - $64x^3$

(b) $243x^5y^5$

(c) JE MATHS $1/x^{3}$

J(d)ATHS $16y^4/81x^4$ JE MATHS

8. (a) $4^x = 4^3$ x = 3

(b) $4^x = 4^{-3}$ x = -3

JE.Maths

(c) $2^{4x} = 2^5$ 4x = 5 x = 5/4 JE MATHS (e) $3^{-x} = 3^4$ -x = 4 x = -4		JE MATHS	(d) $2^{4x} = 2^{-5}$ 4x = -5 x = -5/4 IB MATHS (f) $(2/3)^{2x} = (2/3)^{-3}$ 2x = -3 x = -3/2	je maths	je maths
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Foundation stage 2:

- 1. (a)
 - 3

(b) 1/5

- (c)
- 100 JE MATHS

- (d)
- 4/3 JB MATHS

- (e)
- $5^2 = 25$

- (f)
- $(5/2)^4 = 625/16$

- 2. (a) $7^{\frac{1}{3}}$
 - 1.91

- JE MATHS
- (b)
- 9.88
- 3. (a)
 - X

- (b)
- JE MATHS
- X

- (c)
- JE MATHS \mathbf{X}^{2}

- (d)
- $x^{3/2+1/2+1/2}$
- $= \chi^{5/2}$
- JE MATHS

- (e) $x^{1/4}$
 - JE MATHS
- (f)
 - $x^{-3/5}$

- (g)
- x^{-4}

- (h) $x^{3/4}$
- JE MATHS

- 4. (a) $\sqrt{\mathbf{x}}$
 - (c)

- (b)
- $6 \sqrt[3]{x}$

 $6/3\sqrt{x^2}$

- - JE MATHS

- (d)
- JE MATHS

- 5. (a)
 - $x^{1/2}$

(b) $x^{1/3}$

(c) $3x^{1/2}$ _{B MATHS}

(d) $3^{1/2}x^{1/2}$

- (e)
- $3x^{-1/2}$

(f) $3^{-1/3}x^{-1/3}$

6. (a) $2^{4x}=2^{1}$ (b) $3^{-2x}=3^{-5}$ JE.Maths

-2x = -54x = 1x = 1/4x = 5/2(c) (d) $6^{-2x} = 6^{1/3}$ $5^{2x} = 5^{1/2}$ 2x = 1/2 x = 1/4MATHS -2x = 1/3x = -1/6JE MATHS JE MATHS

Foundation stage 3:

$$2^{x} = 8$$

$$x=3$$

$$10^x = 10^{-1}$$

$$x = -1$$

$$3^{x}=1^{\text{JB MATHS}}$$

$$Z^{on}=Z$$

$$3x = 5$$

$$x = 5/3$$

JE MATHS

JE MATHS

JE MATHS

JE MATHS

$$9^{x} = 9$$

$$x = 1$$

$$32^x = 64^{1/2}$$

$$2^{5x}=2^{6/2}$$

$$5x = 3$$

$$5x = 3$$

$$x = 3/5$$
JB MATHS

(a)
$$x = 8^3 = 512$$
 JE MATHS

(b)

$$x^3 = 8$$

$$x = 2$$

JE MATHS

JE MATHS

JE MATHS

$$x = 6^{-2}$$

$$x = \frac{1}{36} \frac{6}{\text{JB MATHS}}$$

JE MATHS

$$x^3 = 1/27$$

$$x = 1/3$$

(e)

$$x = 4^{-5/2}$$

$$x = 1/32$$

(f)

$$x^{3/2} = 1/64$$

$$x = (1/64)^{2/3}$$

$$x = (1/4)^2$$

$$x = 1/16$$

3. (a)

$$log_{6}216$$

$$= log_6 6^3$$

$$= 3$$

JE MATHS

(b)

$$log_864$$
 JB MATHS

$$= log_8 8^2$$

$$=2$$

(c)

$$log_41$$

$$= 0$$

JE MATHS

(d)

$$log_2(4\times6\div3/4)$$

$$= log_2 32$$

$$JBMA = log_2 2^{25}$$

4. (a)

$$2log_a 2$$

$$-log_a 2$$

(c)

JE.Maths

				JE.Maths
	$-6log_a 2$		$-5/2 \times log_a 2$	
5.	(a) $log_2 3 + log_2 5$		(b) $log_2 3 + log_2 2$ = $log_2 3 + 1$	
	(c) $^{JB MATHS}$ $log_2 3 + log_2 5 + log_2 2$ $= log_2 3 + log_2 5 + 1$		$ JB MATHS (d) $ $ log_2 3 + log_2 5 - log_2 2 $ $ = log_2 3 + log_2 5 - 1 $	
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