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- Negative indices evaluation: $a^{-n} = \frac{1}{a^n}$

- 1. Evaluate:
 - (a) 2^{-2}

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

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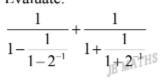
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- (c) $(2\frac{1}{2})^{-2}$
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- (d) $(0.2)^{-2}$

Evaluate:



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- Negative indices simplification:

- 3. Change the following in the index form:
 - (a) $\frac{1}{r^2}$

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



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4. Simplify without negative indices:

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(a) $(2^x)^2 \times (2^{2x})^{-2}$

(b) $(2^x)^{-2} \div 2_{\mathbb{S}}^{-x} MATHS$

(c) $2m^{-2}n^4 \times 4m^{-4}n^2$

(d)
$$6(m^{-2}n^3)^{-2} \div (2m^{-2}n^3)^2$$

- Simplify expressions in terms of index number n.
 - (a) $2^n + 2^n$

(b) $\frac{1}{2} \times 2^{2n}$

(d) $\frac{2^{-n} \times 4^{2n}}{16^{-\frac{n}{4}}}$

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- Negative indices expanding and simplify:

- 6. Simplify binomial expressions without negative indices: JB MATHS
 - (a) $(x-x^{-1})^2$ JB MATHS

(b) $(x^2 + x^{-2})^2$

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(c) $(x + y^{+1})^{-2}$

- (d) $(x^{-1} + y^{-1})^{-2}$

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- Negative indices factorisation:

- Factorise and simplify involving index number:
 - (a) $\frac{9^n-1}{3^n-1}$

(b) $2^{3n} - 1$

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- Negative indices equations:

Solve x involving negative index number:

(a)
$$(\frac{2}{3})^x = \frac{9}{4}$$

(b)
$$(\frac{3}{5})^{-3x} = \frac{25}{9}$$

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(c) $4^{2-x} = 8$

(d) $(\frac{1}{4})^{x+2} = (\frac{1}{8})^{x-2}$

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9. Find the values of x and y by solving the following index equation simultaneously: ATHS

(a)
$$2^{x-y} = 1$$
 and $8^{x+y} = 64$

(b)
$$3^{x+y} = 27$$
 and $4^{x-y} = 8$

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10. Solve for x involving index number factorisation:



 $2^{2n+2} - 2^{2n-1} = 1792$

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- Fractional indices simplification: $a^{\frac{m}{n}} = \sqrt[n]{a^m} = (\sqrt[n]{a})^m$

- 11. Evaluate:
 - (a) $4^{\frac{1}{2}}$

(b) $4^{-\frac{1}{2}}$

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- (c) $\left(\frac{27}{8}\right)^{\frac{2}{3}}$
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- (d) $\left(\frac{8}{27}\right)^{-\frac{4}{3}}$
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- 12. Simplify the following in index form:
 - (a) $5a^{\frac{1}{2}}b^{\frac{1}{3}} \times 3a^{-\frac{1}{3}}b^{\frac{1}{2}}$

(b) $(2x^{\frac{1}{2}}y^{-\frac{2}{3}})^6 \div (x^2y)^{-1}$

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- 13. Write the following expression using a fractional index.
 - (a) $-\sqrt{x^3}$

(b) $\frac{3}{\sqrt[3]{x^2}}$

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- (c) $\frac{x}{\sqrt{y^3}}$

- $(d) \ \frac{\sqrt{x^3}}{\sqrt[3]{y^2}}$
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- Fractional indices expansion:

- 14. Simplify binomial expressions without negative indices:
 - (a) $(x^{\frac{1}{2}} x^{-\frac{1}{2}})^2$

(b) $(x^{\frac{3}{2}} + x^{-\frac{3}{2}})^2$

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- Fractional indices equations: (ATHS

- 15. Solve x involving flipping the index.
 - (a) $x^5 = 5$

(b) $x^{\frac{5}{3}} = 243$

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- (c) $x^4 = 81$ (Hint: 2 solutions)
- (d) $x^{\frac{2}{3}} = 9$

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Solve x involving fractional indices.

(a)
$$8^{kM}ATHS$$

(b)
$$\left(\frac{8}{125}\right)^{x+2} = \left(\frac{5}{2}\right)^x$$
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(c) $4^x = \sqrt{8}$ IB MATHS

(d) $\sqrt{18} \times 9^{x+1} = 9\sqrt{6}$

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- Log laws:

- 17. Use the law of logarithm to solve it. $(x > 0 \text{ and } x \neq 1)$
 - (a) $\log_x x^5$

(b) $\log_x \frac{1}{x^2}$

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(c) $\log_x \sqrt{x}$

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(d) $\log_x \frac{1}{\sqrt{x}}$

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(e) $\log_x x^2 \sqrt{x}$

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(f) $\log_x \frac{1}{x\sqrt{x}}$

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- 18. Use the log law to simplify:
 - (a) $\log_6 \frac{1}{2} + \log_6 2$

(b) $\log_2 96 - \log_2 6$

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(c) log₃ 4+log₃ 18-log₃ 8

(d) log, 4-log, 8-log, 16

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- Change of base law:

19. Use the change of base law $\log_{a^n} b^m = \frac{m}{n} \log_a b$ to simplify:

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(a) $\log_{2^2} 2^3$

(b) log₉ 27

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(c) $\log_{\sqrt{3}} \frac{1}{3}$

(d) $\log_{4^n} 8^n$

- Inverse law: $\log_a a^x = x$ and $a^{\log_a x} = x$

20. Use $a^{\log_a x} = x$ and $\log_a a^x = x$ to simplify:

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(a) log₆ 6⁵

(b) 7^{log₇3}

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(c) $\log_9 9^a$

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- Log simplification:

- 21. Express in terms of $\log_2 3$ and $\log_2 5$:
 - (a) log₂15

(b) $\log_2 \frac{1}{15}$

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(c) $\log_2 \frac{8}{5}$ JE MATHS

(d) $\log_2 \frac{10}{3}$

(e) \log_2^{MATHS}

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- Log simplification involving x:

- 22. Simplify the following log expressions:
 - (a) $\log_{10} 10x$

(b) $\log_3 \frac{x}{3}$

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(c) $\log_2 8x^3$

(d) $\log_3 \frac{9}{27x}$

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- Inverse law (hard):



23. Use $a^{\log_a x} = x$ and $\log_a a^x = x$ to simplify:



(b) $t^{a \log_t b}$

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(c) $a^{x\log_{\alpha}x}$ IB MATHS

(d) $a^{\frac{\log_{\sigma} x}{x}}$

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- Log simplification (hard):

24. Show that the following expression can be changed in terms of $\log_2 3$ and $\log_2 5$.

(a)
$$\log_2 30\sqrt{3} = \log_2 5 + 1 + \frac{3}{2}\log_2 3$$

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(b)
$$\log_2 \frac{8}{25\sqrt{30}} = 3 - \frac{5}{2}\log_2 5 - \frac{1}{2}\log_2 3$$
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25. Let $p = \log_x 2$, $q = \log_x 3$ and $r = \log_x 5$, show that:

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(a) $\log_x \frac{24}{15x^3} = 3p - r - 3$

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(b)
$$\log_x \frac{36}{25x} = \frac{JB \text{ MATHS}}{2p + 2q - 2r - 1}$$

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- Log proving question:

26. Prove that $\log_{an} x = \frac{\log_a x}{1 + \log_a n}$ by using the change of base law.

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- Inverse law magic:

- 27. Use $x = a^{\log_a x}$ to express:
 - (a) 5 as a power of 3.

(b) m as a power of 3.

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(c) 0.4 as a power of 2.

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(d) y as a power of x.

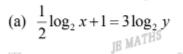
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- Log relations:

28. Rewrite the following into relations:



(b) $3\log_5(2x-1) = 2\log_5(2x+1) + 1$

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