# Negative and Fractional Exponents

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## HW 9-2

1. $8x^{18}y^{9}$
2. $x^{3a+1}$
3. $\frac{16x^{6}}{9y^{4}}$
4. 1000
5. $162y^{8}$
6. $\frac{3x}{16}$
7. $80b^{12}$
8. $3^{6}$
9. 32
10. 400
11. $2^{8} = 256$

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Simplify each expression. No calculators!

1. $(2x^6y^3)^3$ $= 2^3x^{18}y^9 = 8x^{18}y^9$

2. $x^{2a} \bullet x^{a+1}$ $= x^{2a+a+1} = x^{3a+1}$

3. $\left(\frac{4x^3}{3y^2}\right)^2$ $= \frac{4^2x^6}{3^2y^4} = \frac{16x^6}{9y^4}$

4. $2^3 \bullet 5^3$ $= (2\cdot5)^3 = 10^3 = 1000$

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5. $2(3x^0y^2)^4$ $= 2\cdot(3^4y^8) = 2\cdot81y^8 = 162y^8$

6. $\frac{3x^5}{(2x)^4}$ $= \frac{3x^5}{16x^4} = \frac{3x}{16}$

7. If $x=5a^4$ and $a=2b^3$ express x in terms of b.

$x = 5(2b^3)^4 = 5\cdot16b^{12} = 80b^{12}$

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8. Express $9^3$ as a power of 3.

$9 = 3^2 \quad (3^2)^3 = 3^6$

9. Divide $8^3$ by $2^4$

$(2^3)^3 \div 2^4 = \frac{2^9}{2^4} = 2^5 = 32$

10. Using the power rule evaluate 25 times 16.

$5^2 \cdot 4^2 = (5 \cdot 4)^2 = 20^2 = 400$

11. Use the powers of 2 to help you perform the calculation of $\frac{2^7 \bullet 2^5}{16}$

$\frac{2^7 \cdot 2^5}{2^4} = \frac{2^{12}}{2^4} = 2^8 = 256$

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Negative and Fractional Exponents Unit 9 Day3

| | Rule: | Examples: |
|---|---|---|
| Negative Exponent➔ | $x^{-1} = \frac{1}{x^1}$ | a. $3^{-1} = \frac{1}{3^1} = \frac{1}{3}$ |
| | | b. $2 \cdot 3^{-1} = \frac{2}{3}$ |
| | $x^{-n} = \frac{1}{x^n}$ | a. $3^{-2} = \frac{1}{3^2} = \frac{1}{9}$ |
| | | b. $-5^{-2} =$ $(-5)^{-2} = \frac{1}{(-5)^2} = \frac{1}{25}$ $= -1 \cdot 5^{-2} = \frac{-1}{5^2} = \frac{-1}{25}$ |

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$\frac{1}{x^{-n}} = x^n$

a. $\frac{1}{3^{-2}} = 3^2 : 9$

b. $\frac{3}{2^{-3}} = 3 \cdot 2^3 : 3 \cdot 8 : 24$

$\left(\frac{x}{y}\right)^{-n} = \left(\frac{y}{x}\right)^n : \frac{y^n}{x^n}$

a. $\left(\frac{2}{3}\right)^{-2} = \left(\frac{3}{2}\right)^2 : \frac{3^2}{2^2} : \frac{9}{4}$

b. $\frac{x^{-6}}{y^{-6}} = \frac{y^6}{x^6}$

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**Simplify each expression leaving only positive exponents. Assume all variables are nonzero.**

1. $5^{-2} : \frac{1}{5^2} : \frac{1}{25}$

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

3. $\left(-\frac{3}{2}\right)^{-3} : \left(\frac{-2}{3}\right)^3 : \frac{-8}{27}$

4. $\frac{y^{-3}}{x^{-4}} : \frac{x^4}{y^3}$

5. $(3x)^{-3} : \frac{1}{(3x)^3} : \frac{1}{27x^3}$

6. $\frac{(4x)^{-3}}{3x^{-2}} : \frac{x^2}{3(4x)^3} : \frac{x^2}{3 \cdot 64 x^3} = \frac{x^2}{192x^3} = \frac{1}{192x}$

7. $2^{-5} \cdot 2^3 \cdot 2^4 : 2^2 : 4$

8. $\left(\frac{3x^2}{2x^{-3}}\right)^{-2}$ PEMDAS $: \left(\frac{3x^5}{2}\right)^{-2} : \left(\frac{2}{3x^5}\right)^2 : \frac{4}{9x^{10}}$

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Fractional Exponents ➔ $\sqrt[n]{x^1}$ → radicand

index

$x^{1/n}$

| Exp | 3 | 4 | 5 |
|---|---|---|---|
| 1 | 3 | 4 | 5 |
| 2 | 9 | 16 | 25 |
| 3 | 27 | 64 | 125 |
| 4 | 81 | 256 | 625 |
| 5 | 243 | - | - |

2 → $\sqrt{x} = x^{1/2}$

$\sqrt[3]{x} = x^{1/3}$

$\sqrt[n]{x} = x^{1/n}$

$9^{\frac{1}{2}} = \sqrt{9} = 3$

$8^{\frac{1}{3}} = \sqrt[3]{8} = 2$

$243^{\frac{1}{5}} = \sqrt[5]{243} = 3$

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**Write using a radical sign:**

9. $y^{\frac{1}{5}} = \sqrt[5]{y}$

10. $(3x)^{\frac{1}{4}} = \sqrt[4]{(3x)}$

**Write using exponents:**

11. $\sqrt[4]{2a} = (2a)^{1/4}$

12. $x\sqrt{y} = xy^{1/2}$

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**Evaluate. (No calculators!)**

13. $81^{\frac{1}{4}}$ : $\sqrt[4]{81}$ : 3

14. $27^{\frac{1}{3}}$ : $\sqrt[3]{27}$ : 3

15. $100^{-\frac{1}{2}}$ : $\frac{1}{100^{\frac{1}{2}}}$ : $\frac{1}{\sqrt{100}}$

$\therefore \frac{1}{10}$

16. $(-8)^{\frac{1}{3}}$ : $\sqrt[3]{(-8)}$ : $-2$

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17. $(-27)^{-\frac{1}{3}}$ : $\frac{1}{(-27)^{\frac{1}{3}}}$ : $\frac{1}{\sqrt[3]{(-27)}}$ : $-\frac{1}{3}$

18. $\left(\frac{4}{49}\right)^{\frac{1}{2}}$ : $\sqrt{\frac{4}{49}}$ : $\frac{2}{7}$

19. $\left(\frac{16}{25}\right)^{-\frac{1}{2}}$ : $\left(\frac{25}{16}\right)^{\frac{1}{2}}$

: $\sqrt{\frac{25}{16}}$ : $\frac{5}{4}$

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20. Use the properties of exponents to rewrite the expression with positive exponents.

* $f(x) = \frac{9}{(2x)^{-3}}$ : $9(2x)^3$ : $9 \cdot 8x^3$ : $72x^3$

Find the value of $f\left(-\frac{1}{3}\right)$

$f(-1/3) : 72(-1/3)^3 : \frac{72}{1} \cdot -\frac{1}{27} : \frac{-72}{27} : -\frac{8}{3}$

$\div 9$

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Do you recall how to add, subtract and multiply fractions?

$\frac{1}{5} + \frac{2}{5} =$ ____ $\frac{2}{3} \cdot \frac{3}{4} =$ ____ $\frac{6}{7} - \frac{1}{2} =$ ____ $\frac{5}{9} - \frac{1}{3} =$ ____

$3 \bullet \frac{2}{5} =$ ____ $\frac{3}{8} =$ ____

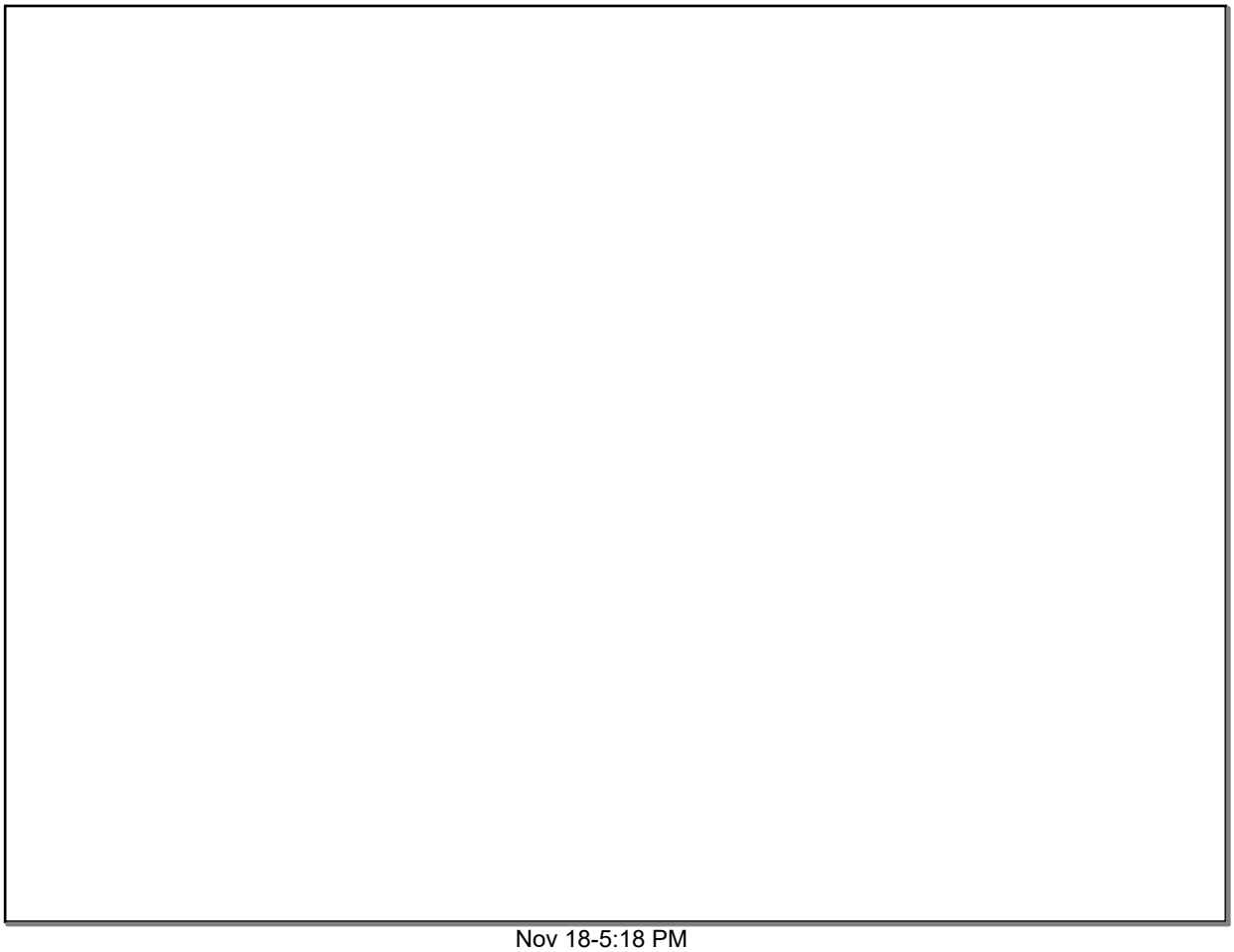
21. Use the properties of exponents to evaluate the following expressions

a. $3^{\frac{1}{2}} \bullet 3^{\frac{1}{8}}$ : $3^{1/2+1/8}$ : $3^{5/8}$

b. $\frac{5^{\frac{1}{3}}}{5^{\frac{1}{6}}}$ : $5^{1/3-1/6}$ : $5^{1/6}$

c. $\left(7^{\frac{1}{6}}\right)^6$ : $7^{1/6 \cdot 6} = 7^1 = 7$

Jan 26-8:49 AM



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