$$w^{-7} = \frac{1}{w^7} \qquad \frac{1}{w^{-8}} = w^8$$

Take Reciprocal and Make exponent positive

Write the following using POSITIVE exponents only.

$$\frac{-6a^{-4}b}{5x^7y^{-2}} = \frac{-6by^2}{5x^7a^4}$$

$$\frac{2a^{-1}bc^{-4}}{3x^4y^{-3}z^{-1}} = \frac{2by^3z}{3x^4ac^4}$$

How about NEGATIVE RATIONAL exponents?

$$\left(\frac{9}{16}\right)^{-\frac{3}{2}} = \left(\frac{16}{9}\right)^{\frac{3}{2}}$$ Write with a positive exponent.

$$= \left(\sqrt{\frac{16}{9}}\right)^{3}$$ Take the square root.

$$= \left(\frac{4}{3}\right)^{3}$$ Cube the result.

$$= \frac{64}{27}$$

Evaluate the following:

$$9^{-\frac{3}{2}} =$$

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

$$= \frac{1}{\left(\sqrt{9}\right)^{3}}$$

$$= \frac{1}{27}$$

$$\left(\frac{8}{27}\right)^{-\frac{4}{3}} =$$

$$\left(\frac{27}{8}\right)^{4/3}$$

$$\frac{\left(\sqrt[3]{27}\right)^{4}}{\left(\sqrt[3]{8}\right)^{4}}$$

$$= \frac{81}{16}$$

Check your understanding:

1. $8^{\frac{2}{3}} =$

$(\sqrt[3]{8})^2$

$=2^2$

$=4$

4

2. $125^{-\frac{1}{3}} =$

$\frac{1}{125^{1/3}} = \frac{1}{\sqrt[3]{125}} = \frac{1}{5}$

$\frac{1}{5}$

3. $32^{-\frac{7}{5}} =$

$\frac{1}{32^{7/5}}$

$\frac{1}{(\sqrt[5]{32})^7}$

$\frac{1}{2^7}$

$\frac{1}{128}$

$\frac{1}{128}$

4. $\frac{3}{9^{-\frac{3}{2}}} =$

$= 3(9)^{3/2}$

$= 3(\sqrt{9})^3$

$= 3(3)^3$

$= 3(27)$

$= 81$

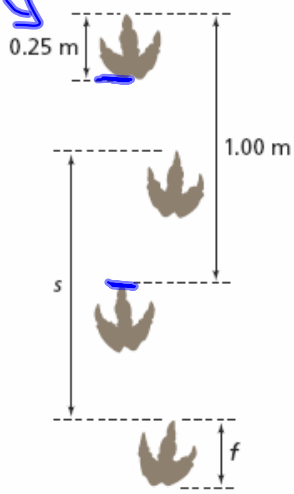
81

Example 3 Applying Negative Exponents

Paleontologists use measurements from fossilized dinosaur tracks and the formula $v = 0.155 s^{\frac{5}{3}} f^{-\frac{7}{6}}$ to estimate the speed at which the dinosaur travelled. In the formula, v is the speed in metres per second, s is the distance between successive footprints of the same foot, and f is the foot length in metres. Use the measurements in the diagram to estimate the speed of the dinosaur.

f=0.25m

S=1m



SOLUTION

Use the formula: $v = 0.155 s^{\frac{5}{3}} f^{-\frac{7}{6}}$

Substitute: $s = 1$ and $f = 0.25$

$v = 0.155 (1)^{\frac{5}{3}} (0.25)^{-\frac{7}{6}}$

0.155(0.25)^(-7/6)
0.781151051

$v = 0.155 (0.25)^{-\frac{7}{6}}$

$v = 0.7811\ldots$

The dinosaur travelled at approximately 0.8 m/s.

Now for the grand finale!!

Evaluate the following...

$$-2^4+\left(\frac{1}{3}\right)^{-2}-64^{-\frac{2}{3}}+4w^0+(-3)^2+\frac{2^{-2}}{4}$$

$$-16+\left(\frac{3}{1}\right)^2-\frac{1}{64^{\frac{2}{3}}}+4+9+\frac{1}{2^2(4)}$$

$$-16+9-\frac{1}{16}+4+9+\frac{1}{16}$$

$$=6$$

2/ $(-2\omega)^0 - \frac{1}{3^{-2}} + 27^{-\frac{2}{3}} - 3^{-2} + 125^{\frac{2}{3}}$

$1 - 3^2 + \frac{1}{27^{\frac{2}{3}}} - \frac{1}{3^2} + \left(\sqrt[3]{125}\right)^2$

$1 - 9 + \frac{1}{\left(\sqrt[3]{27}\right)^2} - \frac{1}{9} + 25$

$1 - 9 + \frac{1}{9} - \frac{1}{9} + 25$

$= 17$

Practice Problems...

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