

Math 10

Lesson 1–7 Answers

Lesson Questions

Question 1

$$7^{-2} = \frac{1}{7^2}$$
$$= \frac{1}{49}$$

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

$$\left(\frac{-6}{5}\right)^{-3} = \left(\frac{5}{-6}\right)^3$$
$$= \frac{125}{-216} \text{ or } \frac{-125}{216} \text{ or } -\frac{125}{216}$$

Question 2

$$16^{-\frac{5}{4}}$$

$$\left(\frac{125}{216}\right)^{-\frac{2}{3}}$$

$$= \left(\frac{1}{16}\right)^{\frac{5}{4}}$$

$$= \left(\frac{216}{125}\right)^{\frac{2}{3}}$$

$$= \left(\left(\frac{1}{16}\right)^{\frac{1}{4}}\right)^5$$

$$= \left(\left(\frac{216}{125}\right)^{\frac{1}{3}}\right)^2$$

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

$$= \left(\frac{6}{5}\right)^2$$

$$= \frac{1}{32}$$

$$= \frac{36}{25}$$

Question 3

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

$$v = 0.155(1.50)^{\frac{5}{3}}(0.30)^{-\frac{7}{6}}$$

$$v = 1.2412...$$

$$\mathbf{v = 1.24}$$

Assignment

1. a) $\frac{1}{5^4} = 5^{-4}$

d) $\frac{1}{4^{-2}} = 4^2$

2. a) 16 and $\frac{1}{16}$

b) 16 and $\frac{1}{16}$

3. $\frac{1}{1024}$

4. a) 2^2 c) $\left(-\frac{5}{6}\right)^4$

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

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

c) $(-2)^{-5} = \frac{1}{(-2)^5} = \frac{1}{-32}$ or $-\frac{1}{32}$ or $\frac{-1}{32}$

d) $\left(\frac{1}{3}\right)^{-3} = 3^3 = 27$

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

f) $\frac{1}{5^{-3}} = 5^3 = 125$

6. a) $4^{-\frac{1}{2}} = \frac{1}{4^{\frac{1}{2}}} = \frac{1}{2}$

b) $0.09^{-\frac{1}{2}} = \left(\frac{9}{100}\right)^{-\frac{1}{2}} = \left(\frac{100}{9}\right)^{\frac{1}{2}} = \frac{10}{3}$ or 3.33

c) $27^{-\frac{1}{3}} = \frac{1}{27^{\frac{1}{3}}} = \frac{1}{3}$

d) $(-64)^{-\frac{1}{3}} = \frac{1}{(-64)^{\frac{1}{3}}} = \frac{1}{-4}$ or $-\frac{1}{4}$ or $\frac{-1}{4}$

7. There are several answers for each question.

a) 3^{-2} b) $25^{-\frac{1}{2}}$ or 5^{-1} c) $\left(\frac{1}{2}\right)^{-2}$ or 4^{-1} d) $\left(\frac{1}{-27}\right)^{-\frac{1}{3}}$

8. \$2651.56

9.

a) $27^{-\frac{4}{3}} = \frac{1}{27^{\frac{4}{3}}} = \frac{1}{\left(27^{\frac{1}{3}}\right)^4} = \frac{1}{3^4} = \frac{1}{81}$

b) $16^{-1.5} = 16^{-\frac{3}{2}} = \frac{1}{16^{\frac{3}{2}}} = \frac{1}{\left(16^{\frac{1}{2}}\right)^3} = \frac{1}{4^3} = \frac{1}{64}$

c) $32^{-0.4} = 32^{-\frac{2}{5}} = \frac{1}{32^{\frac{2}{5}}} = \frac{1}{\left(32^{\frac{1}{5}}\right)^2} = \frac{1}{2^2} = \frac{1}{4}$

d) $\left(-\frac{8}{27}\right)^{-\frac{2}{3}} = \left(\left(-\frac{8}{27}\right)^{\frac{1}{3}}\right)^{-2} = \left(\frac{-2}{3}\right)^{-2} = \left(\frac{-3}{2}\right)^2 = \frac{9}{4}$

$$\text{e) } \left(\frac{81}{16}\right)^{-\frac{3}{4}} = \left(\left(\frac{81}{16}\right)^{\frac{1}{4}}\right)^{-3} = \left(\frac{3}{2}\right)^{-3} = \left(\frac{2}{3}\right)^3 = \frac{8}{27} \quad \text{f) } \left(\frac{9}{4}\right)^{-\frac{5}{2}} = \left(\left(\frac{9}{4}\right)^{\frac{1}{2}}\right)^{-5} = \left(\frac{3}{2}\right)^{-5} = \left(\frac{2}{3}\right)^5 = \frac{32}{243}$$

10.

$$\begin{aligned} \left(-\frac{64}{125}\right)^{-\frac{5}{3}} &= \left(\frac{64}{125}\right)^{\frac{5}{3}} \rightarrow \left(-\frac{125}{64}\right)^{\frac{5}{3}} \\ &= \left(\sqrt[3]{\frac{64}{125}}\right)^5 = \left(\sqrt[3]{-\frac{125}{64}}\right)^5 \\ &= \left(\frac{4}{5}\right)^5 = \left(-\frac{5}{4}\right)^5 \\ &= \frac{1024}{3125} = -\frac{3125}{1024} \end{aligned}$$

11. \$1266.57

12.

$$\begin{aligned} I &= 100d^{-2} \\ I &= 100(23)^{-2} \\ I &= 0.189 \\ I &= 18.9\% \end{aligned}$$

13. $5^{-2}, \frac{1}{25} > \frac{1}{32}$

14.

a) The numbers on the left are divided by 2 each time. The exponents in the powers on the right decrease by 1 each time.

b) $16 = 2^4$
 $8 = 2^3$
 $4 = 2^2$
 $2 = 2^1$
 $1 = 2^0$
 $\frac{1}{2} = 2^{-1}$
 $\frac{1}{4} = 2^{-2}$
 $\frac{1}{8} = 2^{-3}$

c) Note that $\frac{1}{8} = 2^{-3}$ and $8 = 2^3$. Therefore $\frac{1}{2^3} = 2^{-3}$. By extension $a^{-n} = \frac{1}{a^n}$.

15. divide 3^3 by 3^{-5}

$$\frac{3^3}{3^{-5}} = 3^{3-(-5)} = 3^8 ; 6561 \text{ times greater}$$

16. a) $x > 0$ b) $x < 0$ c) $x = 0$

17. If the base is greater than 1 then the value of the power will be less than 1. For example, $2^{-2} = 1/4$. However, if the base is between 0 and 1, the power will be greater than 1. For

example $\left(\frac{1}{3}\right)^{-1} = 3$.

18.

$$F = (6.67 \times 10^{-11})(5.9736 \times 10^{24})(7.349 \times 10^{22})(382260000)^{-2}$$

$$F = 2.0 \times 10^{20} \text{ N}$$

19.

a) 14 mg/mL

b) 8 h