Class/Homework

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Questions : 3,4acegh, 5bdfh, 6,7,8,10bdfhj

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Questions 9, 10, 11, 13,15, 17,18,19

3. When can you not add or subtract exponents to multiply or divide powers?

When the bases are not he same.

4. Write each product as a single power.

a) $5^5 \times 5^4$ $= 5^9$

b) $10^2 \times 10^{11}$ 10^{13}

c) $(-3)^3 \times (-3)^3$ $= (-3)^6$

d) $21^6 \times 21^4$ 21^{10}

e) $(-4)^1 \times (-4)^3$ $= (-4)^4$

f) $6^{12} \times 6^3$ 6^{15}

g) $2^0 \times 2^4$ $= 2^4$

h) $(-7)^3 \times (-7)^0$ 1 $(-7)^3$

5. Write each quotient as a power.

a) $4^5 \div 4^3$ $= 4^2$

b) $8^9 \div 8^6$ $= 8^3$

c) $15^{10} \div 15^0$ $= 15^{10}$

d) $(-6)^8 \div (-6)^3$ $= (-6)^5$

e) $\frac{2^{12}}{2^{10}}$ $= 2^2$

f) $\frac{(-10)^{12}}{(-10)^6}$ $= (-10)^6$

g) $\frac{6^5}{6^1}$ 6^4

h) $\frac{(-1)^5}{(-1)^4}$ $= (-1)$

6. a) Evaluate.

i) $3^4 \div 3^4$

$= 3^0$

$= 1$

ii) $(-4)^6 \div (-4)^6$

$= (-4)^0$

$= 1$

iii) $\frac{5^8}{5^8} = 5^0$

$= 1$

iv) $\frac{(-6)^3}{(-6)^3} = (-6)^0$

$= 1$

b) Use the results of part a. Explain how the exponent law for the quotient of powers can be used to verify that a power with exponent 0 is 1.

8. Express as a single power.

a) $3^4 \times 3^9 \div 3^{11}$

$3^{13} \div 3^{11}$

3^2

b) $(-4)^3 \div (-4)^2 \times (-4)^{10}$

$(-4)^1 \times (-4)^{10}$

$= (-4)^{11}$

c) $6^0 \times 6^3 \div 6^2$

$(6)^3 \div (6)^2$

$= (6)^1$

d) $\dfrac{4^3 \times 4^5}{4^2 \times 4^6} = \dfrac{4^8}{4^8}$

$= 4^0$

$= 1$

e) $\dfrac{(-3)^4 \times (-3)^4}{(-3)^4} = \dfrac{(-3)^8}{(-3)^4}$

$= (-3)^4$

9. a) Express as a single power, then evaluate.

i) $(-6)^1 \times (-6)^7 \div (-6)^7$

$(-6)^8 \div (-6)^7$

$= (-6)^1$

$= -6$

ii) $(-6)^7 \div (-6)^7 \times (-6)^1$

$= (-6)^0 \times (-6)^1$

$= (-6)^1$

$= -6$

b) Explain why changing the order of the terms in the expressions in part a does not affect the answer.

The order you multiply or divide numbers doesn't matter

10. Simplify, then evaluate.

a) $10^2 \times 10^2 + 10^4$

$10^4 + 10^4$

$10000 + 10000$

$= 20000$

b) $10^3 \times 10^3 - 10^3$

$10^6 - 10^3$

$= 1000000 - 1000$

$= 999000$

c) $10^{11} - 10^3 \times 10^6$

$10^{11} - 10^9$

$100\,000\,000\,000 - 1\,000\,000\,000$

$99\,000\,000\,000$

d) $10^1 + 10^5 \times 10^2$

$10^1 + 10^7$

$= 10 + 10\,000\,000$

$= 10\,000\,010$

e) $10^6 \div 10^2 \times 10^2$

$10^4 \times 10^2$

$= 10^6$

$= 1000000$

f) $10^9 \div 10^9$

10^0

$= 1$

g) $\frac{10^{12}}{10^6}$

$= 10^6$

$= 1\,000\,000$

h) $\frac{10^4 \times 10^3}{10^2} = \frac{10^7}{10^2}$

$= 10^5$

$= 100\,000$

i) $\frac{10^{11}}{10^4 \times 10^2}$

$= \frac{10^{11}}{10^6}$

$= 10^5$

$= 100\,000$

j) $\frac{10^5}{10^3} + 10^2$

$= 10^2 + 10^2$

$= 100 + 100$

$= 200$

13. Evaluate.

a) $2^3 \times 2^2 - 2^5 \times 2$

$2^5 - 2^6$

$= 32 - 64$

$= -32$

b) $3^2 \times 3^1 + 2^2 \times 2^4$

$3^3 + 2^6$

$= 27 + 64$

$= 91$

c) $4^2 - 3^0 \times 3^1 + 2^3$

$4^2 - 3^1 + 2^3$

$= 16 - 3 + 8$

$= 21$

d) $(-3)^6 \div (-3)^5 - (-3)^5 \div (-3)^3$

$(-3)^1 - (-3)^2$

$-3 - 9$

$= -12$

e) $(-2)^4[(-2)^5 \div (-2)^3] + (-2)^4$

$(-2)^4[(-2)^2] + (-2)^4$

$(-2)^6 + (-2)^4$

$64 + 16$

$= 80$

f) $-2^4(2^6 \div 2^2) - 2^4$

$-2^4(2^4) - 2^4$

$-2^8 - 2^4$

$= -256 - 16$

$= -272$

g) $(-5)^3 \div (-5)^2 \times (-5)^0 + (-5)^2 \div (-5)$

$(-5)^1 \times (-5)^0 + (-5)^1$

$(-5)^1 + (-5)^1$

$= -10$

19. Simplify, then evaluate only the expressions with a positive value. Explain how you know the sign of each answer without evaluating.

a) $(-2)^2 \times (-2)^3$

$(-2)^5$

$= -32$

b) $(-2)^0 \times (-2)^5$

$(-2)^5$

$= -32$

c) $(-2)^5 \div (-2)^3$

$(-2)^2$

$= 4$

d) $(-2)^6 \div (-2)^6$

$(-2)^0$

$= 1$

e) $\dfrac{(-2)^3 \times (-2)^4}{(-2)^3 \times (-2)^2}$

$= \dfrac{(-2)^7}{(-2)^5}$

$= (-2)^2$

$= 4$

f) $\dfrac{(-2)^6}{(-2)^3 \times (-2)^2}$

$= \dfrac{(-2)^6}{(-2)^5}$

$= (-2)^1$

$= -2$

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4. Write each expression as a product of powers.

a) $(6 \times 4)^3$ $6^3 \times 4^3$ or $(24)^3$

b) $(2 \times 5)^4$ $2^4 \times 5^4$ or $(10)^4$

c) $[(-2) \times 3]^5$ $(-2)^5 \times 3^5$ or $(-6)^5$

d) $(25 \times 4)^2$ $25^2 \times 4^2$ or $(100)^2$

e) $(11 \times 3)^1$ $11^1 \times 3^1$ or (33)

f) $[(-3) \times (-2)]^3$ $(-3)^3 \times (-2)^3$ or $(6)^3$

5. Write each expression as a quotient of powers.

a) $(8 \div 5)^3$ b) $(21 \div 5)^4$ c) $[(-12) \div (-7)]^5$

$8^3 \div 5^3$ $21^4 \div 5^4$ $(-12)^5 \div (-7)^5$

d) $\left(\frac{10}{3}\right)^3$ e) $\left(\frac{1}{3}\right)^2$ f) $\left(\frac{27}{100}\right)^4$

$\frac{10^3}{3^3}$ $= \frac{1^2}{3^2}$ $= \frac{27^4}{100^4}$

6. Write as a power.

a) $(3^2)^4$ $=3^8$

b) $(6^3)^3$ $=6^9$

c) $(5^3)^1$ $=5^3$

d) $(7^0)^6$ $=7^0$

e) $-(8^2)^2$ $= -(8)^4$

f) $[(-3)^4]^2$ $= (-3)^8$

7. Simplify $(2^4)^2$ and $(2^2)^4$. What do you notice? Explain the results.

$(2^4)^2$

2^8

$(2^2)^4$

2^8

8. Write each expression as a product or quotient of powers.

$[(2)^3 \times (3)^4]^4$

$2^{12} \times 3^{16}$

a) $[3 \times (-5)]^3$

$3^3 \times (-5)^3$

or

$(-15)^3$

b) $-(2 \times 4)^5$

$-(2)^5 \times (4)^5$

$= -(8)^5$

c) $\left(\frac{2}{3}\right)^4$

$= \frac{2^4}{3^4}$

d) $\left(\frac{-7}{-2}\right)^2$

$= \frac{(-7)^2}{(-2)^2}$

e) $-[(-10) \times 3]^3$

$-(-10)^3 \times (3)^3$

or

$-(-30)^3$

f) $(16 \div 9)^2$

$= 16^2 \div (9)^2$

For each expression, state the strategy you used and why.

a) $(3 \times 2)^3$ b) $[(-2) \times 4]^2$ c) $\left(\frac{9}{-3}\right)^3$

$= 6^3$

$= 216$

$= (-8)^2$

$= 64$

$= (-3)^3 = -27$

$= \frac{9^3}{(-3)^3} = \frac{729}{-27} = -27$

d) $\left(\frac{8}{2}\right)^2$

$= \frac{8^2}{2^2}$

$= \frac{64}{4}$

$= 16$

e) $(12^8)^0$

$= 12^0$

$= 1$

f) $[(-4)^2]^2$

$= (-4)^4$

$= 256$

14. Simplify, then evaluate. Show your work.

a) $(3^2 \times 3^1)^2$

$= (3^3)^2$

$= 3^6$

$= 729$

b) $(4^6 \div 4^4)^2$

$= (4^2)^2$

$= 4^4$

$= 256$

c) $[(-2)^0 \times (-2)^3]^2$

$= [(-2)^3]^2$

$= (-2)^6$

$= 64$

d) $(10^6 \div 10^4)^3$

$= (10^2)^3$

$= 10^6$

$= 1\,000\,000$

e) $(10^3)^2 \times (10^2)^3$

$= 10^6 \times 10^6$

$= 10^{12}$

$= 1\,000\,000\,000\,000$

f) $(12^2)^4 \div (12^3)^2$

$= 12^8 \div 12^6$

$= 12^2$

$= 144$

g) $(5^2)^6 \div (5^3)^4$

$= 5^{12} \div 5^{12}$

$= 5^0$

$= 1$

h) $[(-2)^2]^3 \times (-2)^3$

$= (-2)^6 \times (-2)^3$

$= (-2)^9$

$= -512$

Copy the solution and correct the errors.

a) $(3^2 \times 2^2)^3 = (6^4)^3$

$= 6^{12}$

$= 2\,176\,782\,336$

b) $[(-3)^2]^3 = (-3)^6$

$= -243$

a) $(3^2 \times 2^2)^3 = (9 \times 4)^3$

$3^6 \times 2^6 = (36)^3$

$729 \times 64 = 46\,656$

b) $[(-3)^2]^3 = (-3)^6$

$= 729$

c) $\left(\frac{6^2}{6^1}\right)^2 = 6^4$

$= 1296$

d) $(2^6 \times 2^2 \div 2^4)^3 = (2^4)^3$

$= 2^{12}$

$= 512$

c) $\left(\frac{6^2}{6^1}\right)^2 = (6^1)^2$

$= 6^2$

$= 36$

d) $(2^6 \times 2^2 \div 2^4)^3 = (2^4)^3$

$= 2^{12}$

$= 4096$

e) $(10^2 + 10^3)^2 = (10^5)^2$

$= 10^{10}$

$= 10\,000\,000\,000$

e) $(10^2 + 10^3)^2 = (100 + 1000)^2$

$= (1100)^2$

$= 1\,210\,000$

16. Simplify, then evaluate each expression.

a) $(4^2 \times 4^3)^2 - (5^4 \div 5^2)^2$

$(4^5)^2 - (5^2)^2$

$4^{10} - 5^4$

$1048576 - 625$

$= 1047951$

b) $(3^3 \div 3^2)^3 + (8^4 \times 8^3)^0$

$= (3^1)^3 + (8^7)^0$

$= (3)^3 + 8^0$

$= 27 + 1$

$= 28$

c) $(2^3)^4 + (2^4 \div 2^3)^2$

$= 2^{12} + (2^1)^2$

$= 2^{12} + 2^2$

$= 4096 + 4$

$= 4100$

d) $(6^2 \times 6^0)^3 + (2^6 \div 2^4)^3$

$(6^2)^3 + (2^2)^3$

$(6)^6 + (2^6)$

$46\,656 + 64$

$= 46\,720$

e) $(5^3 \times 5^3)^0 - (4^2)^2$

$= (5^6)^0 - 4^4$

$= 5^0 - 4^4$

$= 1 - 256$

$= -255$

f) $(10^5 \div 10^2)^2 + (3^3 \div 3^1)^4$

$= (10^3)^2 + (3^2)^4$

$= 10^6 + 3^8$

$= 100\,0000 + 6561$

$= 1006\,561$

17. Simplify, then evaluate each expression.

a) $[(-2)^3 \times (-2)^2]^2 - [(-3)^3 \div (-3)^2]^2$

$= [(-2)^5]^2 - [(-3)^1]^2$

$= (-2)^{10} - (-3)^2$

$= 1024 - (9)$

$= 1015$

b) $[(-2)^3 \div (-2)^2]^2 - [(-3)^3 \times (-3)^2]^2$

$= [(-2)^1]^2 - [(-3)^5]^2$

$= (-2)^2 - (-3)^{10}$

$= 4 - (59049)$

$= -59045$

c) $[(-2)^3 \times (-2)^2]^2 + [(-3)^3 \div (-3)^2]^2$

$= [(-2)^5]^2 + [(-3)^1]^2$

$= (-2)^{10} + (-3)^2$

$= 1024 + 9$

$= 1033$

d) $[(-2)^3 \div (-2)^2]^2 + [(-3)^3 \times (-3)^2]^2$

$= [(-2)^1]^2 + [(-3)^1]^2$

$= (-2)^2 + (-3)^2$

$= 4 + 9$

$= 13$

e) $[(-2)^3 \div (-2)^2]^2 - [(-3)^3 \div (-3)^2]^2$

$= [(-2)^1]^2 - [(-3)^1]^2$

$= (-2)^2 - (-3)^2$

$= 4 - 9$

$= -5$

f) $[(-2)^3 \times (-2)^2]^2 + [(-3)^3 \times (-3)^2]^2$

$= [(-2)^5]^2 + [(-3)^5]^2$

$= (-2)^{10} + (-3)^{10}$

$= 1024 + 59049$

$= 60073$