# MATH 7 <br> HOMEWORK 1: ALGEBRA REVIEW 

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## Exponents Laws

If $a$ is a real number, $n$ is a positive integer, $a^{n}=\underbrace{a \times a \times \ldots \times a}_{n \text {-times }}$

$$
\begin{aligned}
& a^{0}=1 \\
& a^{m} \times a^{n}=a^{m+n} \\
& a^{m} \div a^{n}=a^{m-n} \\
& (a \times b)^{n}=a^{n} \times b^{n} \\
& \left(\frac{a}{b}\right)^{n}=\frac{a^{n}}{b^{n}} \\
& a^{-n}=\frac{1}{a^{n}} \\
& \left(a^{m}\right)^{n}=a^{m n}
\end{aligned}
$$

## Radicals

$$
\begin{aligned}
& a^{\frac{m}{n}}=\sqrt[n]{a^{m}}, n \neq 0 \\
& \sqrt{a b}=\sqrt{a} \sqrt{b}
\end{aligned}
$$

## Algebraic Identities

$$
\begin{aligned}
& (a+b)^{2}=a^{2}+2 a b+b^{2} \\
& (a-b)^{2}=a^{2}-2 a b+b^{2} \\
& a^{2}-b^{2}=(a-b)(a+b)
\end{aligned}
$$

## Homework

1. The difference between two numbers is $\frac{5}{12}$. If $\frac{3}{4}$ of the larger number is $\frac{3}{8}$ more than $\frac{1}{2}$ of the smaller, find the larger number.
2. Without a calculator, compute

$$
19999 \cdot 20001
$$

Is there a shorter way of doing it than the straightforward multiplication?
3. Expand
(a) $2 x(a+2 b+3 c)$
(b) $-3 y(a-a y+b y)$
(c) $\left(a^{2}+2 a+1\right)(a+1)$
(d) $\left(b^{2}-2 b+1\right)(b-1)$
(e) $(4 x-7 y)(4 x+7 y)$
(f) $\left(6 x^{2}-y\right)\left(7 x^{2}-2 x-5\right)$
4. Factor (i.e., write as a product) the following expressions:
(a) $a^{2}+4 a b+4 b^{2}$
(b) $a^{2}-2 a+1$
(c) $a^{4}-b^{4}\left[\right.$ Hint: $a^{4}=\left(a^{2}\right)^{2}$.]
(d) $x^{2}-7\left[\right.$ Hint: $7=(\sqrt{7})^{2}$.]
(e) $a c+a b$
(f) $x^{2}+3 x^{3}$
(g) $x^{2}-2 x-y x+2 y$
(h) $4 x^{2}-4 x+1$
(i) $4 x^{2}+16 x+2 x y+8 y$
(j) $x^{2}(x+4)+5(x+4)$
(k) $100 x^{8} y^{2}-16 x^{4} y^{6}$
5. John takes 15 min to walk from school to the bus station. Jim takes 20 min to walk from the school to the bus station. If the difference in their speeds is $2 \mathrm{~km} / \mathrm{h}$, how far is the station from the school?
6. Simplify:
(a) $\frac{1}{x+1}-\frac{1}{x-1}$
(b) $\left(1+\frac{1}{x}\right) \div(x+1)$
(c) $\left(1+\frac{1}{x}\right) \div\left(1-\frac{1}{x}\right)$
7. The area of the trapezoid shown is 12 . The top has length 3 and the base has length 5 . What is the area of the shaded region?

8. $\mathrm{AB}=6, \mathrm{BD}=5, \mathrm{ABDC}$ is a rectangle. If EFGH is a square, what is its side length?


