Table 1   Properties of numbers

If A and B and C are algebraic or arithmetic expressions, then

1) $A + 0 = A$

2) $A - 0 = A$

3) $A \cdot 0 = 0$

4) $\dfrac{A}{0}$ is not defined,

5) $\dfrac{0}{A} = 0$

6) $A \cdot 1 = A$

7) $\dfrac{A}{1} = A$

8) $\dfrac{A}{A} = 1$

9) $\dfrac{A}{B} = A \cdot \dfrac{1}{B}$

Table 2   Properties of expressions

If A and B and C are algebraic or arithmetic expressions, then

1) $A + B = B + A$

2) $A - B = -(B - A)$

3) $AB = BA$

4) $\dfrac{A}{B}$ is not generally equivalent to $\dfrac{B}{A}$

5) $\dfrac{A}{B} = \dfrac{AC}{BC}, \quad C \neq 0 \qquad < Fundamental\ Principle\ of\ Fractions >$

6) $A(B + C) = AB + AC$

7) $AB + AC = A(B + C)$

Table 3   Properties of exponents and radicals

1) $a^n = \underbrace{a \cdot a \cdot a \cdots a}_{n-many\,times}$

2) $a^{n+m} = a^n a^m$

3) $a^0 = 1$

4) $a^1 = a$

5) $(a^n)^m = a^{nm} = (a^m)^n \qquad < \text{student can explain why} >$

6) $a^{-1} = \dfrac{1}{a}$

7) $a^{-n} = \dfrac{1}{a^n}$

8) $\left(\dfrac{a}{b}\right)^n = \dfrac{a^n}{b^n} \qquad < \text{student can explain why} >$

9) $a^{1/n} = \sqrt[n]{a}$

10) $a^{m/n} = \sqrt[n]{a^m} = (\sqrt[n]{a})^m$

11) $(\sqrt[n]{a})^n = a$

12) $\sqrt[n]{ab} = \sqrt{a}\sqrt{b}$ and $\sqrt[n]{\dfrac{a}{b}} = \dfrac{\sqrt[n]{a}}{\sqrt[n]{b}}$

Plus,

13) $\sqrt[n]{a+b} \neq \sqrt{a} + \sqrt{b} \qquad < unless\ a = 0\ or\ b = 0 >$

14) $(a+b)^n \neq a^n + b^n \qquad < unless\ a = 0\ or\ b = 0 >$

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Table 4   Properties of Logarithms

1) $\log_b 1 = 0$

2) $\log_b b = 1$

3) $\log_b b^x = x$

4) $b^{\log_b x} = x$

5) $\log_b M + \log_b N = \log_b (MN)$

6) $\log_b M - \log_b N = \log_b (\frac{M}{N})$

7) $\log_b (x^a) = a \log_b x$

8) $\log_b (a) = \dfrac{\log_c a}{\log_c b}$

Table 5   Properties of equality

If *A* and *B* and *C* are algebraic or arithmetic expressions, and, $A = B$, then

1) $A + C = B + C$ *< we may add the same expression to both sides >*

2) $A - C = B - C$ *< we may subtract the same expression from both sides >*

3) $AC = BC$ *< we may multiply both sides by the same (nonzero) expression >*

4) $\dfrac{A}{C} = \dfrac{B}{C}$ *< we may divide both sides by the same (nonzero) expression >*

5) $B = A$ *< we may interchange the two sides of the equation >*

Table 6   Properties of inequalities

If *A* and *B* are algebraic or arithmetic expressions with $A \le B$, then

1) $A + C \le B + C$ *< we may add the same expression to both sides >*

2) $A - C \le B - C$ *< we may subtract the same expression from both sides >*

3) $AC \le BC$, $0 < C$ *< we may multiply both sides by the same (positive) expression >*

4) $BC \le AC$, $C < 0$ *< with care, we may multiply both sides by the same (negative) expression >*

5) $\dfrac{A}{C} \le \dfrac{B}{C}$, $0 < C$ *< we may divide both sides by the same (positive) expression >*

6) $\dfrac{B}{C} \le \dfrac{A}{C}$, $C < 0$ *< with care, we may divide both sides by the same (negative) expression >*