GRADE 7 ACCELERATED · UNIT 4

Reference Sheet

Solving Problems with Rational Numbers — keep this in your binder

Name_____
Date_____
Period_____

Everything on this page is tested from memory. The Grade 8 FAST reference sheet lists none of it; what the test gives you is an on-screen scientific calculator.

1. Operations in Scientific Notation

Lessons 4.01–4.04 · the powers must match to add, never to multiply

Adding and subtracting: the powers of ten must match first. A power of ten is a place value, and you can only add things of the same size. Rewrite one number so both carry the same power, then add or subtract the coefficients and copy the power down.

	Add or subtract	Multiply or divide
Must the powers match?	Yes — rewrite one first	No. They can be as far apart as they like
What happens to the coefficients	add or subtract them	multiply or divide them
What happens to the exponents	nothing — the power is copied down	add them (product) or subtract them, top minus bottom (quotient)
The exponents may be	no more than 2 apart	as far apart as they like

The exponents are never added when you add. $(1.3\times10^{3})+(3.4\times10^{5})$ is not 4.7×10^{8}. Ten to the fifth plus ten to the third is not a power of ten at all.

Every answer ends with a coefficient at least 1 and less than 10. If it is over 10, move the point one place left and raise the exponent: $14.5\times10^{7}=1.45\times10^{8}$. If it is under 1, move the point one place right and lower the exponent: $0.53\times10^{-2}=5.3\times10^{-3}$.

Addition and subtraction are limited to exponents within 2 of each other. That is the benchmark's own rule. Multiplication and division have no such limit.

2. Radicals

Lesson 4.05 · know both lists cold

The radical bar is a grouping symbol. Everything under it is finished before the root is taken. $\sqrt{9+16}=\sqrt{25}=5$ — never $3+4$.

Perfect squares to 225	1, 4, 9, 16, 25, 36, 49, 64, 81, 100, 121, 144, 169, 196, 225
Perfect cubes, −125 to 125	−125, −64, −27, −8, −1, 0, 1, 8, 27, 64, 125

A square root sign gives the nonnegative root only. $\sqrt{49}=7$, not −7 and not both, even though $(-7)^{2}$ is also 49.

A cube root keeps the sign of what is under it. $\sqrt[3]{-64}=-4$. A cube root of a negative number is ordinary; a SQUARE root of a negative number is not a number you have. That difference is the one the state guide names for this benchmark.

Roots of fractions come apart. $\sqrt{\frac{4}{25}}=\frac{2}{5}$ and $\sqrt[3]{\frac{1}{125}}=\frac{1}{5}$ — top and bottom each get the root.

A root and a power in one expression: finish each piece, then combine.
$\sqrt{4^3 - 39} \cdot 5^{-3} = 5 \cdot \frac{1}{125} = \frac{1}{25}$.

3. The Order of Operations

Lesson 4.06 · read the structure, not a mnemonic

There is no mnemonic here, and that is deliberate. A mnemonic has no letter for the radical bar or the fraction bar. Read the expression and ask what is holding what.

Level	What	How
1	Grouping symbols	( ), [ ], the radical bar, the fraction bar — innermost first
2	Powers and roots	the same level as each other
3	Multiply and divide	left to right, as they come
4	Add and subtract	left to right, as they come

Left to right means left to right. $12 \div 3 \cdot 2 = 4 \cdot 2 = 8$, not 2. $10 - 4 + 3 = 6 + 3 = 9$, not 3. Nothing puts multiplication ahead of division or addition ahead of subtraction.

An exponent is attached to its own base, and parentheses decide what that base is. $-2^2 = -4$ but $(-2)^2 = 4$. $2 \cdot 3^2 = 18$, not 36.

A fraction bar is two grouping symbols at once. Finish the numerator, finish the denominator, then divide: $\frac{2^3 - 5}{6^2 - 27} = \frac{3}{9} = \frac{1}{3}$.

4. Formulas and Word Problems

Lessons 4.07–4.08 · substitute in parentheses; round last

Substitute in parentheses, every time. With $x = -4$, x^2 is $(-4)^2 = 16$. The parentheses keep the exponent attached to what it was attached to, and they keep a negative value negative.

There is no key word that tells you which operation to use. Two problems can carry the same numbers and the same words and need different operations. 15 dollars plus 4 dollars for each of 6 gigabytes is $15 + 4(6) = 39$; 15 dollars for each of 4 lines plus 6 dollars of tax is $15(4) + 6 = 66$. Circling and boxing gives the same markings on both.

A rate goes inside the parentheses that multiply the size; a flat fee stays outside. A square floor of side 9 feet at 2.89 dollars a square foot with a flat 95 dollars to install is $9^2(2.89) + 95$, never $9^2(2.89 + 95)$.

Round once, at the end, and write the unit. Six sides of $\sqrt{200}$ feet is 84.85 feet; rounding the side to 14 first gives 84. An answer with no unit is not an answer.

5. Vocabulary

coefficient — the factor a in $a \times 10^n$; in a finished answer, $1 \le a < 10$

radical — a root symbol together with everything under its bar

radicand — the number under the radical bar; the bar groups it, so it is finished before the root is taken

principal square root — the nonnegative root that the square root sign names

grouping symbol — anything that holds part of an expression together: ( ), [ ], the radical bar, the fraction bar

formula — a rule written with letters that becomes a number once each letter is replaced by a value

substitute — replace a letter with its value, in parentheses

rate — an amount per unit — per square foot, per second — which multiplies the size; a flat fee does not