

8th Grade Math Final Exam Review

Everything on a typical 8th grade math final, one unit at a time: the rules you need, the mistakes that cost the most points, and three practice questions per unit with answers. Start with the quick checks to find your weak units, then use the linked lessons to fix them.

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What’s on the 8th Grade Math final

The order of units varies more in 8th grade math than in most courses. Many schools teach transformations, similarity, slope, linear equations and systems in the first semester, then functions, volume, data, exponents and the Pythagorean theorem in the second, but some start the year with exponents and irrational numbers instead. Check your review packet, and if your final is in December, focus on the units your class has covered.

Unit	Usually on	Lessons
1. Transformations, congruence & angles	Semester 1	Transformations & Similarity, Geometry
2. Dilations & similarity	Semester 1	Similarity Arguments with Transformations, Transformations & Similarity
3. Slope & linear relationships	Semester 1	Linear Relationships & Slope
4. Linear equations & systems	Semester 1	Linear Relationships & Slope, Systems of Linear Equations
5. Functions	Semester 2	Functions & Patterns, Comparing Two Functions, Graph Stories & Qualitative Features
6. Volume of cylinders, cones & spheres	Semester 2	Volume of Cylinders, Cones & Spheres
7. Scatter plots & two-way tables	Semester 2	Scatter Plots & Bivariate Data, Two-Way Tables & Relative Frequencies, Building Linear Models from Data

Unit	Usually on	Lessons
8. Exponents & scientific notation	Semester 2	Exponents & Scientific Notation
9. Real numbers & the Pythagorean theorem	Semester 2	Irrational Numbers & the Real Number Line, Cube Roots & Powers of Roots, Pythagorean Theorem, Distance on the Coordinate Plane

A two-week study plan

DAY 14

Find your weak units

Do the quick checks for all 9 units without notes. Mark each unit solid, shaky or lost. This tells you where your study time goes.

DAYS 13–6

Fix the lost and shaky units, one a day

Start with the units you marked lost, then shaky. For each one, read the must-know list, work through the linked lesson, and redo that unit's quick checks until you get all three right.

DAYS 5–3

Mixed practice

Finals mix units together, so practice that way: pick problems from different units, work them without looking at which unit they came from, and check each answer.

DAY 2

Formulas and mistakes

Review the formula sheet and every "common mistakes" list. Write out from memory the formulas you still look up.

DAY 1

Light review and sleep

Redo only the questions you missed before. Then stop: a full night of sleep helps your memory more than a late cram session.

Transformations, congruence & angles

MUST KNOW

- Translation: add to the coordinates, $(x, y) \rightarrow (x + a, y + b)$. Reflections: over the x -axis $(x, y) \rightarrow (x, -y)$; over the y -axis $(x, y) \rightarrow (-x, y)$.
- Rotations about the origin: 90° counterclockwise $(x, y) \rightarrow (-y, x)$ and 180° $(x, y) \rightarrow (-x, -y)$.
- Translations, reflections and rotations keep lengths and angle measures, so the image is congruent to the original. Two figures are congruent when a sequence of these moves matches them.
- When parallel lines are cut by a transversal, corresponding angles and alternate interior angles are equal, and same-side interior angles add to 180° . Vertical angles are always equal.
- The angles of a triangle add to 180° , and an exterior angle equals the sum of the two remote interior angles.

COMMON MISTAKES

- Mixing up the rotation rules. Check with a sketch: a point in Quadrant I rotated 90° counterclockwise lands in Quadrant II.
- Changing the wrong sign in a reflection. Over the x -axis, x stays the same and y changes sign.

QUICK CHECK

1.1 Translate $(-2, 5)$ 4 units right and 3 units down.

1.2 Rotate $(3, -1)$ by 180° about the origin.

1.3 Two angles of a triangle are 38° and 75° . Find the third angle and the exterior angle at that vertex.

Dilations & similarity

MUST KNOW

- A dilation about the origin with scale factor k sends (x, y) to (kx, ky) . If $k > 1$ the figure gets bigger; if $0 < k < 1$ it gets smaller.
- A dilation keeps angle measures but multiplies every length by k , so the image is similar to the original, not congruent (unless $k = 1$).
- Similar figures have equal corresponding angles and proportional corresponding sides. A sequence of rigid motions and dilations shows two figures are similar.
- AA: if two angles of one triangle equal two angles of another, the triangles are similar, because the third angles must match too.
- Slope triangles drawn on the same line are similar, which is why the slope is the same between any two points on a line.

COMMON MISTAKES

- Adding the scale factor instead of multiplying. A scale factor of 3 turns a side of 4 into 12, not 7.
- Calling triangles similar from one pair of equal angles. You need two pairs.

QUICK CHECK

2.1 Dilate $(4, -6)$ by a scale factor of $\frac{1}{2}$ centered at the origin.

2.2 A triangle with sides 3, 4 and 5 is similar to a triangle whose shortest side is 12. Find its other two sides.

2.3 One triangle has angles 40° and 75° . Another has angles 40° and 65° . Are they similar?

UNIT 3 · SEMESTER 1

Slope & linear relationships

MUST KNOW

- Slope is the rate of change: $m = \frac{y_2 - y_1}{x_2 - x_1}$, rise over run.
- A proportional relationship $y = kx$ is a line through the origin, and its slope k is the unit rate.
- In $y = mx + b$, m is the slope and b is the y -intercept, the value of y when $x = 0$.
- In a word problem, the slope is the rate (per hour, per ticket) and the y -intercept is the starting amount.
- A horizontal line has slope 0; a vertical line has an undefined slope.

COMMON MISTAKES

- Putting the change in x on top. Slope is change in y over change in x .
- Subtracting the coordinates in a different order on the top and the bottom, which flips the sign of the slope.

QUICK CHECK

3.1 Find the slope of the line through $(-1, 4)$ and $(3, -4)$.

3.2 A plumber charges a 45 dollar visit fee plus 30 dollars per hour. Write an equation for the total cost y after x hours.

3.3 Car A gets gas mileage given by $y = 28x$, where y is miles and x is gallons. Car B goes 150 miles on 5 gallons. Which car gets more miles per gallon?

UNIT 4 · SEMESTER 1

Linear equations & systems

MUST KNOW

- Solve an equation by distributing, combining like terms, collecting the variable on one side, then undoing operations in reverse order.
- An equation can have one solution, no solution (you end with something false like $6 = 5$) or infinitely many (you end with something true like $4 = 4$).
- The solution of a system is the ordered pair that makes both equations true, the point where the two lines cross.
- Substitution: solve one equation for a variable and put that expression into the other. Elimination: add or subtract the equations so one variable cancels.
- Lines with the same slope and different y -intercepts are parallel, so the system has no solution; the same line has infinitely many.

COMMON MISTAKES

- Dropping a negative when distributing: $-2(x - 3)$ is $-2x + 6$.
- Stopping after finding x . A system's answer is an ordered pair, so substitute back to find y .

QUICK CHECK

4.1 Solve $3(x - 2) = 5x + 4$.

4.2 How many solutions does $2(x + 3) = 2x + 5$ have?

4.3 Solve the system $y = x + 3$ and $2x + y = 12$.

Functions

MUST KNOW

- A function gives each input exactly one output. A graph is a function if it passes the vertical line test.
- A linear function $y = mx + b$ has a constant rate of change, so equal steps in x always change y by the same amount, and its graph is a straight line.
- Functions like $y = x^2$ are nonlinear: equal steps in x change y by different amounts, and the graph curves.
- Find the rate of change and the initial value from a table, graph, equation or story, and use them to compare two functions.
- On a graph with no numbers, rising means increasing, falling means decreasing, flat means constant, and steeper means changing faster.

COMMON MISTAKES

- Saying a relation is not a function because an output repeats. Repeated outputs are fine; only a repeated input with different outputs breaks the rule.
- Assuming every table is linear. Check that the steps in y are equal before you write $y = mx + b$.

QUICK CHECK

5.1 Is $\{(1, 4), (2, 5), (1, 6), (3, 7)\}$ a function?

5.2 A table shows $x = 0, 1, 2, 3$ and $y = 5, 8, 11, 14$. Write the function.

5.3 Is $y = x^2 + 1$ linear? Use $x = 0, 1, 2, 3$ to explain.

UNIT 6 · SEMESTER 2

Volume of cylinders, cones & spheres

MUST KNOW

- Cylinder: $V = \pi r^2 h$.
- Cone: $V = \frac{1}{3} \pi r^2 h$, one third of a cylinder with the same radius and height.
- Sphere: $V = \frac{4}{3} \pi r^3$.
- If you are given the diameter, find the radius first: $r = \frac{d}{2}$.
- Volume is in cubic units. Leave the answer in terms of π or round a decimal, whichever the question asks for.

COMMON MISTAKES

- Using the diameter as the radius, which makes a cylinder four times too big.
- Using the slant height of a cone. The formula needs the straight up-and-down height.
- Forgetting the $\frac{1}{3}$ for a cone.

QUICK CHECK

6.1 Find the volume of a cylinder with radius 4 and height 10.

6.2 Find the volume of a cone with a diameter of 6 and a height of 10.

6.3 Find the volume of a sphere with radius 3.

Scatter plots & two-way tables

MUST KNOW

- A scatter plot can show a positive association, a negative association or no association. Also look for a linear or curved pattern, clusters and outliers.
- A line of best fit follows the trend with about as many points above it as below it. Use it to make predictions.
- In a fit line $y = mx + b$, the slope is the predicted change in y for each one-unit increase in x , and b is the predicted value at $x = 0$.
- A two-way table counts data for two categories. Row or column relative frequencies (percents) let you compare groups of different sizes.
- If the row percents are very different, the two variables are associated. An association alone does not prove that one causes the other.

COMMON MISTAKES

- Comparing raw counts when the groups are different sizes. Compare percents instead.
- Predicting far outside the data. A fit line is most trustworthy inside the range of the data.

QUICK CHECK

7.1 The line of best fit for plant height y (cm) after x weeks is $y = 2.5x + 4$. Predict the height at 6 weeks and explain the slope.

7.2 Describe the association between outdoor temperature and a home heating bill.

7.3 In a survey, 10 of 40 seventh graders and 30 of 60 eighth graders ride the bus. Is there an association between grade and riding the bus?

UNIT 8 · SEMESTER 2

Exponents & scientific notation

MUST KNOW

- With the same base: $a^m \cdot a^n = a^{m+n}$, $\frac{a^m}{a^n} = a^{m-n}$ and $(a^m)^n = a^{mn}$.
- $a^0 = 1$ and $a^{-n} = \frac{1}{a^n}$ (for $a \neq 0$). A negative exponent makes a fraction, not a negative number.
- Scientific notation is $a \times 10^n$ with $1 \leq a < 10$. Large numbers have a positive n ; small decimals have a negative n .
- To multiply or divide in scientific notation, work with the numbers in front and the powers of 10 separately, then adjust so the front number is between 1 and 10.
- To compare, look at the powers of 10 first; if they match, compare the numbers in front.

COMMON MISTAKES

- Multiplying the bases: $3^2 \cdot 3^4 = 3^6$, not 9^6 .
- Thinking 2^{-3} is negative. It equals $\frac{1}{8}$.
- Leaving an answer like 12×10^8 . The front number must be less than 10, so write 1.2×10^9 .

QUICK CHECK

8.1 Simplify $\frac{2^5 \cdot 2^{-3}}{2^4}$.

8.2 Write 0.00072 in scientific notation.

8.3 Multiply $(3 \times 10^5)(4 \times 10^3)$.

Real numbers & the Pythagorean theorem

MUST KNOW

- Rational numbers can be written as a fraction of integers, and their decimals end or repeat. Irrational numbers like $\sqrt{2}$ and π have decimals that never end or repeat.
- Estimate a square root between perfect squares: $49 < 50 < 64$, so $\sqrt{50}$ is between 7 and 8, close to 7.
- $x^2 = p$ has two solutions, $x = \pm\sqrt{p}$; $x^3 = p$ has one, $x = \sqrt[3]{p}$. Know the perfect squares to 144 and the perfect cubes to 125.
- Pythagorean theorem: in a right triangle, $a^2 + b^2 = c^2$, where c is the hypotenuse across from the right angle. If the sides of a triangle fit this equation, it is a right triangle (the converse).
- The distance between two points is the hypotenuse of a right triangle: $d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$.

COMMON MISTAKES

- Calling every square root irrational. $\sqrt{16} = 4$ and $\sqrt{\frac{1}{9}} = \frac{1}{3}$ are rational.
- Adding the sides instead of their squares, or using a leg as c . The hypotenuse is always the longest side.

QUICK CHECK

9.1 Between which two whole numbers is $\sqrt{70}$? Which is it closer to?

9.2 Write $0.\overline{36}$ as a fraction in simplest form.

9.3 Find the distance between $(-3, 2)$ and $(5, 8)$.

Answer key

Unit 1: Transformations, congruence & angles

1.1 $(2, 2)$. Add 4 to x and subtract 3 from y .

1.2 $(-3, 1)$. A 180° rotation changes the sign of both coordinates.

1.3 67° and 113° . $180 - 38 - 75 = 67$, and the exterior angle is $38 + 75 = 113$.

Unit 2: Dilations & similarity

2.1 $(2, -3)$. Multiply both coordinates by $\frac{1}{2}$.

2.2 16 and 20. The scale factor is $12 \div 3 = 4$, so multiply 4 and 5 by 4.

2.3 Yes. The first triangle's third angle is $180 - 40 - 75 = 65^\circ$, so both have angles 40° , 65° and 75° , and AA applies.

Unit 3: Slope & linear relationships

3.1 -2 . $\frac{-4-4}{3-(-1)} = \frac{-8}{4}$.

3.2 $y = 30x + 45$. The rate, 30 dollars per hour, is the slope, and the fee is the y -intercept.

3.3 Car B. Its unit rate is $150 \div 5 = 30$ miles per gallon, which beats Car A's 28.

Unit 4: Linear equations & systems

4.1 $x = -5$. Distribute to get $3x - 6 = 5x + 4$, so $-2x = 10$.

4.2 None. Distributing gives $2x + 6 = 2x + 5$, and subtracting $2x$ leaves $6 = 5$, which is false.

4.3 $(3, 6)$. Substitute: $2x + x + 3 = 12$, so $x = 3$ and $y = 3 + 3 = 6$.

Unit 5: Functions

5.1 No. The input 1 has two different outputs, 4 and 6.

5.2 $y = 3x + 5$. y goes up by 3 each step, and the value at $x = 0$ is 5.

5.3 No. The outputs are 1, 2, 5, 10, which change by 1, 3 and 5, not by a constant amount.

Unit 6: Volume of cylinders, cones & spheres

6.1 $160\pi \approx 502.7$ cubic units. $\pi(4^2)(10) = 160\pi$.

6.2 $30\pi \approx 94.2$ cubic units. The radius is 3, and $\frac{1}{3}\pi(9)(10) = 30\pi$.

6.3 $36\pi \approx 113.1$ cubic units. $\frac{4}{3}\pi(27) = 36\pi$.

Unit 7: Scatter plots & two-way tables

7.1 19 cm. $2.5(6) + 4 = 19$; the slope means the plant grows about 2.5 cm per week.

7.2 Negative. As the temperature goes up, the heating bill tends to go down.

7.3 Yes. 25% of seventh graders ride the bus compared with 50% of eighth graders, a large difference in row percents.

Unit 8: Exponents & scientific notation

8.1 $\frac{1}{4}$. The exponent is $5 + (-3) - 4 = -2$, and $2^{-2} = \frac{1}{4}$.

8.2 7.2×10^{-4} . Move the decimal 4 places right to get 7.2, so the exponent is -4 .

8.3 1.2×10^9 . $3 \cdot 4 = 12$ and $10^5 \cdot 10^3 = 10^8$, then $12 \times 10^8 = 1.2 \times 10^9$.

Unit 9: Real numbers & the Pythagorean theorem

9.1 Between 8 and 9, closer to 8. $64 < 70 < 81$, and 70 is much closer to 64; $\sqrt{70} \approx 8.4$.

9.2 $\frac{4}{11}$. Let $x = 0.\overline{36}$; then $100x - x = 36$, so $x = \frac{36}{99} = \frac{4}{11}$.

9.3 10. The legs are $5 - (-3) = 8$ and $8 - 2 = 6$, and $\sqrt{64 + 36} = \sqrt{100}$.