



High School Math Long-Term Sub Plans, 4 Weeks

Four complete week binders of high school math, grades 9 to 12, for any course: Algebra 1, Geometry or Algebra 2 classes. Every day has individual work and a team task, and every task has a "say this" script.

PREVIEW

What is included

- Four week binders (68, 65, 65, 64 pages): 262 pages
- 52 front pages: binder cover, important information, note to the sub, the week plan filled in, schedule, set index, class list, how it went, Monday opener
- 40 solo blocks (20 math sets, 20 calm blocks) and 20 team tasks for groups of four
- A "say this to the class" script for all 84 tasks: 2 or 3 sentences the sub reads out
- A core task and a ★ challenge in every math set and team task
- 20 optional games, each on that day's math lesson, a fun way to end the class
- Answer keys for everything; color and ink-saver B&W, US Letter and A4

How it works

1. Leave the four binders out. Each has its own filled-in plan with page numbers.
2. The sub reads the "say this" box out, then runs the day's math set in every period; students work on their own. Everyone does the core task, early finishers go on to the ★ challenge.
3. The calm block fits any gap, the team task fills a block period or extra time, the game the last 15 minutes.
4. No prep and no tech: print and go.

The 20 days, 20 topics: a math set, a team task and a game each day

- **Week 1, days 1 to 5. Math:** Linear Equations and Inequalities, Slope and Graphing Lines, Systems of Equations, Exponents and Polynomials, Area, Volume and Right Triangles. **Team tasks:** Largest to Smallest, The Pocket Park Plan, Twenty Four Squares, The Fountain Arc, Calculator Debate.
- **Week 2, days 6 to 10. Math:** Function Notation, Literal Equations and Formulas, Factoring Polynomials, Percent Applications, Two-Way Tables and Relative Frequency. **Team tasks:** Vending Machine Audit, Formula Help Desk, Tile Rectangle Builders, Best Offer Rankings, Club Fair Survey Desk.
- **Week 3, days 11 to 15. Math:** Linear Functions from Tables, Graphs and Words, Absolute Value Equations and Inequalities, Solving Quadratics by Factoring and Square Roots, Similar Triangles and Scale, Compound Probability. **Team tasks:** Taxi Fare Detectives, Quality Control Line, Root Rummy, Classroom Floor Plan, Random Digit Lab.
- **Week 4, days 16 to 20. Math:** Exponential Growth and Decay, Radicals and Rational Exponents, The Quadratic Formula and Parabolas, Right Triangle Trigonometry, Scatter Plots, Best Fit and Correlation. **Team tasks:** Which Offer Wins, Radical Dominoes, Skate Ramp Designer, Height Finder Survey, Prediction Contest.

Optional game every day, on that day's math lesson: Mon **Whiteboard Quiz Game** Tue **Paper Password** Wed **Class Feud** Thu **Classroom Millionaire** Fri **Mystery Box**

What this preview shows: the note to the substitute, the Week 1 plan, more front pages, one page of every daily part, a full math set with its answer key, a calm block, a team task, the game types and one ink-saver page. Every product page is watermarked. The full product has 262 pages.



Note to the Substitute

Grades 9 to 12 · five days · every set runs from the printout alone

Thank you for covering my classes this week

Everything you need is in this binder. The front pages (important information, weekly schedule, class list) are filled in for this week. After them come the work sets, one per day: **Math 1** is Monday's set, **Math 2** is Tuesday's, and so on to **Math 5** on Friday. Run the day's set in every period you teach that day. Each set is one period (45 to 55 minutes), stands alone, and has its own answer key at the back of the binder, so you never have to make anything up or know the subject. Every task starts with a short **Say this to the class** box under its title: read it out, and the class knows what to do and how to start.

Every student page has a core task first, then a ★ challenge. Every student does the core task. Students who finish early go on to the ★ challenge; it fills a few extra minutes, and nobody has to finish it.

After the subject sets come the shared blocks, one of each per day. The **calm block** is always allowed: for a period that runs short, a loud class, or anyone who finishes early. The **team task** fills a period on its own. The **game** is optional: a fun way to end the class, or something for extra time. Fifteen minutes, from the script.

Each day has

- One Math set (one period, core task + ★ challenge on every page)
- A calm and quiet block: a math puzzle and a self-checking practice page
- A team task for groups of four
- A paper game from the script

If the class is loud

- Set a voice level with a number, 0 to 3, and use it all week (the Day 1 opener explains it).
- Switch to the calm block. Nobody needs to move.
- Every student page has a ★ challenge, so fast finishers always have something.
- If a set is not working, stop it and use the calm block or the team task. Every set starts cold.

At the end of each day

Please fill in that day's line on the "How it went" page. It takes two minutes and I read every word.

Did this kit work well for your class? A quick review helps other teachers find it and earns you TpT credits. Thank you!



This Week's Plan

Filled in for you: run the day's set in every period you teach. Keep it as it is, or use the blank schedule on the next page for your own order.

WHEN	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY
Start of class	Meet Your Sub p. 11 · 15 min, every period	Attendance, voice level	Attendance, voice level	Attendance, voice level	Attendance, voice level
Main work, every period	Math 1 Linear Equations and Inequalities p. 14	Math 2 Slope and Graphing Lines p. 22	Math 3 Systems of Equations p. 31	Math 4 Exponents and Polynomials p. 40	Math 5 Area, Volume and Right Triangles p. 49
Early finishers or a loud moment	Word Search and Quiet Practice p. 17	Term Match and Quiet Practice p. 25	Code Breaker and Quiet Practice p. 34	Word Scramble and Quiet Practice p. 43	Cross-Number and Quiet Practice p. 52
Block period or extra time	Largest to Smallest p. 19	The Pocket Park Plan p. 27	Twenty Four Squares p. 36	The Fountain Arc p. 45	Calculator Debate p. 54
Last 15 minutes (optional): a fun way to end the class, or for extra time	Whiteboard Quiz Game p. 20	Paper Password p. 29	Class Feud p. 38	Classroom Millionaire p. 47	Mystery Box p. 56

How to use this plan

- Page numbers point to the first page of each set. Copy one per student.
- The calm block is always allowed: a period that runs short, a loud class, or anyone who finishes early.
- The game is optional: a fun way to end the class, or something for extra time.

HS MATH SUB PLANS WEEK 1

High School Math, 5 Days of Print and Go Work

Teacher _____
Room _____
Grade and classes _____
Week of _____

Everything a sub needs for five days is in this binder: a filled-in weekly plan, a blank schedule, the class list, and for every day one Math set, a calm block, a team task and a paper game. Each set is one period, stands alone, and has its own answer key. Nothing needs subject knowledge, a login or a projector.



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HS Math Sub Plans Week 1: High School Math, 5 Days of Print and Go Work

Important Information

The page the sub reads first. Fill it in once and keep it current!

People to call

Office _____
Teacher next door _____
Nurse _____
Principal / admin _____
Tech help _____

Emergency procedures

Fire: exit and meeting point _____
Lockdown _____
Severe weather _____
Medical _____
Where the first aid kit is _____

Helpful students

Students who need extra support

Where things are

Attendance / how to take it _____
Paper, pencils, supplies _____
Hall passes _____
Copper, if the sub may use it _____

Class routines

Start of class _____
Bathroom _____
Phones _____
End of class _____

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Important Information

Weekly Schedule (Blank)

Read sub script, write the set for each period (Monday: Math 1, Tuesday: Math 2, and so on) and the class next to each period. Cross out or rename periods to match the school day.

PERIOD / CLASS	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY
Period 1					
Class					
Period 2					
Class					
Period 3					
Class					
Period 4					
Class					
Period 5					
Class					
Period 6					
Class					
Period 7					
Class					

How to fill it in

- One set per period. Each set runs 45 to 55 minutes. If a period runs longer, the 30 challenges fit a few minutes, or add that day's team task.
- Same subject all day? Write the day's set in every period you teach. Planning, lunch and duty periods: cross them out.
- On Monday the opener (15 minutes) comes first in every period, then the set.
- The game is optional: put it in the last period as a fun way to end the class, or use it for extra time. The calm block goes in any gap.

Set naming

Sets are named by subject and day. Math 1 is Monday's set, Math 2 is Tuesday's, and so on to Math 5 on Friday. The set index lists every set with its minutes and page.

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Weekly schedule, blank

Class List and Dismissal

Notes: what a sub must know and how every student gets home. Copy one per class.

☐ bus (write the number) ☐ walks ☐ picked up (write who) ☐ after-school program ☐ other

★ in the notes, a student who finds the core task essay may start with the challenge.

STUDENT NAME	NOTES (ALLERGIES, NEEDS, HELPFUL, LEAVES EARLY)	HOME	BUS # / PICKED UP BY / PROGRAM
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			
16			
17			
18			
19			
20			
21			
22			
23			
24			
25			
26			
27			
28			
29			
30			

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Class list and dismissal

How It Went

For the sub script, one line per day, ten minutes at the end of each day. Check the boxes and go.

Monday

Sets done: _____ Class was: ☐ Great ☐ Fine ☐ Hard, see notes
Notes / stars of the day: _____

Tuesday

Sets done: _____ Class was: ☐ Great ☐ Fine ☐ Hard, see notes
Notes / stars of the day: _____

Wednesday

Sets done: _____ Class was: ☐ Great ☐ Fine ☐ Hard, see notes
Notes / stars of the day: _____

Thursday

Sets done: _____ Class was: ☐ Great ☐ Fine ☐ Hard, see notes
Notes / stars of the day: _____

Friday

Sets done: _____ Class was: ☐ Great ☐ Fine ☐ Hard, see notes
Notes / stars of the day: _____

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How it went

Meet Your Sub

Day 1 opener. 15 minutes at the start of every period on Monday, before the set. Nothing to prepare.

Openers
"Hi everyone, I am covering math for your teacher this week, and each day you get one printed math set for this period. I will start with a short introduction and three of your questions, and then we go through the class agreement. Each page has a core task for everyone and a star challenge for when you finish."

Sub script (the same five minutes in every class)

- Before first period, fill in the introduction sheet on the next page, once, for the whole day. Keep it short and honest. A high school class needs a sub in about 100 seconds, so give them something real to read.
- Introduce yourself from the sheet in two minutes. They hold up the Ask the Sub list and take three questions from raised hands. There, not ten. Say when you are done taking questions.
- Read the class agreement out loud and ask this period to add one line of their own. Write that line on the board for the period. The line they wrote is the one they keep.
- Set the voice level with a number from 0 to 3, using the box at the bottom of the sheet. Say which level today's set needs, and use the same numbers in every class all week.
- Start the set with one sentence: this is today's math, everyone does the core task first, the star challenge is for anyone who finishes, and the calm block is always allowed.

If the room is loud

- Skip the questions. Keep the agreement and the voice level, and say the number out loud.
- Start the set sooner. Work on the desk beats a speech about behavior every time.
- Name the level again after four minutes. A number is easier to follow than a lecture.

If a period runs ten minutes short

- Run Odd One Out in groups of four. Six minutes of work, four minutes of reading out.
- Or hand out the Quiet Practice page from the day's calm block and let the room go quiet early.
- Or have each student write one question they would ask the teacher when they get back.

Monday checklist (before first period)

- Read the Important Information page: office extension, exits, the nurse, the teacher next door.
- Check the class list for allergies, medical needs, early releases and students who carry a pass.
- Find today's set on the weekly schedule and count copies for every period, plus five spares.
- Fill in the About Your Sub sheet once and post it where the back row can read it.
- Write the voice levels 0 to 3 on the board and leave them there all week.
- Keep the answer keys inside the binder, not face up on the desk.

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Day 1 opener: sub script

Math Set 4: Exponents and Polynomials

Read the four worked examples and the rules. Then do the quick check. Leave every answer in simplest form.

Today's task: Today's task is exponents and polynomials, and you work on your own. Read the four worked examples on page 1 first. Then work on the tasks below. You will use all general laws every answer in simplest form, and try to be the "class" on each page when you finish.

1. Product and quotient rules
Multiply the numbers out front and ADD the exponents. $(x^2)^3 = x^{2 \cdot 3} = x^6$. Divide the numbers and SUBTRACT the exponents. $x^5 \div x^2 = x^{5-2} = x^3$.
 $2x^5$ and x^3

2. Power of a power
A power outside the parentheses raises everything inside. $(x^2)^3 = x^{2 \cdot 3} = x^6$.
 $8x^3$

3. Zero and negative exponents
Anything except 0 raised to the power 0 is 1. $x^0 = 1$. A negative exponent means one over the positive power. $x^{-2} = 1/x^2$.
1 and 18

Remember
• Multiply: add the exponents. Divide: subtract them. Power of a power: multiply them. The bases have to match first.
• $x^0 = 1$ for every base except 0, and $x^{-n} = 1/x^n$. A negative exponent means one over the positive power.
• Use terms only, $3x^2$ and $4x^2$ add to $7x^2$, but $3x^2$ and $4x$ do not combine at all.
• Subtracting a polynomial means subtracting every term in it. Change each sign inside the second set of parentheses, then add.
• Multiplying: every term in the first set of parentheses multiplies every term in the second. Then combine like terms.

Quick check
1. $(2x^3)^2(7x^2)^3$ _____ 2. $x^5 \div x^8$ _____
3. $(3x^2)^3$ _____ 4. $(x + 2)(x + 3)$ _____

Challenge Simplify $(8x^2)(2x^3)^2(4x^5)$. Write the answer with no negative exponent.

Math set, Week 1 (solo)

Math Set 5: Practice

Three tasks: complete a table, find frequencies and percents, and decide about association.

A. Complete the table (the you like to study with music on?)

Grade	Yes	No	Total
Grade 11	10	40	50
Grade 12	20	100	120
Total	30	140	170

$a = \frac{10}{170}$ $b = \frac{40}{170}$
 $c = \frac{20}{170}$ $d = \frac{100}{170}$

B. Field trip: vote: museum or park? (200 students)

	Museum	Park	Total
Grade 11	30	40	70
Grade 12	60	52	112
Total	90	92	182

1. Grade 12 students who chose the park: $\frac{52}{182}$
2. Grade 11 students in all: $\frac{70}{182}$
3. Grade 11 and park, as a percent of all 200: $\frac{70}{200}$
4. Percent of all 200 who chose the museum: $\frac{90}{200}$
5. Of the Grade 11 students: percent museum: $\frac{30}{70}$
6. Of the museum choosers: percent Grade 11: $\frac{30}{90}$
7. Of the park choosers: percent Grade 12: $\frac{52}{92}$

C. Is there an association? For each table, find the percent of each group that said yes, then write yes or no.

Group	Yes	No	Total
Group A	15	40	55
Group B	10	30	40
Total	25	70	95

$A = \frac{15}{95}$ $B = \frac{10}{95}$

Group	Yes	No	Total
Group A	15	40	55
Group B	10	30	40
Total	25	70	95

$A = \frac{15}{95}$ $B = \frac{10}{95}$

Challenge
Use the museum and park table. Which is larger: the percent of Grade 11 students who chose the park, or the percent of park choosers who are in Grade 11? Explain why they differ.
Percent: _____
Why they differ: _____

Math practice, Week 2 (solo)

Math Set 3: Word Problems

One problem: write the equation, solve it, then decide which solution makes sense in the story. Show your work!

1. A ball is dropped from a ledge 64 feet up. Its height after t seconds is $h = 64 - 16t^2$. After how many seconds does it hit the ground ($h = 0$)?

2. A rectangle is 5 cm longer than it is wide, and its area is 84 cm^2 . Write an equation and find the width and the length.

3. Two consecutive positive integers have a product of 156. Write an equation and find the two integers.

4. A square garden has a path 2 m wide all around it. The garden and the path together make a square with an area of 144 m^2 . How long is each side of the garden?

5. One number is 3 more than the other. The product of the two numbers is 10. Write an equation and find the two numbers that work.

Challenge
1. Explain in one or two sentences why $x^2 + 9 = 0$ has no real solution.
2. Given $x^2 + 10x = 100$ by dividing both sides by x and get only $x = 10$. Which solution did we lose, and why?

Word problems + challenge, Week 3 (solo)

Calm Block, Day 2: Radical Terms Match

Match the terms with the meaning. Each term has a meaning. Each meaning has a term. Write the term next to the meaning.

Terms
1. radicand
2. index
3. cube root
4. perfect square
5. rational exponent
6. square root
7. simplest form
8. like radicals
9. product rule
10. principal root

Meanings
A. roots of the same kind with the same number inside, so they add
B. a value that, multiplied by itself once, gives the number under the sign
C. the positive one of 7 and -7; each one times itself is 49
D. a power written as a fraction, such as the $2/3$ in $8^{2/3}$
E. a whole number such as 49 or 81 that is a whole number times itself
F. a value that, used as a factor three times, gives the number
G. the root of a times 6 equals root a times root 6
H. the number written under the root sign
I. the root has no factor left inside that could come out

How to start
1. Do the pairs you are sure of first and cross off those items.
2. Read each leftover meaning slowly and try every term left on it.
3. Every letter is used exactly once, so the last pair checks the rest.

Done early?
Put ten terms. Draw each with a number example, and use it for the rest of the day.

Calm block: math puzzle (solo)

Calm Block, Day 4: Quiet Practice

For one person, at your seat, work on 3. Every answer is in the box below. Do your best!

Similarly: Be careful
Matching sides of similar figures share one scale factor. Set up a proportion with the matching sides in the same order on both sides.

1. Scale factor from a triangle with sides 4, 5, 6 to one with sides 12, 15, 18.
Answer: _____

2. A map scale is 1 cm : 20 km. How many km does 3.5 cm stand for?
Answer: _____

3. A 1.5 m post casts a 2 m shadow. A wall casts a 6 m shadow. How high is it?
Answer: _____

4. Two angles of a triangle are 40° and 77° . The third angle is 63° .
Answer: _____

5. Scale factor 2. The small triangle has perimeter 21. Perimeter of the large one?
Answer: _____

6. A 10 m model house is 1/50 scale. How many feet of wood does 1 m in it cost?
Answer: _____

Answer bank
Two answers in the bank should be in proportion. Your answer is in the box. Use the bank to check your work, one step at a time.

In my own words
Pick one problem. Write the first step you took, so a friend could follow it.

Calm block: quiet practice (solo)

Team Task, Day 5: Random Digit Lab

Groups of four. Each team has a team name. Each team has a team color. Each team has a team logo. Each team has a team motto.

Today's task: Today's task is Random Digit Lab. For groups of four and about forty minutes. Your group uses a printed table of random digits to act out the experiments of early trials. Then compare the results with the theory. Read the digits in pairs. Write down each pair on a piece of paper. Use the bank below to help you.

The lab
A table of random digits lets you act out chance events without coins or cubes. Every digit 0 to 9 is equally likely. Read the digits two at a time. Each pair is one trial of two events. Run simulation 1 on the row with your group's letter (the sub gives each group a letter from A to I) and simulation 2 on the next row after it comes 1.

Random digit table

A	4418	4398	8032	4841	0663	5714	9882	5733	4808	0781
B	6016	1141	9840	2188	0871	1406	5505	5033	9277	9490
C	4200	2033	0030	3561	5105	3450	1327	5872	2443	8487
D	7396	7904	4252	5183	4559	1993	3986	8830	4132	0088
E	0214	8227	4382	5036	8924	4367	5493	9346	2361	4418
F	7870	4138	7307	9642	5952	5508	8843	9751	3546	0198
G	2797	5143	3205	6263	5707	0917	1492	7023	6494	3524
H	5537	3040	8970	8188	7382	8477	0388	8711	7465	1206

Simulation 1: Two free throws
The player makes 70% of free throws. Digits 0 to 6 = make, 7 to 9 = miss. One pair of digits = one trial. A trial counts as a success every time you get two makes.

Simulation 2: Two free throws
The player makes 70% of free throws. Digits 0 to 6 = make, 7 to 9 = miss. One pair of digits = one trial. A trial counts as a success every time you get two makes.

Jobs and time (40 minutes)
1. Read the lab sheet and the two digit lists: 4 min
2. Run simulation 1: twenty trials: 9 min
3. Run simulation 2: twenty trials: 9 min
4. Work on the theoretical probabilities and compare: 10 min
5. Add your results to the class table on the board: 6 min

Challenge
Make a digit table for a spinner with three parts: A, B, and C. What do you do with the digit that is left over? Then find the theoretical 1/3 chance for each part.

Team task, Week 3 (groups of four)

Back for Week 4

Day 1 opener: 10 minutes of the start of every period on Monday, before the rest of the class. Know the routine.

Today's task: Welcome back for week 4 of math, and the routine has not changed. Come back to the start of the challenge. We start with three of your partners for the start of the challenge. Then today's set of exponential growth and decay. Check the board during the period, because the video feed changes from one look to the next.

Sub script (the same steps every period)
1. Have the board ready before the bell: Week 4, Monday, today's topic and voice level 1. If this class has not met yet, give your name and one sentence about yourself.
2. Show the This Week sheet (next page) and read the five topics. Point to Monday's topic today in exponential growth and decay.
3. Answer three questions: a student from each part of the room reads one Ask the Student from the class page, and give answer in unity.
4. Read the Week 4 agreement out loud. Ask the class for one more line and write it on the board for this period.
5. Read out today's set: worked examples first, then the core task on every page, then the star challenge.

If the room will not settle
• Skip the questions and the extra agreement line. Keep the voice level on the board and start the work.
• Stand over the board for the first five minutes of the set.

If ten minutes are left over
• Play Graph Sketch Relay (next page). Read the stories below. The key graphs are in the answer key.
• Another option: students give the self-reflection page of the Day 1 claim book.

Graph Sketch Relay: stories to read out (pairs)
1. Mike's phone battery. At 7 a.m. Mike's phone is fully charged: 100%. It drains slowly until noon, when it shows 60%. He charges it for one hour. Back to 100%. Then he starts a game and it drops fast, to 40% at 3 p.m. After that it drains slowly to 25% at 8 p.m.
2. Always late. Jason rides his bike at a steady speed to a park 6 km from home, which takes 20 minutes. He stops at the park for 10 minutes. Then he rides straight home, which takes 15 minutes.
3. The rain barrel. A rain barrel holds 40 liters of water when it starts. The storm hits it quickly for 2 hours, until it is full at 100 liters. It rains for 1 hour with extra water spilling over the top. Then a garden hose drains it at a steady rate, back to 40 liters 3 hours later.
Storyboard story: 1 point for each piece of the graph giving the right way up (up or down), and 1 point for each corner point giving the right equation of the line.

Week 4 checklist (before first period)
• Check copies of today's set, the claim book pages and the team task for every period.
• Scan the class list for anyone new this week, and for early groups.
• Put Week 4, Monday, today's topic and voice level 1 on the board before the bell.
• Skip the work answer keys together and keep them out of sight.
• Read the new Graph Sketch Relay stories once, so they are ready as a team.
• At the end of each period, note for the teacher who was absent and one thing that worked.

Monday opener, Week 4 (whole class)

Game, Day 3: Class Feud

One setup and one period survey answers: 10 minutes at the end of the period, or for extra time, optional.

Today's task: For extra time at the end of the period, we can play Class Feud, but from passing the top answers, and if it is optional and fun. The answers come from a printed survey about today's topic: exponential growth and decay, and read 2 doublets.

Set up and play
1. Split the room into two teams. Choose five numbered lines (up the board, all lines up the board).
2. Free on: one player from each team stands. Read the question. That first player answers. If the answer is on the list, write it on the list. The other player may try to give a higher answer. The team with the higher answer plays the question.
3. The playing team answers one student at a time. On the list, write it with the points. Not on the list, a 0.00.
4. Three strikes: the other team has to give 0.00.
5. Read. Right they take all the points wrong. Wrong the playing team keeps them.
6. When all five are found, the playing team takes the points. Read out any answers nobody found.

Round 1, Q1: Name a word that describes a parabola.
1. Upward 34
2. Curved 25
3. Symmetric 18
4. Smooth 13
5. Open up or down 8

Round 1, Q2: Name a point on the parabola $y = x^2$.
1. (0, 0) 34
2. (1, 1) 25
3. (-1, -1) 25
4. (2, 4) 18
5. (-2, -4) 13

Round 1, Q3: Name a part of the quadratic formula.
1. Plus-minus sign 34
2. Square root 25
3. Negative 18
4. On the bottom 13
5. No 8

Round 1, Q4: Name a box squared b^2 has two real roots.
1. 1 34
2. 4 25
3. 9 25
4. 16 18
5. 25 13

Round 2, Q1: Name a real thing shaped like a parabola (doublet).
1. Bridge 34
2. Thrown ball path 25
3. Parabolic arch 25
4. Satellite dish 18
5. Dish shape 8

Round 2, Q2: Name a c so $x^2 + cx + 6$ has no real roots (doublet).
1. 10 34
2. Maximum 25
3. Minimum 25
4. Real root 18
5. Graph this case 8

Round 2, Q3: Name something the discriminant tells you (doublet).
1. Number of roots 34
2. Positive or negative 25
3. Equal roots 25
4. Different roots 18
5. Graph this case 8

Round 2, Q4: Name a word for a parabola's turning point (doublet).
1. Vertex 34
2. Maximum 25
3. Minimum 25
4. Low point 18
5. Peak 13

Game: Class Feud (whole class)

Game, Day 5: The Boxes

One setup, 10 minutes. Each team opens boxes, cross off and write the team number on it.

Today's task: Today's task is The Boxes. Each team has a team name. Each team has a team color. Each team has a team logo. Each team has a team motto.

Setup: Each team has a team name. Each team has a team color. Each team has a team logo. Each team has a team motto.

Game: Each team has a team name. Each team has a team color. Each team has a team logo. Each team has a team motto.

Boxes: Each team has a team name. Each team has a team color. Each team has a team logo. Each team has a team motto.

Scoring: Each team has a team name. Each team has a team color. Each team has a team logo. Each team has a team motto.

Game: Mystery Box (whole class)



Math Set 1: Exponential Growth and Decay

Math • Day 1

Read the four worked examples and the reminders, then do the quick check. Show your work.

This set reviews: exponential growth and decay models, growth and decay rates, half-life, and telling linear tables from exponential ones



SAY THIS TO THE CLASS

"Today's math is exponential growth and decay, and you work on your own this period. Growth multiplies by more than 1 each step, decay multiplies by less than 1, so read the four worked examples before anything else. Write every model as $y = a(b)^t$ to the t before you put numbers in."

1 Growth: $y = a(1 + r)^t$

A town of 2,000 people grows 10% a year. The start value is $a = 2,000$ and the growth factor is $1 + 0.10 = 1.1$, so $y = 2,000(1.1)^t$. After 2 years: $2,000 \times 1.1 \times 1.1 = 2,000 \times 1.21$.
2,420 people

2 Decay: $y = a(1 - r)^t$

A \$20,000 car loses 20% of its value each year. It keeps $1 - 0.20 = 0.8$ of its value, so $y = 20,000(0.8)^t$. After 2 years: $20,000 \times 0.8 \times 0.8 = 20,000 \times 0.64$.
\$12,800

3 Half-life

80 mg of a substance has a half-life of 6 hours: $y = 80(1/2)^{t/6}$. In 18 hours there are $18 \div 6 = 3$ half-lives, so halve three times: 80, 40, 20, 10.
10 mg left

4 Linear or exponential?

Table P: 5, 8, 11, 14 ($x = 0, 1, 2, 3$). The same number, 3, is ADDED each step: linear, $y = 3x + 5$. Table Q: 5, 10, 20, 40. Each value is MULTIPLIED by the same number, 2: exponential, $y = 5(2)^x$.
P linear, Q exponential

Remember

- a is the start value** (the value when $t = 0$) and **b is the factor** you multiply by each step.
- b more than 1 means growth**, b between 0 and 1 means decay. A rate of 7% growth gives $b = 1.07$; 7% decay gives $b = 0.93$.
- Half-life**: the time it takes for an amount to halve. Count the half-lives, then halve that many times.
- Linear adds, exponential multiplies**. Check the differences first; if they are not equal, check the ratios.

Quick check: try one of each first

1. $y = 300(1.04)^t$: growth or decay, and the rate? _____

2. $y = 50(0.85)^t$: growth or decay, and the rate? _____

3. Evaluate $y = 6(3)^x$ when $x = 3$. _____

4. Table 2, 6, 18, 54: linear or exponential? _____

★ Challenge

Make a table of $y = 100 + 50x$ and $y = 3(2)^x$ for $x = 0, 1, 2, \dots$ What is the first whole number x where the exponential value is larger?



Math Set 1: Practice

Rates, models, tables: sixteen growth and decay problems. Keep your work next to each one and the answer on its line.

Math • Day 1

A. Growth or decay? Give the rate as a percent

1. $y = 1,200(1.05)^t$

2. $y = 90(0.7)^t$

3. $y = 4,000(1.25)^t$

4. $y = 64(0.96)^t$

B. Evaluate each model

1. $y = 5(2)^x$, $x = 6$

2. $y = 400(1/2)^x$, $x = 3$

3. $y = 1,000(1.1)^x$, $x = 2$

4. $y = 2,500(0.8)^x$, $x = 2$

C. Write the model $y = a(b)^t$

1. A colony of bacteria of 600 doubles every hour.

2. A laptop worth \$1,500 loses 30% of its value each year.

3. A savings account starts at \$800 and grows 3% each year.

4. A 240 mg sample of an isotope halves every 5 days.

D. Linear or exponential? Give the step

1. 3, 7, 11, 15

2. 4, 12, 36, 108

3. 160, 80, 40, 20

4. 50, 45, 40, 35

Block A: write growth or decay and the percent, for example decay, 12%. Block D: the tables give y for $x = 0, 1, 2, 3$; write linear or exponential and the step, for example linear, add 6.



Challenge

A model $y = a(b)^t$ gives 200 at $t = 0$ and 242 at $t = 2$. Find b and the growth rate.

$b =$ _____

Rate: _____



Math Set 1: Word Problems

Six word problems. Write the model first, then evaluate it. The star challenge is for anyone who finishes early.

Math • Day 1

- 1 A town of 5,000 people grows 2% a year. Write the model and find the population after 2 years.

- 2 A car bought for \$24,000 loses 15% of its value each year. What is it worth after 2 years?

- 3 A 400 mg dose of a medicine leaves the body so that the amount halves every 4 hours. How much is left after 12 hours?

- 4 Kenji puts \$2,000 in a savings account that earns 5% a year, added once a year. How much is in it after 2 years?

- 5 Marisol's art account has 3,000 followers, and the count grows 20% a month. How many followers after 3 months?

- 6 A hot drink is 160°F warmer than the room. The difference shrinks by 25% every 10 minutes. How much warmer is it after 20 minutes?

★ Challenge

- 1 A 1,000 g sample has a half-life of 3 years. Make a table of the amount after each half-life. After how many whole half-lives is less than 50 g left, and how many years is that?

- 2 An amount doubles every 5 years. By what factor does it grow in 20 years?

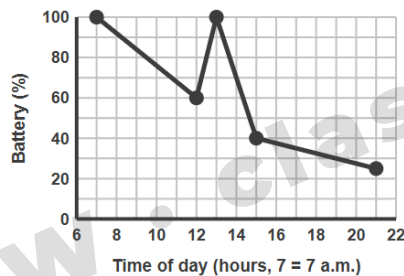


Answer Keys (1 of 6)

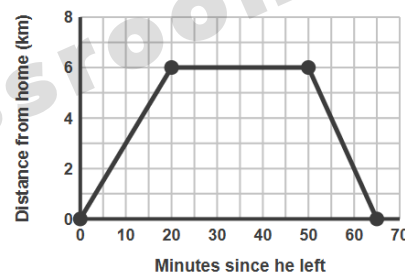
Teacher copy. Keep these pages out of the student sets.

Opener: Graph Sketch Relay key graphs

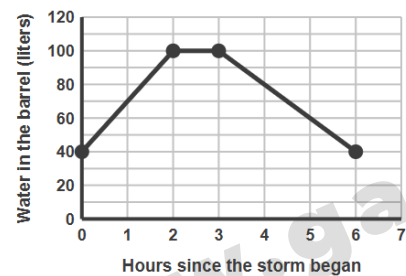
1. Mika's phone battery: (7, 100), (12, 60), (13, 100), (15, 40), (21, 25)



2. Jovan's bike ride: (0, 0), (20, 6), (50, 6), (65, 0)



3. The rain barrel: (0, 40), (2, 100), (3, 100), (6, 40)



A sketch scores even without exact numbers when the shape is right: up, down and flat pieces in the right order.

Math Set 1: Exponential Growth and Decay

Quick check: 1. growth, 4%; 2. decay, 15%; 3. 162; 4. exponential (times 3)

Rates: 1. growth, 5%; 2. decay, 30%; 3. growth, 25%; 4. decay, 4%

Models: 1. $y = 600(2)^t$; 2. $y = 1,500(0.7)^t$; 3. $y = 800(1.03)^t$; 4. $y = 240(1/2)^{t/5}$

Evaluate: 1. 320; 2. 50; 3. 1,210; 4. 1,600

Tables: 1. linear, add 4; 2. exponential, times 3; 3. exponential, times 1/2; 4. linear, subtract 5

Word problems: 1. $y = 5,000(1.02)^t$; 5,202 people; 2. \$17,340; 3. 50 mg; 4. \$2,205; 5. 5,184 followers; 6. 90°F warmer. Accept $y = 5,000(1 + 0.02)^t$ for the model. Block C: t is in hours in problem 1 and in days in problem 4; also accept $240(0.5)^{t/5}$, or $240(1/2)^t$ when the student says t counts 5-day periods.

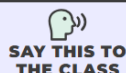
Challenge, page 1: $x = 8$ (500 against 768); at $x = 7$ the values are 450 and 384. **Challenge, page 2:** $b = 1.1$, a growth rate of 10% ($b \times b = 242 \div 200 = 1.21$). **Challenge, page 3:** 1. 5 half-lives, 15 years (1,000, 500, 250, 125, 62.5, 31.25 g); 2. 16 (it doubles 4 times: $2 \times 2 \times 2 \times 2$)



Calm Block, Day 1: Word Search

Find all 12 words about linear functions. Every direction, including backward. Pencils only, voices at 0.

Calm • Day 1



SAY THIS TO THE CLASS

"Quiet time now: you work alone, and voices stay at zero. Page 1 hides twelve words about linear functions, and page 2 has eight short problems with an answer bank. Do the pages in any order and check every answer in the bank."

G	E	R	W	X	H	A	X	H	K	L	Z	G	L
C	P	Y	W	W	D	Y	N	K	V	N	A	N	C
G	D	W	E	J	H	B	T	E	A	R	P	H	U
U	R	E	Y	D	A	E	T	S	L	E	S	X	B
A	R	W	K	T	V	F	O	A	U	T	T	L	J
E	D	S	I	X	L	L	B	E	E	T	R	U	G
G	Y	C	P	D	H	A	I	R	S	A	A	D	E
N	F	E	R	Z	H	T	T	C	Q	P	I	X	S
A	G	C	E	K	S	V	N	E	B	L	G	M	A
H	T	E	D	D	V	I	M	D	J	A	H	H	E
C	I	O	I	H	N	S	T	E	X	L	T	E	R
Z	Z	H	C	R	A	E	P	L	N	Z	P	M	C
N	F	B	T	A	U	L	R	Q	U	I	X	B	N
L	Y	O	G	R	A	P	H	T	K	Y	L	P	I

LINE

CHANGE

PREDICT

VALUES

GRAPH

FLAT

STRAIGHT

TREND

INCREASE

DECREASE

PATTERN

STEADY

Done early?

Pick three of the words. Write a short example of each one, like a table that goes up by 4 at every step for a constant rate.



Team Task, Day 2: Inspection Sheet and Shift Report

Team • Day 2

Fill in your own four rows, then initial the rows you check in the relay. One sheet per group.

CARD	PART	MEASURED	DISTANCE FROM TARGET	PASS OR FAIL	SORTED BY	CHECKED BY
1	Washer	24.2				
2	Rod	151.6				
3	Spring	39.1				
4	Washer	23.7				
5	Rod	148.5				
6	Spring	40.8				
7	Washer	24.4				
8	Spring	41.0				
9	Rod	150.9				
10	Washer	23.6				
11	Rod	147.9				
12	Spring	39.5				
13	Washer	24.0				
14	Rod	152.0				
15	Spring	40.3				
16	Rod	149.2				

Shift report

1. How many cards passed in all?

2. Which part had the most fails?

3. Which cards sit exactly on a tolerance and still pass?

Rules without bars

Write each pass rule as one compound inequality, smallest value first.

Washer:

Rod:

Spring:



Challenge

Write one absolute value inequality that is true for exactly the spring lengths x that FAIL.



Game, Day 1: The Board

Tape this to the whiteboard or copy it. Cross squares off as they are played.

Game • Day 1

GROW/DECAY	RATE	EVALUATE	HALF-LIFE	NEXT VALUE
100	100	100	100	100
200	200	200	200	200
300	300	300	300	300
400	400	400	400	400
500	500	500	500	500

Scores

Team 1

.....

.....

.....

Team 2

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Team 3

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Team 4

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Team 5

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Team 6

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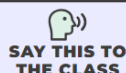
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Game, Day 2: Paper Password

Sub script and math word list. 15 minutes at the end of the period, or for extra time. Optional.

Game • Day 2



"Paper Password is optional, a fun way to end the class with today's absolute value words. Partners take turns: one gives one-word clues, and the other guesses. Fewer clues means more points."

Set up (2 minutes)

1. Pairs sit face to face. Give each pair one card page, cut into the four round cards (or folded so one card shows). Turn the cards you are not using face down.
2. Partner A is the clue giver in rounds 1 and 3, Partner B in rounds 2 and 4. The guesser never sees the card.
3. Each round lasts 2 minutes. The clue giver says ONE word. The guesser gets ONE guess. Wrong: give another one-word clue.
4. After five clues without a right guess, the word scores 0 and the pair moves on. Say "Go" and "Stop" for each round.

Read this out

"Your clue is one word only. You may not say the secret word or any part of it. If the word is snowman, you cannot say snow or man. No gestures, no spelling, no rhymes. Break a rule and that word scores zero."

Scoring: guessed on clue 1 = 5 points, clue 2 = 4, clue 3 = 3, clue 4 = 2, clue 5 = 1. The clue giver circles the number on the card. After round 4, pairs add their four round totals. Highest total wins; ask pairs to call out totals over 60.

Referee calls

Two words glued together ("hotdog") count as one clue only if they make a real single word. Plurals and "-ing" forms of the secret word are not allowed. If the partners disagree about a clue, the word scores zero and they move on. The example clues below are allowed and show students what a good first clue sounds like.

Timing (15 minutes)

0:00

Set up, rules

2:00

Round 1, Partner A

4:30

Round 2, Partner B

7:00

Round 3, Partner A

9:30

Round 4, Partner B

12:00

Add totals, winners

Round 1: Partner A gives clues

ABSOLUTE example clue: distance
APART example clue: far
TOLERANCE example clue: allowed
BETWEEN example clue: inside
OUTSIDE example clue: beyond

Round 3: Partner A gives clues

OPPOSITE example clue: reverse
DOT example clue: point
OPEN example clue: hollow
CLOSED example clue: filled
SHADED example clue: colored

Round 2: Partner B gives clues

BOUNDARY example clue: edge
CASE example clue: scenario
VALUE example clue: worth
ZERO example clue: nothing
CHECK example clue: verify

Round 4: Partner B gives clues

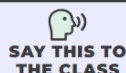
INTERVAL example clue: stretch
SPLIT example clue: divide
BARS example clue: lines
WITHIN example clue: near
MARGIN example clue: leeway



Game, Day 4: Classroom Millionaire

Sub script and the 12 questions. 15 minutes at the end of the period, or for extra time. Optional.

Game • Day 4



"To end the class, we can play Classroom Millionaire, which is optional and just for fun. We climb one ladder of twelve questions on today's right triangle trigonometry, with a new student in the hot seat each time."

How it works

1. Tape up the ladder sheet. The whole class is one player. Pick a student for the hot seat (a new student for every question).
2. Read the question and the four options, then read the options again. The hot seat may listen to quiet advice, then says "final answer" and a letter.
3. Right: the class climbs one rung. Before hearing the next question, the class may vote to walk away and keep what it has.
4. Wrong: the climb ends. Rungs 4 and 8 are safe: the class keeps the last safe amount it passed.
5. Time left over? Play the questions again as a team quiz.

Three lifelines (one use each)

Ask the class: everyone shows 1, 2, 3 or 4 fingers at once for A, B, C or D. The hot seat looks, then decides.

50/50: read out the two wrong options listed under the question. Cross them off.

Phone a friend: the hot seat picks one classmate, who has 30 seconds to say what they think out loud.

"Only the hot seat's final answer counts. Shout an answer and the class loses a lifeline."

Rungs 1 to 4, rung 4 is safe

1. **\$100** Longest side of a right triangle?
A. Opposite B. Adjacent C. Hypotenuse D. Base
Answer: C. Hypotenuse (50/50 removes A and D)
2. **\$250** SOH: sine is opposite over what?
A. Adjacent B. Hypotenuse C. Tangent D. Angle
Answer: B. Hypotenuse (50/50 removes C and D)
3. **\$500** TOA: tangent is opposite over what?
A. Hypotenuse B. Opposite C. Sine D. Adjacent
Answer: D. Adjacent (50/50 removes B and C)
4. **\$1,000** Legs 3, 4, hyp 5: sin of angle opposite 3?
A. 3/5 B. 4/5 C. 3/4 D. 5/3
Answer: A. 3/5 (50/50 removes C and D)

Rungs 5 to 8, rung 8 is safe

5. **\$2,500** $\sin 40^\circ = 0.6428$. Which cosine is equal?
A. $\cos 40^\circ$ B. $\cos 50^\circ$ C. $\cos 60^\circ$ D. $\cos 20^\circ$
Answer: B. $\cos 50^\circ$ (50/50 removes C and D)
6. **\$5,000** Hyp 12, angle 30° , $\sin 30^\circ = 0.5$. Opposite?
A. 6 B. 24 C. 10.4 D. 12
Answer: A. 6 (50/50 removes B and D)
7. **\$10,000** $\tan 45^\circ = 1$, adjacent 9. Opposite side?
A. 4.5 B. 12.7 C. 9 D. 18
Answer: C. 9 (50/50 removes A and D)
8. **\$25,000** Which angle has a tangent of 1.7321?
A. 30° B. 45° C. 60° D. 75°
Answer: C. 60° (50/50 removes A and B)

Rungs 9 to 12

9. **\$50,000** Opposite 10, hypotenuse 20. The angle?
A. 30° B. 45° C. 60° D. 90°
Answer: A. 30° (50/50 removes C and D)
10. **\$100,000** 20 ft ladder at 60° to the ground, $\sin 60^\circ = 0.866$. Height?
A. 10 ft B. 11.5 ft C. 34.6 ft D. 17.3 ft
Answer: D. 17.3 ft (50/50 removes A and C)
11. **\$500,000** 100 ft away, 35° elevation, $\tan 35^\circ = 0.7002$. Height?
A. 57.4 ft B. 70.0 ft C. 81.9 ft D. 142.8 ft
Answer: B. 70.0 ft (50/50 removes C and D)
12. **\$1 MILLION** $\sin A = 0.8$ in a right triangle. $\cos A$?
A. 0.2 B. 1.25 C. 0.8 D. 0.6
Answer: D. 0.6 (50/50 removes A and B)

If the class misses

- | | |
|------------------------|----------------------|
| Wrong on rung 1 to 4 | class keeps \$0 |
| Wrong on rung 5 to 8 | class keeps \$1,000 |
| Wrong on rung 9 to 12 | class keeps \$25,000 |
| Walk away after rung n | class keeps rung n |



Math Set 2: Radicals and Rational Exponents

Math • Day 2

Read the four worked examples and the reminders, then do the quick check. Show your work.

This set reviews: simplifying square and cube roots, multiplying and adding radicals, rational exponents, rewriting between radical and exponent form



"Today you work alone on radicals and on exponents that are fractions. The key idea is that x to the $1/2$ is the square root of x , and the bottom of a fraction exponent tells you which root to take. Read the four worked examples first, then show your work on every problem."

1 Simplify a square root

Find the largest perfect square factor: $50 = 25 \times 2$. Then $\sqrt{50} = \sqrt{25} \times \sqrt{2} = 5\sqrt{2}$.
 $\sqrt{50} = 5\sqrt{2}$

2 Multiply radicals

Multiply under one sign: $\sqrt{6} \times \sqrt{15} = \sqrt{90}$. Then simplify: $90 = 9 \times 10$, so $\sqrt{90} = 3\sqrt{10}$.
 $\sqrt{6} \times \sqrt{15} = 3\sqrt{10}$

3 Exponents that are fractions

An exponent of $1/2$ means a square root and $1/3$ means a cube root: $x^{1/2} = \sqrt{x}$ and $x^{1/3} = \sqrt[3]{x}$. So $49^{1/2} = \sqrt{49}$ and $125^{1/3} = \sqrt[3]{125}$.
 $49^{1/2} = 7$ and $125^{1/3} = 5$

4 Top and bottom of the fraction

In $8^{2/3}$ the bottom (3) is the root and the top (2) is the power. Take the root first: $(\sqrt[3]{8})^2 = 2^2$. The same rule rewrites $\sqrt[3]{x^2}$ as $x^{2/3}$.
 $8^{2/3} = 4$

Remember

- **Perfect squares to know:** 4, 9, 16, 25, 36, 49, 64, 81, 100. **Perfect cubes:** 8, 27, 64, 125, 216, 343, 1,000.
- **Simplest form** means no perfect square factor is left under a square root (no perfect cube under a cube root).
- **Multiply** under one sign: $\sqrt{a} \times \sqrt{b} = \sqrt{ab}$. **Add** only like radicals: $2\sqrt{3} + 5\sqrt{3} = 7\sqrt{3}$.
- $x^{m/n} = (\sqrt[n]{x})^m$: the bottom number is the root, the top number is the power.

Quick check: try one of each first

- | | | | |
|--------------------------|-------|--------------------------------|-------|
| 1. Simplify $\sqrt{75}$ | _____ | 2. $\sqrt{2} \times \sqrt{32}$ | _____ |
| 3. Evaluate $1000^{1/3}$ | _____ | 4. Evaluate $9^{3/2}$ | _____ |

★ **Challenge** Simplify $\sqrt{72x^4}$. Hint: take the root of the number and of x^4 separately. _____

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