

Firefighter Training

Grades 3-5



The Big Idea

Today you'll find out how much math firefighters do! First, see how many pounds of gear they have to carry while moving quickly. Next, measure your room or building to find out how much water you'd need to put out a fire there. Finally, learn the secret color that helps firefighters know how fast a hydrant can pump water.

Supplies

In your kit:

- ★ Measuring tape: 1
- ★ Giant paper rectangles: 20

To print:

- ★ Fire Hydrant Printout, 1 copy
See last page of these directions
See Key Prep for no-print option

You provide:

- ★ Marker: 1
- ★ Reusable tote or backpack: 1
- ★ Stopwatch/stopwatch function on phone
- ★ Water: 1 gallon or 8 16-ounce bottles
See Key Prep for other options
- ★ Writing surface: whiteboard or large sheet of paper

Key Prep

- ★ If you can't acquire water, fill the tote or backpack with any heavy items, like books. Skip putting water bottles on the squares during **Learn the Drill**.
- ★ Print 1 copy of the Fire Hydrant Printout in color. If you don't have access to a color printer, write the following on your writing surface:
 - Red-cap hydrants pump 500 gallons per minute (GPM)
 - Orange-cap hydrants pump 500 to 999 GPM
 - Green-cap hydrants pump 1000 to 1499 GPM
 - Blue-cap hydrants pump over 1500 GPM

Room Set-up

- ★ You'll need a long hallway, empty room, or outdoor space to run a short relay race during the first part of this session. If you can't find space, skip forward to **Learn the Drill**.

What's the Math?

- ★ Adding 100s
- ★ Area
- ★ Counting by 10s
- ★ Estimation
- ★ Linear measurement
- ★ Multiplication, division

Kickoff

"Have you ever seen firefighters put out a fire on TV or in real life?" **Discuss.** "They have to be really brave - and smart, too, because they need to do math quickly in their heads to figure out how much water they need. Today we're going to learn how they do it!"

Suit Up Like a Hero (15-20 minutes)

"Firefighters have to move quickly, and that takes practice. Let's heat things up with some fun exercises to get moving!"

1. Spread out and have the kids do 10 jumping jacks, 10 push-ups, and 10 sit-ups. You can lead them in the exercises or have one of the kids demonstrate for the group.
 - ? "How many moves did each of us just do in total?" **Discuss.** Let the kids talk about how we did 3 sets of 10, which is 30 moves.
 - ? "If we did twice as many moves, how many would we do?" **Discuss.** Answer: 60
2. Split the kids into 2 groups. Send one group to the opposite end of the space.
3. Have the kids run a relay race, using your stopwatch to record the time it takes run the entire relay.
 - ★ "Firefighters need to be in shape because they also carry lots of heavy gear! Their clothes, helmet, and air pack together weigh 45 pounds. When you add a radio, light, and ax, it could be as much as 75 pounds of stuff! Let's see how extra weight affects running speed."
4. Repeat Step 2, except this time give the first runner the backpack/tote with 1 gallon/8 bottles of water inside. Like a real relay where runners pass a baton at each leg of the race, kids should hand the bag to the next runner after each lap.
 - ? "How much weight did we add to this backpack?" **Discuss** the liquid and weight ounces!
 - ? "The amazing thing is, when firefighters carry 75 pounds of gear, that's about 1/2 their own weight! How did carrying the extra weight affect our running speed?" **Discuss.**

Math Challenge (optional)

- ? "How many 1-pound bottles would add up to 1/2 of *your* weight?" **Discuss.**

Learn the Drill (20-25 minutes)

"Luckily, firefighters don't usually need to carry water, since hydrants pump out lots of water very quickly – much faster than a kitchen faucet. The area the fire covers matters a lot, because you need about 1 gallon of water (or 8 water bottles) for every 3 square feet of fire. Let's see how much water we'd need to extinguish a fire in this room."

1. Place 1 paper rectangle on the ground.
2. Using the measuring tape, let the kids measure to find that it's 3 feet long by 1 foot wide, or 3 square feet. (Hopefully, kids remember area and perimeter from Cowabunga!)
 - ? "How many 1-foot-by-1-foot squares does this cover?" If needed, show the kids that the paper is folded into thirds creating 3 square feet.

3. Put 1 gallon/8 bottles of water on the paper rectangle. If you don't have water, use your marker to label the paper: "1 GALLON."
? "If 1 gallon would extinguish a fire that covers 3 square feet just like the size of this shape, how many gallons do you think we'd need to put out a fire the size of this room?" **Discuss.** Take guesses.
4. Now find out for real! Let the kids line up 4 rectangles.
? "How many square feet does the giant rectangle cover?" **Discuss.** They can count all the 1x1 squares or may realize that 3 squares per sheet x 4 sheets = 12 squares.
? "Does that change your guess for the whole room?" **Discuss.**
? "How could you figure out the real answer?"
5. Give each kid a sheet of paper rectangles.
6. Let the kids self-organize to figure out the number of rectangles across the room (width) and down the length. Multiply those 2 numbers to find number of gallons needed to extinguish a fire in that room.

Extra Challenge (optional)

- ? "How many gallons of water would we need to put out a fire in an 1800-square-foot room?" **Discuss.** 600 gallons, because 1800 square feet divided by 3 square feet per gallon = 600 gallons. See if kids also realize that they can take the shortcut of dividing length or width by 3 when calculating the room's area to figure out how many gallons it would take, e.g., $30/3 \times 60$ or $10 \times 60 = 600$; alternatively, $30 \times (60/3)$ or $30 \times 20 = 600$.

Go Fast. Go Big (10-15 minutes)

"Now that we've figured out the number of gallons we would need to put out a fire in this room, let's see how fast each of these hydrants could help us put it out!"

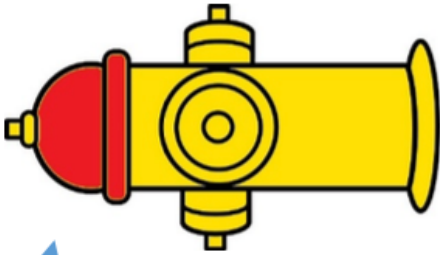
1. Show Fire Hydrant Printout or direct kids to the information on your writing surface.
★ **Party Fun Fact:** "Did you know that in many places, the hydrant cap color tells you how fast that hydrant can pump water? Red cap hydrants can pump up to 500 gallons per minute (GPM) - the same as 200 kitchen faucets on full blast at the same time! Orange cap hydrants pump 500 to 999 GPM. Green pumps 1000 to 1499 GPM. Blue ones gush over 1500 GPM. They could fill 30 bathtubs in 1 minute!"
? "If a red cap hydrant pumps 500 gallons in a minute, can it put out a fire in this room in 1 minute?" **Discuss:** Based on your earlier calculations, is the amount of water needed for your room more or less than 500? If your room needs more than 500 gallons, continue down the chart.
? "How could we estimate the number of gallons needed to extinguish a fire in this whole building?" **Discuss.** Consider the number of rooms this size on one floor; number of floors; and whether each floor is as big as the one below it.

Extra Challenge (optional)

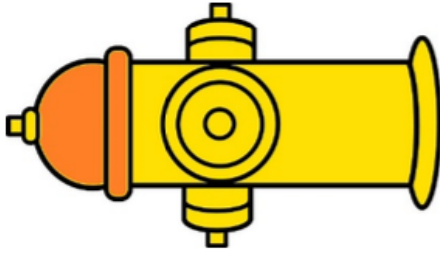
- ? "What's the biggest area a blue hydrant could put out a fire in 1 minute with 1500 gallons of water per minute?" **Discuss.** See if they can figure out that if each gallon per minute can extinguish 3 square feet, then $1500 \text{ GPM} \times 3 \text{ square feet} = 4500 \text{ square feet}$.
- ? "Would it be better to have 1 blue hydrant or 2 orange hydrants? How about 2 green hydrants?" **Discuss.** Encourage the kids to figure out the gallon per minute power for different hydrant combinations!
- ? "How many red hydrants would you need to pump as much water as 1 blue hydrant?" **Discuss.** Answer: 3 red hydrants, because $500 + 500 + 500 = 1500$.

Wrap Up

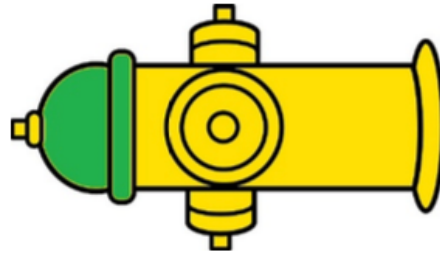
"Today we learned about firefighter math – and a lot of it looks like the math you see in class to figure out the area of a shape! Luckily, we have smart and brave firefighters who respond to emergencies very quickly to help keep us safe."



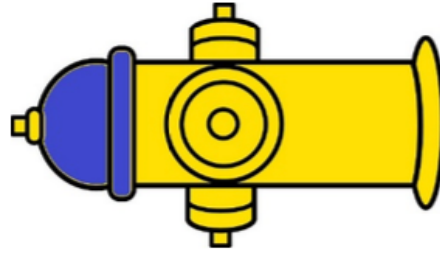
Red Cap
Less than 500 GPM



Orange Cap
500 to 999 GPM



Green Cap
1000 to 1499 GPM



Blue Cap
1500 and more GPM