M2C3 Project
Shower vs Bath
Student Work

This file provides four samples of Grade 4 solutions for the Shower vs Bath Task. Students used multiplication and division with whole and rational numbers to determine the amount of water used. They also worked with time in seconds and minutes.

Factors that Students Considered

- How much time it takes to use a gallon of water in the shower.
- How much time it takes to use a gallon of water to fill a bath tub.
- How many gallons of water it takes to fill the bath tub.
- How full do you usually fill a bath tub.
- How long does it take to shower.

Connections to Students' Experiences

- Students and their families take showers and/or baths.
- Water conservation may be a high priority in their communities.

66 sec

1 5 min

300

+ 6 00

9 0 0 sec

0 3 3 r99

27) 9 0 0

−81

0 9 0

−81

0 9

→ $\frac{9}{27} \div \frac{3}{3} = \frac{3}{9} \div \frac{3}{3} = \frac{1}{3}$ ← shower problems

15 min Shower = 33⅓ gal

bath = 20 gal and
3 min and 40 sec

20 gal

1 1 sec

20

200

+ 200

2 2 0 · seconds

0 0 3 r40

60) 1 2 2 0

−1 8 0

4 0

To determine the amount of water used while showering, these students multiplied 60 seconds per minute by 15 minutes and found that a 15-minute shower would last 900 seconds. Given the fact that a shower uses 1 gallon of water in 27 seconds, they divided 900 seconds by 27 seconds per gallon and found that a 15-minute shower would use 33 and 1/3 gallons of water. Note: The student correctly use the remainder to determine the fractional part 9/27 = 1/3.

The students decided that 20 gallons on water would be used if they took a bath. It is unknown how they made this determination. Given the tub would fill up at the rate of 11 seconds per gallon and multiplying 11 seconds per gallon. x 20 gallons, they would need 220 seconds to fill the tub. They then divided 220 seconds by 60 seconds per minute and found that it would take 3 minutes and 40 seconds to fill the tub with 20 gallons of water. They did not indicate which method would conserve the most water.

The students whose work is shown below do make a determination regarding the shower vs bath question. They found that the shower uses less water. For the shower calculation they decided to use a 5-minute shower. While they note in their written explanation that the shower uses 1 gallon of water every 27 seconds, the rate 3 gallons of water per minute was used in this calculation. How this rate is determined is not explained. The students decided they would use 30 gallons of water for the bath and appear to use the rate 10 seconds per gallon to fill the tub. 30 gallons X 10 seconds per gallon = 300 seconds to fill the tub. This would also take 5 minutes.

The shower takes less water because the bath takes 11 seconds to Fill up a gallon and the shower takes 27 seconds to fill up a gallon. You'll need 15 gallons for a shower and for a bath you need 30 gallons. So thats why the shower takes less water!

These students determined that a shower used 2.3 gallons of water per minute, (Note: The rate 27 seconds per gallon = 2.22… gallons per minute.) They found that a 20-minute shower would use 46 gallons. They decided that 20 gallons of water would be needed to fill the tub for a bath. Multiplying 10 second per gallon x 20 gallons they found the result was 200 gallons. The product unit here should be seconds, i.e. it would take 200 seconds to fill the tub. (Note: It was unnecessary to determine how long it talks to fill the tub.) The comparison should be shower (46 gal) vs bath (20 gal) with the bath conserving more water.

The conclusions in the written section are mislabeled and have been corrected.

Tub". 1 min = 6g
5 min = 30g   3 min = 18g
10 min = 60g
15 min = 90g

Half is about 20.18
is about 20.

Shower".

26	26		8

=1 =1   ≈ 1/3

2 1/3 per minute

2 1/3 × 10 =

$\frac{7}{3} \times \frac{10}{1} = \frac{7+30}{3}$

$\frac{37}{3} = $ 2 1/3 × 10 = 20 1/3
for a
20 minute
shower.

·An average bathtub filled to
the top is about 40
gallons. We choosed half
which is about 20 gallons.

Tub". 1 min = 6 gallons
3 min = 18 gallons
10 min = 60 gallons
18 min = 90 gallons

Shower". 2 1/3 per min
12 1/3 per 10 min
24 2/3 per 20 min
we said it would take
20 min

A tub would take less
than shower.

The organization of the student work presented here helps us understand the authors' thinking. The students clearly explain why 20 gallons of water is the amount used for the bath. Yet, they too, try to determine the amount of time it would take to fill the tub. They also create a list of time vs gallons when filling the tub.

They clearly present the work used to determine that a shower dispenses 2 and 1/3 gallons of water per minute; using 26 seconds per gallon as the given rate. Multiplying $2\frac{1}{3}$ x 10 they found $20\frac{1}{3}$ and labeled this the time for a 20-minute shower. There are several errors in this calculation. The sentence $\frac{7}{3} \times \frac{10}{1} = \frac{7+30}{3} = \frac{37}{3}$ shows some confusion between the addition and multiplication algorithms for fractions. Later they state $2\frac{1}{3}$ x 10 = $20\frac{1}{3}$ ignoring the $\frac{1}{3}$ x 10 part of the computation. The list of water use for a shower presents an error when determining the time for a 10-min shower and then doubles this incorrect result to determine the amount of water used for the 20- minute shower.