

MathLinks

PROFICIENCY CHALLENGES GRADE 6 SETS 13-16

Proficiency Challenges are sets of interesting, mixed-topic problems. It may take a lot of time to complete each set, so consider doing only one or two parts at a time.

PROFICIENCY CHALLENGE 13

1. Find the area of a square if each side length is equal to 3 cm.
 - If you multiply the length of the side of a square by 2, what happens to the area of the square?
 - If you multiply the length of the side of a square by 10, what happens to the area of the square?
 - Explore multiplying the length of the side of a square by some other numbers. In general, if you multiply the length of the side of a square by k what happens to the area of the square?

2. Betty bakes Crispy Rice treats in a $9 \text{ in} \times 13 \text{ in} \times 2\frac{1}{2} \text{ in}$ pan. The treats completely fill the pan to the top. How many $\frac{1}{2} \text{ in} \times \frac{1}{2} \text{ in}$ Ricey Crisp treats can be cut from the pan?
 - a. What is the volume of one Crispy Rice treat?
 - b. What is the total volume of all the Crispy Rice treats?

3. A termite extermination company uses large tarps to cover houses when they are killing termites. The tarps they use measure 10 meters by 15 meters. The tarps need to overlap with each other by at least one meter so they can be clamped together to form an airtight seal.
 - a. How many tarps are needed to cover an apartment building that is 12 meters high, 45 meters wide, and 10 meters long?
 - b. 2 liters of chemicals are needed for every 100 cubic meters of space. How many liters of chemicals are needed for this apartment building?

4. Mark has 72 cube-shaped boxes that need to be stored. Each box measures 2.5 feet on a side. Mark finds the following information about storage units for rent on the website of a local self-storage facility.

| Size | Dimensions (feet) | Cost per Month |
|--------------------------|---------------------------|----------------|
| Small storage unit | $10 \times 5 \times 5$ | \$50 |
| Medium storage unit | $25 \times 9 \times 5$ | \$75 |
| Large storage unit | $15 \times 10 \times 7.5$ | \$80 |
| Extra large storage unit | $15 \times 15 \times 7.5$ | \$100 |

He wants to be able to fit all the boxes into a storage unit as cheaply as possible. Which unit might be best for Mark? Explain your reasoning.

PROFICIENCY CHALLENGE 14

1. Mr. Opus invests money in the stock market. He uses a computer to track his gains and losses relative to his initial investment on a daily basis.

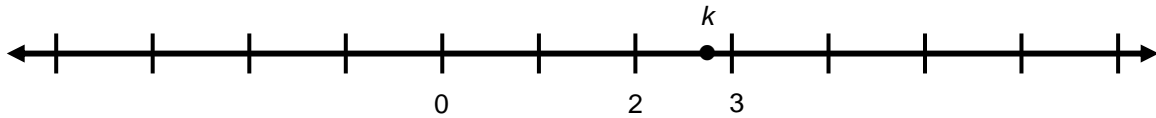
On Monday, he sees that his daily change is -600 dollars.

On Tuesday, he sees that his daily change is 900 dollars.

On Wednesday, he sees that his daily change is 0 dollars.

Describe what each of these statements represents in the context of this problem. Then find the overall change in the value of his investment over the course of these three days.

2. On the number line below, k represents an unknown number between 2 and 3. Graph and label each of the expressions below. You may need to extend your number line.



- | | | |
|------------------------|------------------------|------------------------|
| a. A is at $k + 2$. | b. B is at $k - 2$. | c. C is at $-k$. |
| d. D is at $k - 6$. | e. E is at $6 - k$. | f. F is at $0 - k$. |

3. Think of a number p between -3 and -4 and write it here: _____.

Plot p on the number line below. Be sure to label the tick marks.



- A is at $p + 4$.
- B is at $|p|$.
- Find the distance between p and 2.
- Richard states that the distance between $|p|$ and p is the same as $2 \cdot |p|$. Is Richard's statement true for your value of p ? Do you think Richard's statement is always true? Explain.

- Which number is closer to zero, $-\frac{3}{4}$ or $\frac{4}{3}$? Explain.
- What number is halfway between -4 and 3?

PROFICIENCY CHALLENGE 15

1. Write 4 ordered pairs that meet the following conditions:

- Each ordered pair is in a different quadrant.
- The ordered pairs form a square.
- The area of the square is 25 square units.

Write 4 ordered pairs that meet the following conditions:

- Each ordered pair is in a different quadrant.
- The ordered pairs form a rectangle.
- The perimeter of the rectangle is 24 units.

2. Write 3 ordered pairs that form a right triangle with an area of 32.

Write 3 ordered pairs that form a right triangle with an area of $4\frac{3}{4}$.

3. Write an ordered pair that is halfway between $\left(\frac{5}{6}, -\frac{4}{5}\right)$ and $\left(-\frac{1}{2}, -\frac{4}{5}\right)$.

Write an ordered pair that is halfway between $(-2.3, 0.4)$ and $(-2.3, -5.2)$.

4. Triangle ABC is formed by the vertices $A(3, 4.5)$, $B\left(-\frac{7}{4}, -\frac{12}{5}\right)$, and $C(0, -7)$.

Reflect $\triangle ABC$ across the x -axis. Then list the ordered pairs of the new triangle.

Reflect $\triangle ABC$ across the y -axis. Then list the ordered pairs of the new triangle.

Reflect $\triangle ABC$ across both the x -axis and the y -axis. Then list the ordered pairs of the new triangle.

5. On a coordinate plane, draw a net that represents a cube with a surface area of 36 square units. Label the vertices of your net and list their locations using ordered pairs.

On a coordinate plane, draw a net of a rectangular prism that has a volume of 480 cubic units. Label the vertices of your net and list their locations using ordered pairs.

PROFICIENCY CHALLENGE 16

1. People often say, "A journey of 1,000 miles begins with a single step."

What does this statement mean in your own words?

How many steps would you need to take to finish a journey of 1,000 miles?

What estimations or assumptions do you need to make in order to answer this question?

How will your answer change if the journey was 1,000 kilometers? Explain.

2. Rory walks to his friend's house that is 2 miles away at a rate of 4 miles per hour.

- a. Write an expression that shows how much time it takes Rory to walk to his friend's house.

On the next day, Rory walked to his grandmother's house that is m miles away. He walked at a rate of 4 miles per hour.

- b. Write an expression that shows how much time it takes Rory to walk to his grandmother's house.

That evening, Rory walked back home from his grandmother's house. This time he walked at a rate of 3 miles per hour.

- c. Write an expression that shows how much time it took Rory to make the roundtrip walk to his grandmother's house and back home.

3. Several people were asked if they liked chocolate or vanilla ice cream better. Exactly forty-five percent of the people surveyed said they liked vanilla.

What is the fewest number of people that could have completed the survey? Explain your reasoning.