Applying the Pythagorean Theorem

Information for students

This task will help strengthen your understanding of the Pythagorean Theorem as you will be applying it in different contexts.

Instructions

- Read each problem presented in Appendix A – Applications of the Pythagorean Theorem
- Solve each problem one at a time. Refer to the hints provided in Appendix B when needed

Materials required

- Appendix A – Applications of the Pythagorean Theorem
- Writing materials
- Calculator

Information for parents

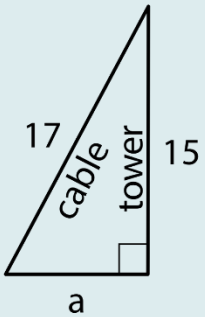
About the activity

Children should:

- complete the activity on their own
- refer to various sources to review the Pythagorean Theorem (class notes, textbooks, internet sources, etc.)

Parents could:

- help the children organize the required materials, if necessary
- read the instructions to the children, if necessary
- have the children explain how they went about solving each problem
- share the following information about the Pythagorean Theorem with the children, if necessary:
  - the Pythagorean Theorem can be used to solve any problem that can be depicted with a right triangle where the lengths of two sides are known and the length of the third side needs to be determined
  - for example[1], let's say a cable is being installed to a support a tower. It is a 17 m cable, and the cable should run from the ground to the top of a 15 m the tower (see image on the right.) How far away from the foot of the tower should the bottom end of the cable be located?



  - it is assumed that the tower makes a right angle with the ground. Since this is a right triangle, the relationship between its sides is $a^2 + b^2 = c^2$, where c represents the length of the hypotenuse and a and b represent the lengths of the other two sides. The hypotenuse is the side opposite the right angle. Substituting the given information for b and c in the equation, we get $a^2 + 15^2 = 17^2$. Solving this equation to find the value of a, we get $a = 8$. The bottom end of the cable should be located 8 metres away from the foot of the tower

The solutions to the problems can be found in Appendix C.

[1] Adapted from: Open-up Resources, accessed May 14, 2020, https://openupresources.org/math-curriculum/6-8-math/

Appendix A – Applications of the Pythagorean Theorem

Information for students

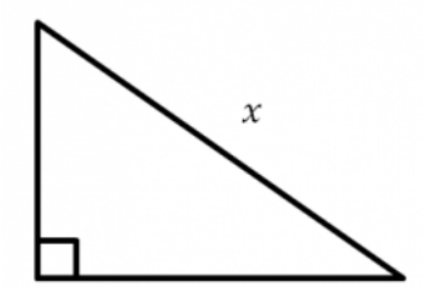
This task will help strengthen your understanding of the Pythagorean Theorem as you will be applying it in different contexts.

Instructions

- Read each problem below
- Solve each problem one at a time. Refer to the hints provided in Appendix B, when needed

Problem 1[2]

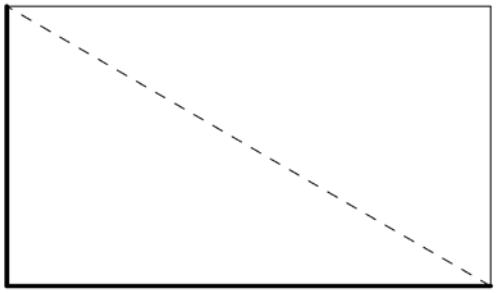
What could the lengths of the legs be if the lengths must be integers and x must be an irrational number between 5 and 7? Try to find at least two possible solutions.



[2] Task adapted from Open-up Resouces, “Pythagorean Theorem Problem,” accessed May 14, 2020, https://www.openmiddle.com/pythagorean-theorem-prob/

Problem 2[3]

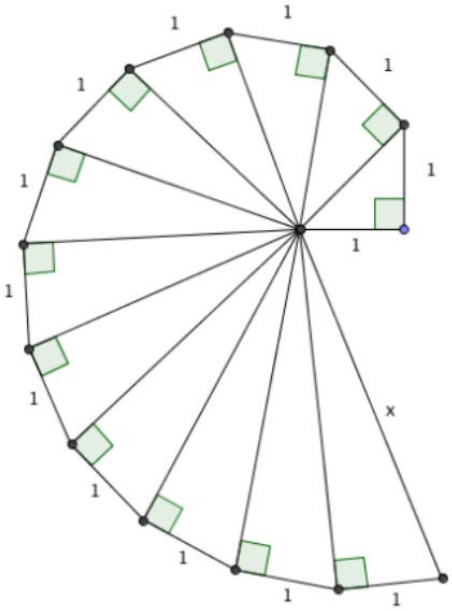
Mai and Tyler were at one corner of a large rectangular field and decided to race to the opposite corner. Since Mai had a bike and Tyler did not, they thought it would be a fairer race if Mai rode along the sidewalk that surrounds the field, while Tyler ran the shorter distance directly across the field. The field is 100 metres long and 80 metres wide. Tyler can run at around 5 metres per second, and Mai can ride her bike at around 7.5 metres per second.



1. Before doing any calculations, who do you think will win? By how much? Explain your thinking
2. Who wins? Show your reasoning. How accurate was your prediction?
1. If you could give the loser of the race a head start, how much time would they need in order for both people to arrive at the same time?
2. If you could make the winner go slower, how slow would they need to go in order for both people to arrive at the same time?

Problem 3[4]

Find the length of side x in the diagram.



[3] Adapted from Open-up Resources, accessed May 14, 2020, https://openupresources.org/math-curriculum/6-8-math/

[4] Adapted from Open-up Resources, accessed May 14, 2020, https://www.openmiddle.com/pythagorean-shell/

Appendix B – Hints

Problem 1:

What is a wrong answer? How can you use this wrong answer to move towards an answer?

What does it mean when we say that a number between 5 and 7 is irrational?

- An irrational number is a number that cannot be expressed as a fraction. For example, the square root of 2 is an irrational number because it cannot be written as a fraction

Problem 2:

Use your knowledge of the Pythagorean Theorem and of rates and ratios to solve the problem.

$$\frac{Distance\ Travelled}{Time} = Speed$$

Problem 3:

What pattern do you see? Can you use the pattern to find the value of x?

Appendix C – Solutions

Problem 1:

Here are the possible lengths of the legs
3 and 5
3 and 6
4 and 4
4 and 5
2 and 5
2 and 6
1 and 5
1 and 6

Problem 2:

1. Answers will vary
2. Mai wins. Mai has 180 metres to travel. At 7.5 metres per second, it will take her 24 seconds, since $\frac{180}{7.5} = 24$. According to the Pythagorean Theorem, Tyler travels $\sqrt{16\,400}$ metres. At 5 metres per second, it will take him approximately 25.6 seconds, since $\frac{\sqrt{16\,400}}{5} \approx 25.6$
3. Mai beats Tyler to the opposite corner by about 1.6 seconds. Tyler needs a head start of roughly 1.7 seconds to beat Mai
4. About 7 metres per second. If Mai goes 7 metres per second, then she will finish the race in $\frac{180}{7} \approx 25.7$ seconds. She will lose to Tyler by a fraction of a second.

Problem 3:

x is equal to $\sqrt{13}$