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CREATE WITH MATH

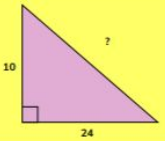
Worksheet Solutions

CREATE WITH MATH

Foundation 8

Learning Outcome:
Know that $\sqrt{2}$ is irrational and show more square root numbers as irrational.
(8.EE.A.2)

1 Use the pattern hypotenuse² = base² + perpendicular², to find the hypotenuse.



Answer: ☐

2 Complete the table by observing the given square root spiral.

Base	Perpendicular	Hypotenuse	Is the hypotenuse rational or irrational?
$\sqrt{7}$	1		
$\sqrt{8}$	1		

3 The base and perpendicular are $\sqrt{12}$ and $\sqrt{14}$, respectively. Spot the error(s) while calculating the hypotenuse. (Use ✓ or ✗)

- Step 1: b = $\sqrt{12}$, p = $\sqrt{4}$, and h = ? ☐
- Step 2: $h^2 = b^2 + p^2$ ☐
- Step 3: $h^2 = (\sqrt{12})^2 + (\sqrt{4})^2$ ☐
- Step 4: $h^2 = 12 + 2$ ☐
- Step 5: $h^2 = 14$ ☐

4 $\sqrt{19}$ lies between which two integers on the number line?

a) 2 and 3 b) 3 and 4 c) 4 and 5

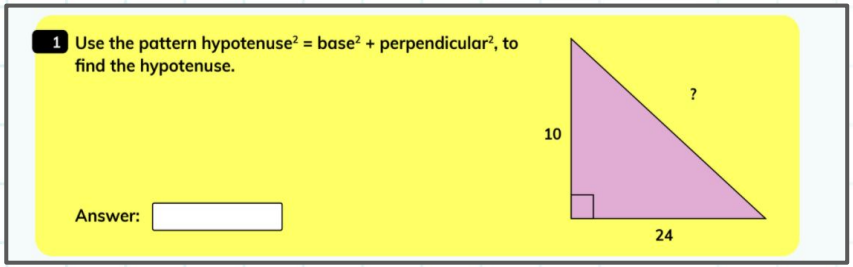
5 State true or false. (Use ✓ or ✗)

a) $\sqrt[3]{10} = 10^{\frac{1}{3}}$ ☐ b) $\sqrt{5} = 5^{\frac{1}{2}}$ ☐

6 Fill in the blanks.

a) $(49)^{\frac{1}{2}} = (\square)^{\frac{1}{2}} = \square$ b) $(125)^{\frac{1}{3}} = (\square)^{\frac{1}{3}} = \square$

Foundation



Given:

hypotenuse^2 = base^2 + perpendicular^2

where, base = 24 and perpendicular = 10

Solution:

As per the pythagoras theorem, we know that

hypotenuse^2 = base^2 + perpendicular^2

hypotenuse^2 = 10^2 + 24^2

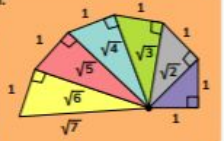
hypotenuse = $\sqrt{(10^2 + 24^2)} \Rightarrow \sqrt{676}$

hypotenuse = 26 units

26

2 Complete the table by observing the given square root spiral.

Base	Perpendicular	Hypotenuse	Is the hypotenuse rational or irrational?
$\sqrt{7}$	1		
$\sqrt{8}$	1		



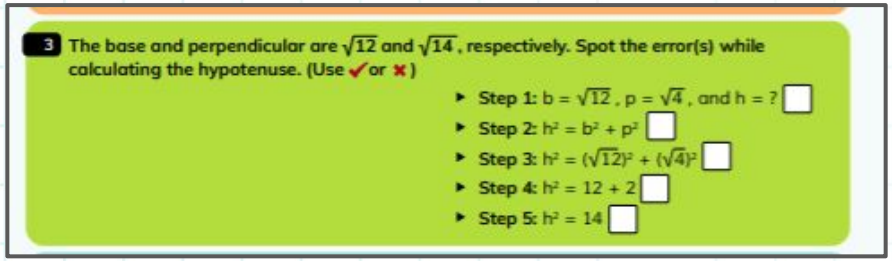
Solution:
As per the pythagoras theorem, we know that

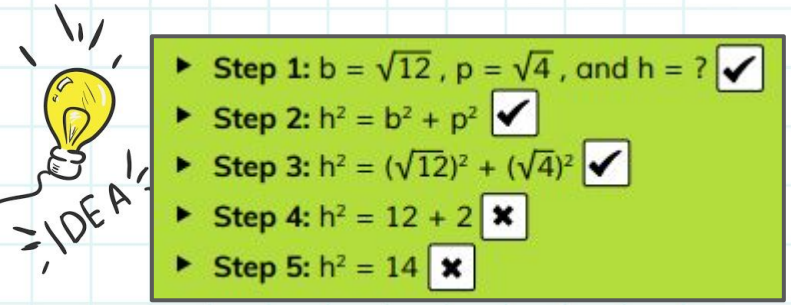
$\text{hypotenuse}^2 = \text{base}^2 + \text{perpendicular}^2$

1. $\text{hypotenuse}^2 = (\sqrt{7})^2 + 1^2 \Rightarrow 8$
   $\text{hypotenuse} = \sqrt{8}$

2. $\text{hypotenuse}^2 = (\sqrt{8})^2 + 1^2 \Rightarrow 9$
   $\text{hypotenuse} = \sqrt{9} \Rightarrow 3$

Base	Perpendicular	Hypotenuse	Is the hypotenuse rational or irrational?
$\sqrt{7}$	1	$\sqrt{8}$	Irrational
$\sqrt{8}$	1	$\sqrt{9} = 3$	Rational





Given:

Base = √12
Perpendicular = √14

Solution:
We know that,
hypotenuse$(h)^2$ = base$(b)^2$ + perpendicular$(p)^2$

Step 1 : b = √12 , p = √14 and h = ? (✔)

Step 2 : $h^2 = b^2 + p^2$ (✔)

Step 3: $h^2 = (\sqrt{12})^2 + (\sqrt{4})^2$ (✔)

Step 4: $h^2 = 12 + 2$ (✘)
It should have been $h^2 = 12 + 4$

Step 5: $h^2 = 14$ (✘)
It should have been $h^2 = 16$

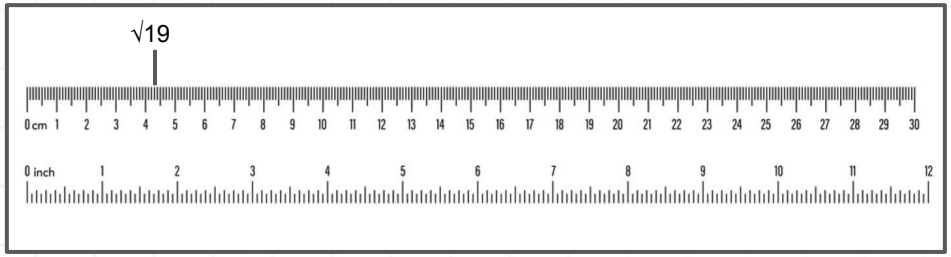
4 $\sqrt{19}$ lies between which two integers on the number line?

a) 2 and 3 b) 3 and 4 c) 4 and 5

Solution:

We know that $\sqrt{1} = 1$, $\sqrt{4} = 2$, $\sqrt{9} = 3$, $\sqrt{16} = 4$, and $\sqrt{25} = 5$
Thus we can say that $\sqrt{19}$ lies between $\sqrt{16}$ and $\sqrt{25}$
Or $\sqrt{19}$ lies between 4 and 5.

It is as shown on the number line:



$\sqrt{16} = 4$
$\sqrt{25} = 5$

Hence $\sqrt{19}$ lies between 4 and 5.
Option(c) is the right answer.

5 State true or false. (Use ✔ or ✖)

a) $\sqrt[3]{10} = 10^{\frac{1}{3}}$ ☐ b) $\sqrt{5} = 5^{\frac{1}{5}}$ ☐

Given:

Expression 1 : $\sqrt[3]{10} = 10^{1/3}$

Expression 2 : $\sqrt{5} = 5^{1/5}$

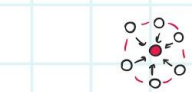
Solution:

$\sqrt[3]{10} = 10^{1/3}$. Hence, true. (✔)

$\sqrt{5} = 5^{1/2}$. Hence, false. (✘)

5 State true or false. (Use ✔ or ✖)

a) $\sqrt[3]{10} = 10^{\frac{1}{3}}$ ✔ b) $\sqrt{5} = 5^{\frac{1}{5}}$ ✖



6 Fill in the blanks.

a) $(49)^{\frac{1}{2}} = (\square^{\square})^{\frac{1}{2}} = \square$ b) $(125)^{\frac{1}{3}} = (\square^{\square})^{\frac{1}{3}} = \square$

Given:

Expression 1 : $49^{1/2}$

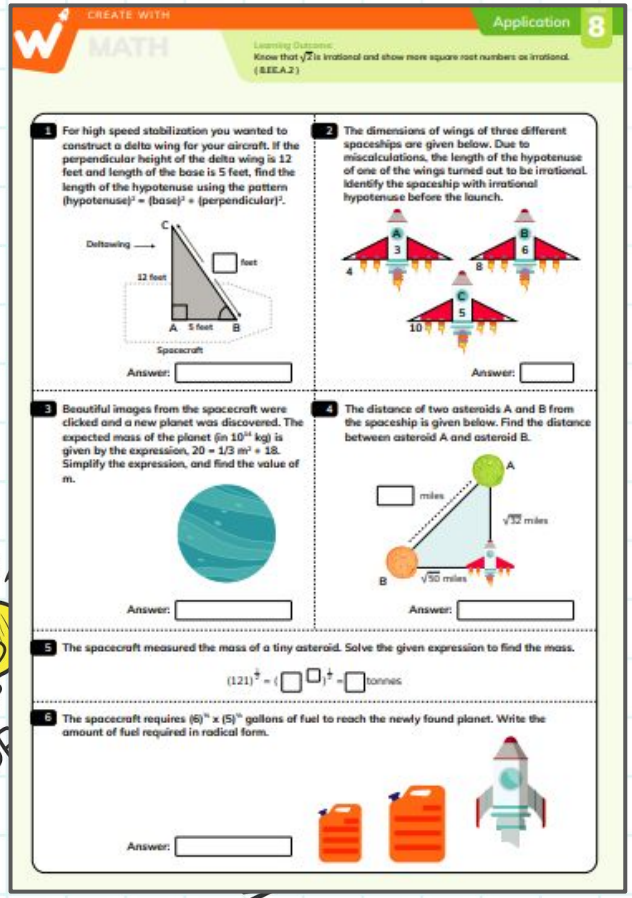
Expression 2 :$125^{1/3}$

Solution:

$(49)^{1/2} = (7^2)^{1/2} = 7$

$(125)^{1/3} = (5^3)^{1/3} = 5$

a) $(49)^{\frac{1}{2}} = (7^{\boxed{2}})^{\frac{1}{2}} = 7$ b) $(125)^{\frac{1}{3}} = (5^{\boxed{3}})^{\frac{1}{3}} = 5$



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Application 8

Learning Outcome:
Know that $\sqrt{2}$ is irrational and show more square root numbers as irrational.
(8.EE.A.2)

1 For high speed stabilization you wanted to construct a delta wing for your aircraft. If the perpendicular height of the delta wing is 12 feet and length of the base is 5 feet, find the length of the hypotenuse using the pattern $(\text{hypotenuse})^2 = (\text{base})^2 + (\text{perpendicular})^2$.

Deltawing → C, □ feet, 12 feet, A, 5 feet, B

Spacecraft

Answer: ☐

2 The dimensions of wings of three different spaceships are given below. Due to miscalculations, the length of the hypotenuse of one of the wings turned out to be irrational. Identify the spaceship with irrational hypotenuse before the launch.

A: 3, 4 — B: 6, 8 — C: 5, 10

Answer: ☐

3 Beautiful images from the spacecraft were clicked and a new planet was discovered. The expected mass of the planet (in 10^{24} kg) is given by the expression, $20 = 1/3\ m^2 + 18$. Simplify the expression, and find the value of m.

Answer: ☐

4 The distance of two asteroids A and B from the spaceship is given below. Find the distance between asteroid A and asteroid B.

A, ☐ miles, $\sqrt{32}$ miles, B, $\sqrt{50}$ miles

Answer: ☐

5 The spacecraft measured the mass of a tiny asteroid. Solve the given expression to find the mass.

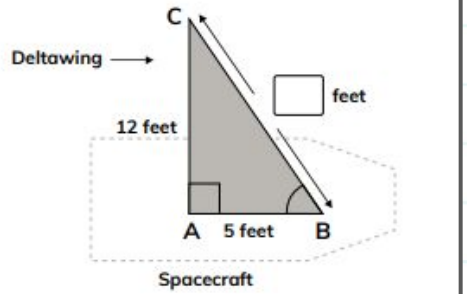
$(121)^{\frac{1}{2}} = (\square^{\square})^{\frac{1}{2}} = \square$ tonnes

6 The spacecraft requires $(6)^{\square} \times (5)^{\square}$ gallons of fuel to reach the newly found planet. Write the amount of fuel required in radical form.

Answer: ☐

Application

1 For high speed stabilization you wanted to construct a delta wing for your aircraft. If the perpendicular height of the delta wing is 12 feet and length of the base is 5 feet, find the length of the hypotenuse using the pattern $(\text{hypotenuse})^2 = (\text{base})^2 + (\text{perpendicular})^2$.



13 feet

Given:

Perpendicular height (p) = 12 feet
Length of base (b) = 5 feet
Hypotenuse $(h)^2$ = base $(b)^2$ + perpendicular $(p)^2$

Solution:

On substituting,

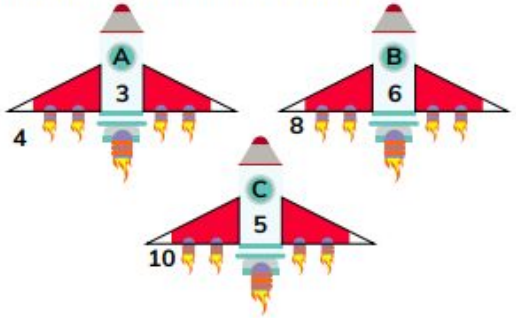
$h^2 = 5^2 + 12^2$

$h^2 = 25 + 144$

$h = \sqrt{169}$

$\Rightarrow h = 13$ feet

2 The dimensions of wings of three different spaceships are given below. Due to miscalculations, the length of the hypotenuse of one of the wings turned out to be irrational. Identify the spaceship with irrational hypotenuse before the launch.



Spaceship C

Given:

hypotenuse(h)^2 = base(b)^2 + perpendicular(p)

Spaceship A : p = 3 , b = 4

Spaceship B : p = 6 , b = 8

Spaceship C : p = 5 , b = 10

Solution:

Spaceship A :

$h^2 = p^2 + b^2 \Rightarrow 3^2 + 4^2$

$h^2 = 25 \Rightarrow h = \sqrt{25} \Rightarrow h = 5$ (Rational)

Spaceship B :

$h^2 = p^2 + b^2 \Rightarrow 6^2 + 8^2$

$h^2 = 100 \Rightarrow h = \sqrt{100} \Rightarrow h = 10$ (Rational)

Spaceship C :

$h^2 = p^2 + b^2 \Rightarrow 5^2 + 10^2$

$h^2 = 125 \Rightarrow h = \sqrt{125} \Rightarrow h = 11.1803..$ (Irrational)

3 Beautiful images from the spacecraft were clicked and a new planet was discovered. The expected mass of the planet (in 10^{14} kg) is given by the expression, $20 = 1/3\ m^2 + 18$. Simplify the expression, and find the value of m.

Given:

Mass (in 10^{14} kg) = $20 = 1/3\ m^2 + 18$

Solution:

On solving we get,

$20 - 18 = 1/3\ m^2$

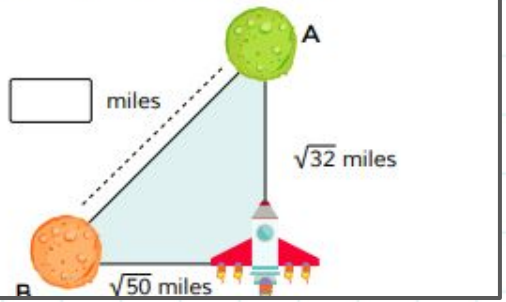
$2 \times 3 = m^2$

$\sqrt{6} = m$

Hence,
$m = \sqrt{6} \times 10^{14}$ kg

$m = \sqrt{6} \times 10^{14}$

4 The distance of two asteroids A and B from the spaceship is given below. Find the distance between asteroid A and asteroid B.



Given:

Base(b) = √50 miles
Perpendicular(p) = √32 miles

Solution:

Hypotenuse $(h)^2$ = base $(b)^2$ + perpendicular $(p)^2$

$h^2 = (\sqrt{50})^2 + (\sqrt{32})^2$

$h^2 = 50 + 32$

$h^2 = 82$

$h = \sqrt{82}$ miles

IDEA

h = √82 miles

5 The spacecraft measured the mass of a tiny asteroid. Solve the given expression to find the mass.

$(121)^{\frac{1}{2}} = (\square^{\square})^{\frac{1}{2}} = \square$ tonnes

Solution:

Mass of asteroid = $(121)^{1/2}$

$= (11^2)^{1/2}$

$= 11$ tonnes

$(121)^{\frac{1}{2}} = (\boxed{11}^{\boxed{2}})^{\frac{1}{2}} = \boxed{11}$ tonnes

6 The spacecraft requires $(6)^{½} \times (5)^{½}$ gallons of fuel to reach the newly found planet. Write the amount of fuel required in radical form.

Answer:

Given:

Fuel required = $(6)^{1/2} \times (5)^{½}$ gallons

Solution:

Fuel required = $(6)^{1/2} \times (5)^{1/2}$

$= (6 \times 5)^{½}$

$= (30)^{½} \Rightarrow \sqrt{30}$ gallons

√30 gallons

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Create

Learning Outcome:

Know that $\sqrt{2}$ is irrational and show more square root numbers as irrational.

8.EE.A.2

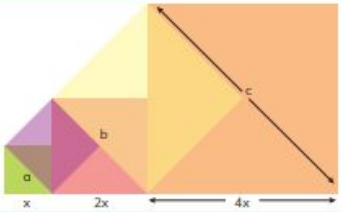
The diagram below is the proposed design of a new solar panel for the spacecraft. It looks like a combination of squares and right triangles, and can be extended to make larger panels.

Step 1 Choose the dimensions (x) of the solar panel and complete the table using the pattern you derived. $(\text{hypotenuse})^2 = (\text{base})^2 + (\text{perpendicular})^2$.

Step 2 Observe the pattern of the squares on the design and extend it to create the squares with sides 6x and 8x.

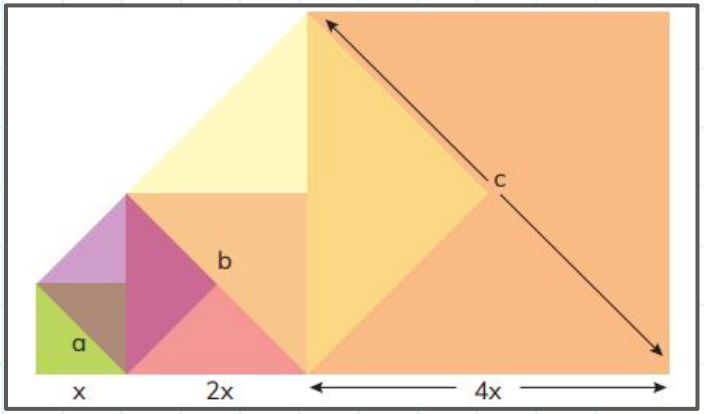
Hint: The vertical and slant diagonals of the previous squares alternatively becomes the side of the next square.

Step 3 Color different sections of the solar panel to bring out the pattern of squares and triangles.



Dimension	Value	Rational or Irrational	Reason
x			
a			
b			
c			

Create



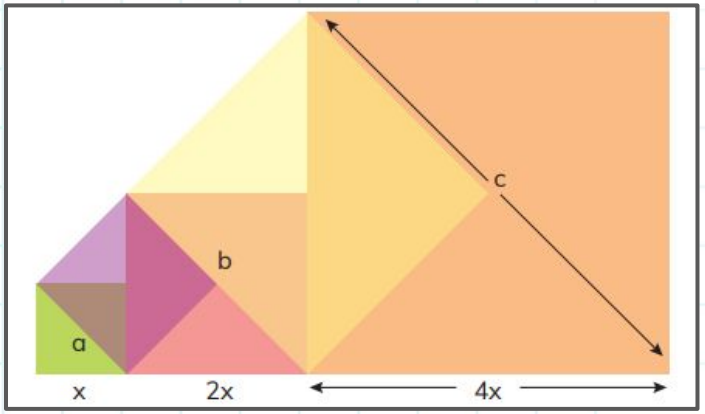
Given:
hypotenuse^2 = base^2 + perpendicular^2 or $h^2 = b^2 + p^2$

Solution:
Choose x = 2 units.

$a^2 = x^2 + x^2$
$\Rightarrow a^2 = 2^2 + 2^2 = 4 + 4 = 8$
$\Rightarrow a = \sqrt{8}$

$b^2 = (2x)^2 + (2x)^2$
$\Rightarrow b^2 = 4x^2 + 4x^2 = 8x^2 = 8 \times 2^2 = 8 \times 4 = 32$
$\Rightarrow b = \sqrt{32}$

$c^2 = (4x)^2 + (4x)^2$
$\Rightarrow c^2 = 16x^2 + 16x^2 = 32x^2 = 32 \times 2^2 = 32 \times 4 = 128$
$\Rightarrow c = \sqrt{128}$



Given:

hypotenuse^2 = base^2 + perpendicular^2

Solution:

Using the above equation and and tabulating the data into the table we have,

Dimension	Value	Rational or Irrational	Reason
x	2	Rational	2 can be represented in the form of p/q.
a	$\sqrt{8}$	Irrational	8 is not a perfect square. Square root of non-perfect squares is irrational.
b	$\sqrt{32}$	Irrational	32 is not a perfect square. Square root of non-perfect squares is irrational.
c	$\sqrt{128}$	Irrational	128 is not a perfect square. Square root of non-perfect squares is irrational.