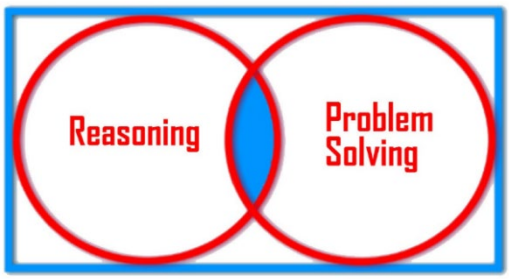
GCSE Foundation (5 – 1)



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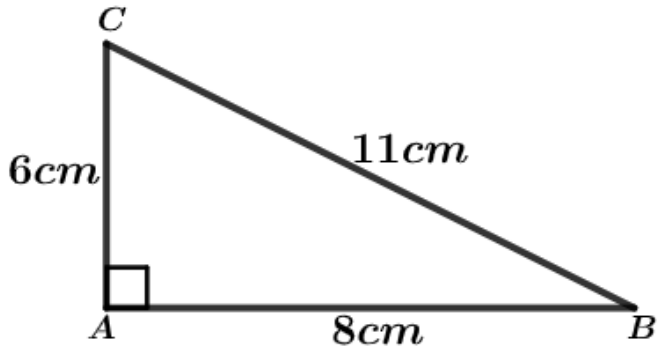
Mathematical Reasoning Questions

(Pythagoras Theorem and Trig) – Set 1

Solutions

The questions are repeated here for your convenience

1 Triangle ABC is shown below



Is triangle ABC accurately drawn? Justify your answer

Solution

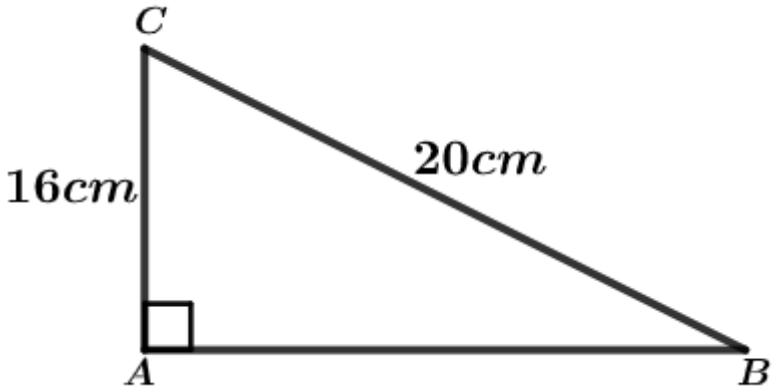
If the triangle is accurately drawn, then it must satisfy Pythagoras' theorem: $\{a^2 + b^2 = c^2\}$

$6^2 + 8^2 = 36 + 64 = 100$

$\sqrt{100} = 10$. The side BC should be equal to 10 cm **not** 11 cm

Therefore, triangle ABC is not accurately drawn **[1mark]**

2 Triangle ABC shown below is right-angled

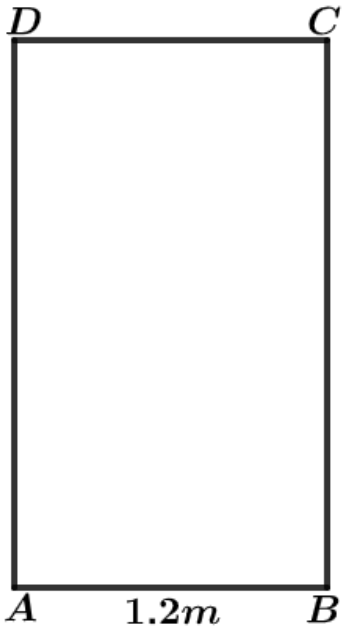


Emilia calculates the side AB. She says her answer is 22 cm. Without carrying out the actual calculation, how could you tell that, Emelia is wrong?

Solution

The side BC is the longer side of the triangle since it is opposite the right angle. Therefore, AB cannot be 22 cm **[1mark]**

3 ABCD is a rectangle of width 1.2 m



The diagonal $AC = 2.8$ m
The perimeter of rectangle ABCD will be closest to.
Choose one answer

a) 7.4 m
b) 6.0 m
c) 8.4 m
d) 8.0 m

Solution

Using Pythagoras theorem:
$1.2^2 + (BC)^2 = 2.8^2$

$(BC)^2 = 2.8^2 - 1.2^2$

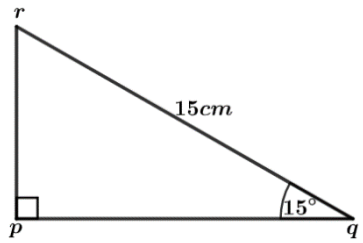
$BC = \sqrt{2.8^2 - 1.2^2} = 2.53$ cm (3sf)

Perimeter of ABCD$= 1.2 \times 2 + 2.53 \times 2 = 2.4 + 5.06 = 7.46$ cm
Even though 7.46 can be rounded to 7.5(1dp), it is still closest to 7.4cm than any other option
Correct Answer: A **[3marks]**

4

Triangle pqr shown below is right-angled at the vertex p.
Angle $pqr = 15°$ and $qr = 15$ cm
Which calculation will give the length of the side pr?
Choose one answer

a) $15 \sin 15$
b) $15 \cos 15$
c) $\sin 15 \div 15$
d) $\cos 15 \div 15$



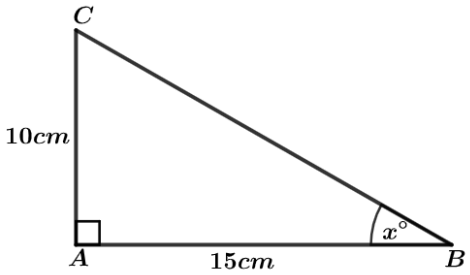
Solution

Using, SOHCAHTOA, we have the length of the **hypotenuse** and need to find the length of the **opposite** side.
Therefore, the correct part of SOHCAHTOA to use will be SOH
Therefore, $\sin 15 = \frac{pr}{15}$
So, $pr = \sin 15 \times 15 = 15 \sin 15$
Correct Answer: A **[2marks]**

5

In triangle ABC shown below, the angle x^o is closest to
Choose one answer

a) 30°
b) 34°
c) 42°
d) 48°



Solution

Using SOHCAHTOA, we have the lengths of the **opposite** and **adjacent** sides to the unknown angle.
Therefore, the correct part of SOHCAHTOA to use will be TOA
Therefore, $\tan x = \frac{10}{15} = \frac{2}{3}$
So, $x = \tan^{-1}\left(\frac{2}{3}\right) = 33.7$ (3sf) $\approx 34°$ (Nearest whole number)
Correct Answer: B **[2marks]**

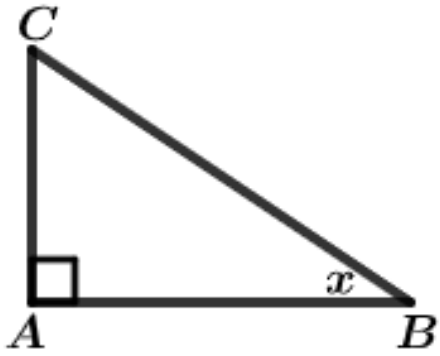
6 Answer **True** or **False** to the following statements **[3marks]**

a) A right - angled triangle has sides 4 cm, 5 cm and 6 cm
False $(4^2 + 5^2 \neq 6^2)$

b) If $\sin x = 0.5$, then $x = 30°$ **True**

c) If $3^2 = x^2 + 2^2$, then $x = \sqrt{3} - \sqrt{2}$ **False** $x = \sqrt{3^2 - 2^2}$

7 Triangle ABC is shown below. Where angle ABC = x



Which of the following is **false** about triangle ABC?
Choose all that may apply

a) $(\mathrm{AB})^2 = (\mathrm{AC})^2 + (\mathrm{BC})^2$

b) $\sin x = \frac{AB}{BC}$

c) $\cos x = \frac{AB}{BC}$

d) $(\mathrm{AB})^2 = (\mathrm{AC})^2 - (\mathrm{BC})^2$

Solution

a) Is **false**. The correct statement should be
$\mathrm{AB}^2 + \mathrm{AC}^2 = \mathrm{BC}^2$

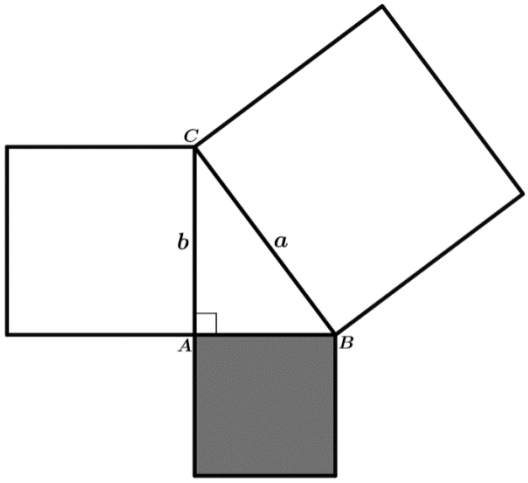
b) Could be true if $\mathrm{AB} = \mathrm{AC}$

c) True

d) Is **false**. The correct statement should be
$(\mathrm{AB})^2 = (\mathrm{BC})^2 - (\mathrm{AC})^2$

Correct Answer: A and D **[2marks]**

8 Three squares are drawn on the sides of triangle ABC as shown below. Where the sides BC and AC are a and b respectively



Which expression is equal to the area of the shaded square?

a) $\sqrt{b^2 + a^2}$

b) $a^2 - b^2$

c) $\sqrt{a^2 - b^2}$

d) $b^2 + a^2$

Solution

The side a is the longer side of triangle ABC since it is opposite the right-angle.

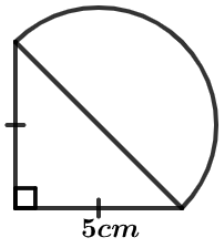
Apply Pythagoras theorem: $\{a^2 + c^2 = b^2\}$

Subtract a^2 from both sides: $a^2 - b^2 = (AB)^2$

Where AB is the side length of the shaded square

Correct Answer: B **[1mark]**

9 Ana is calculating the exact perimeter of the shape below



Here is her Answer:

Longer side of the triangle: $\sqrt{5^2 + 5^2} = 10$cm

Perimeter of the circular part: $10\times \pi = 7\pi$

Perimeter of the shape: $10\pi + 5 + 5 = 10\pi + 10$

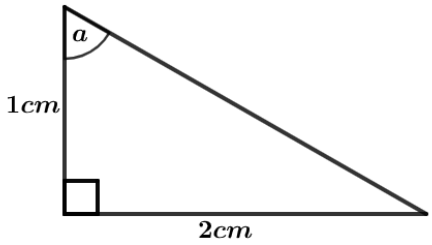
Comment on the accuracy of Ana's answer

Solution

Anna's answer will not be accurate because

$\sqrt{5^2 + 5^2} = \sqrt{25 + 25} = \sqrt{50}$ **[1mark]**

10 A right-angled triangle is shown below. Where angle a is indicated



Which of the following is equal to the value of $\cos a$?

a) $\sqrt{5}$

b) $\frac{1}{\sqrt{5}}$

c) $\frac{1}{2}$

d) 2

Solution

Use pythagoras to find the hypotenuse: $1^2 + 2^2 = c^2$

Where c is the hypotenuse

$c^2 = 5$ therefore, $c = \sqrt{5}$

Using $SOHCAHTOA$, we will use the CAH to find $\cos(a)$

$\cos(a) = \frac{Adjacent}{Hypotenuse}$

So, $\cos(a) = \frac{1}{\sqrt{5}}$ **[2marks]**