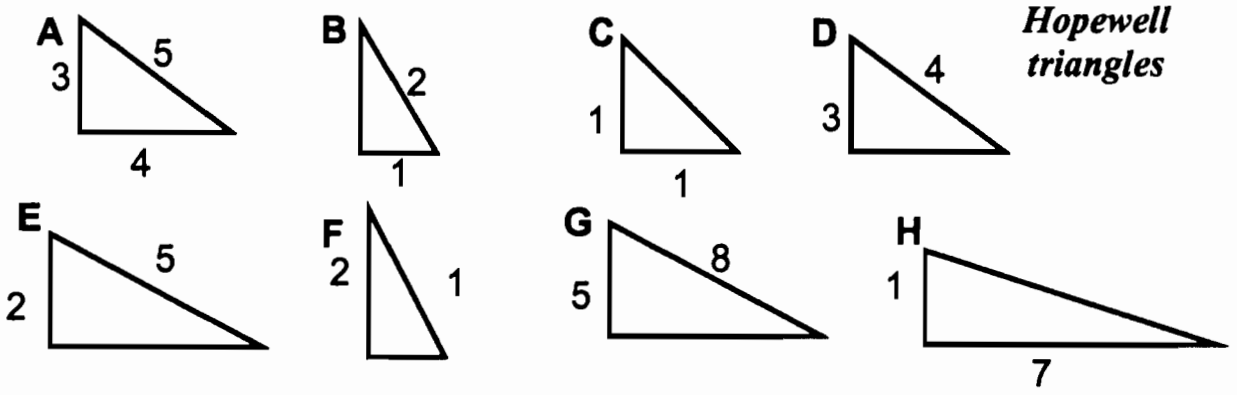
Hopewell Geometry

T1

The Hopewell people were Native Americans whose culture flourished in the central Ohio Valley about 2000 years ago.

The Hopewell people constructed earthworks using right triangles, including those below.



Hopewell triangles

1. What is the length of the hypotenuse of Triangle H?
   Give your answer correct to one decimal place.
   Show your calculations.

   7.1

$1^2 + 7^2 = 50$

$\sqrt{50} \approx 7.1$

2. What is the size of the smallest angle in Triangle A?
   Give your answer correct to one decimal place.
   Show your calculations.

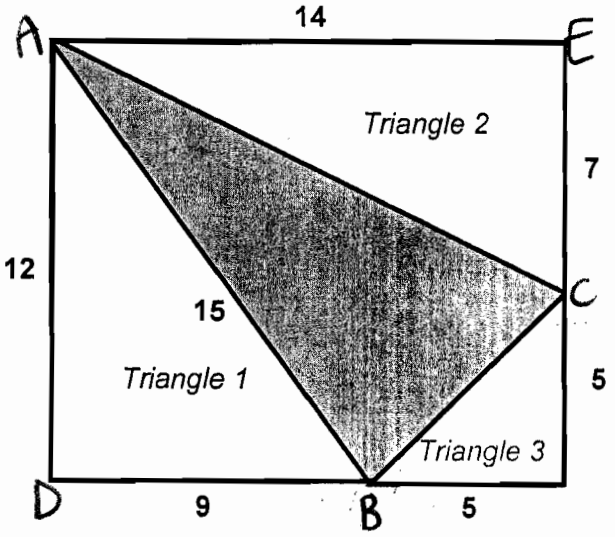
   36.9°

$\tan x = \frac{3}{4}$

$\tan^{-1}\left(\frac{3}{4}\right) = 36.9$

The diagram on the next page shows the layout of some Hopewell earthworks. The centers of the Newark Octagon, the Newark Square and the Great Circle were at the corners of the shaded triangle.

T1



Not drawn to scale

The three right triangles surrounding the shaded triangle form a rectangle measuring 12 units by 14 units.

Each of these three right triangles is similar to one of the Hopewell triangles on the previous page.

For example, Triangle 3 above is similar to Hopewell Triangle C.

3. Which Hopewell triangle is similar to Triangle 1? A

Explain how you decided.

The ratios of the sides were the same.

4. Is the shaded triangle a right triangle? No

Prove your answer.

In Triangle 3, the legs are congruent, so it makes a 45°-45°-90° triangle. If ∠ABC were 90°, then ∠ABD should be 45°. However, triangle 1 doesn't have congruent legs. If ∠ACB were 90°, then ∠ACE should be 45°, but triangle 2 doesn't have congruent legs.

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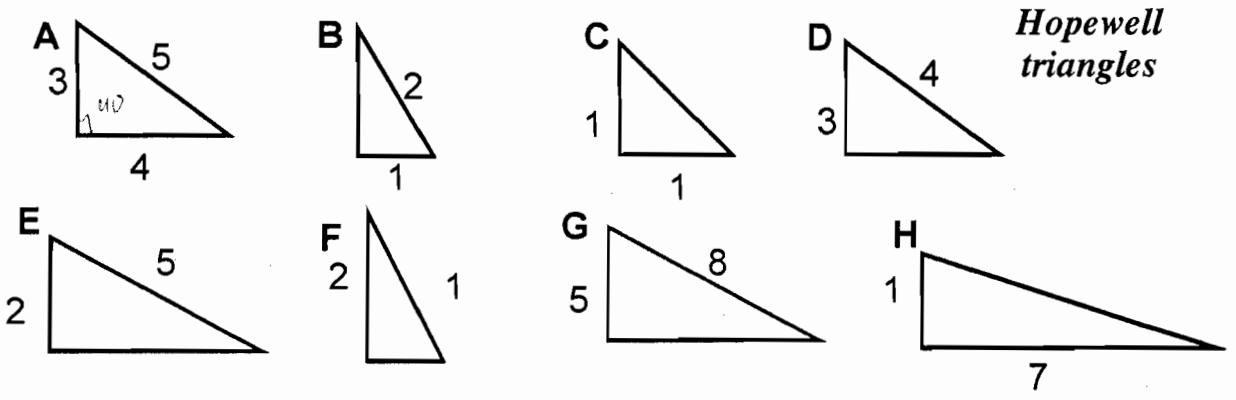

1. What is the length of the hypotenuse of Triangle H?
   Give your answer correct to one decimal place.
   Show your calculations.

   7.1

$$\sqrt{7^2 + 1^2} = \sqrt{50} \approx 7.1$$

2. What is the size of the smallest angle in Triangle A?
   Give your answer correct to one decimal place.
   Show your calculations.

   36.9^0

calculate

$$\cos^{-1}(4/5) \approx 36.9$$

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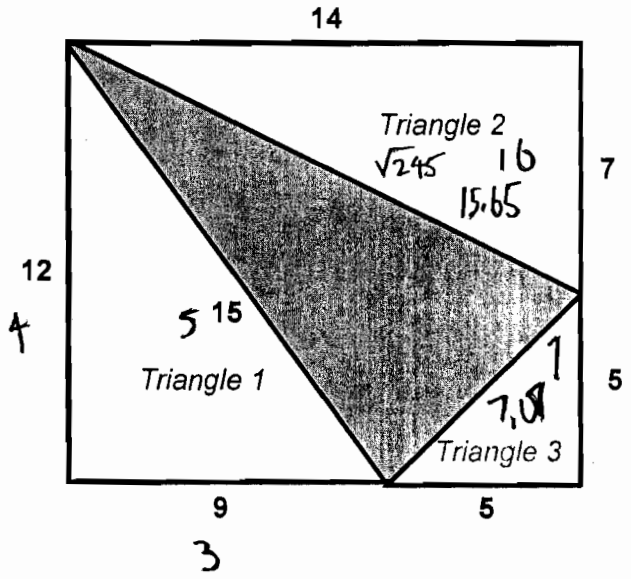
T2



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For example, Triangle 3 above is similar to Hopewell Triangle C.

3. Which Hopewell triangle is similar to Triangle 1? A

Explain how you decided.

Because I divided all the sides by 3 so 4's 3, 4, 5 and that is triangle A.

4. Is the shaded triangle a right triangle? No

Prove your answer.

Triangle 2 is a rt. triangle, But, the hypotenuse of triangle 3 is $\sqrt{5^2+5^2}$ which is about $7.07 \approx 7$. So, the shaded must have the other side of 14 to be a rt. triangle.

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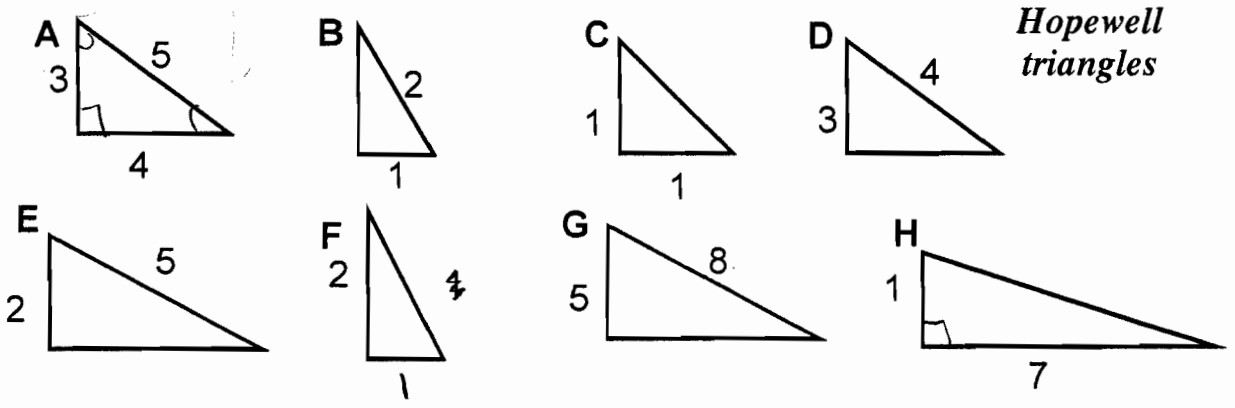

Hopewell triangles

1. What is the length of the hypotenuse of Triangle H?
   Give your answer correct to one decimal place.
   Show your calculations.

   $1^2 + 7^2 = c^2$

   $1 + 49 = \sqrt{c^2}$

   7.1

2. What is the size of the smallest angle in Triangle A?
   Give your answer correct to one decimal place.
   Show your calculations.

   $\frac{3}{5}$ SIN^{-1}

   36.9°

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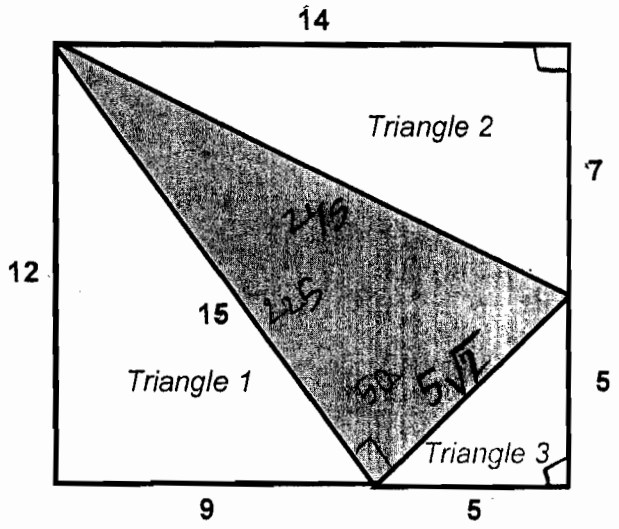

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3. Which Hopewell triangle is similar to Triangle 1? Triangle A

Explain how you decided.

Triangle A and 1 are both pythagorean triples. This means they are all real numbers and when doing $A^2+B^2=C^2$, the numbers have no decimal points or fractions.

4. Is the shaded triangle a right triangle? NO

Prove your answer.

Hypotenuse of $\Delta 3 = 5^2+5^2=C^2$, $C=5\sqrt{2}$, $C^2=50$

Hypotenuse of $\Delta 2 = 7^2+14^2=C^2$, $C=15.7$, $C^2=245$

if the shaded triangle was a right Δ, then

$15^2+50 \neq 245$

$225+50 \neq 245$

$275 \neq 245$ ← since this is not true, it is not a right Δ

Hopewell Geometry

T4

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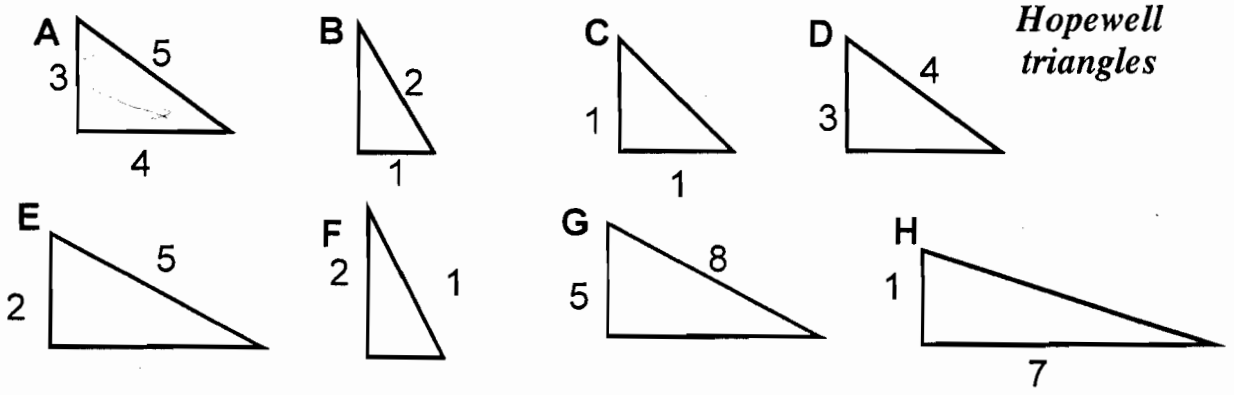

Hopewell triangles

1. What is the length of the hypotenuse of Triangle H?
   Give your answer correct to one decimal place.
   Show your calculations.

   7.1

$1^2 + 7^2 = c^2$

$1 + 49 = c^2$

$c^2 = 50$

$c = \sqrt{50} \approx 7.1$

2. What is the size of the smallest angle in Triangle A?
   Give your answer correct to one decimal place.
   Show your calculations.

   53.1°

$\sin \angle = \frac{4}{5}$

$\angle = 53.1^\circ$ → smallest $\angle = 53.1^\circ$

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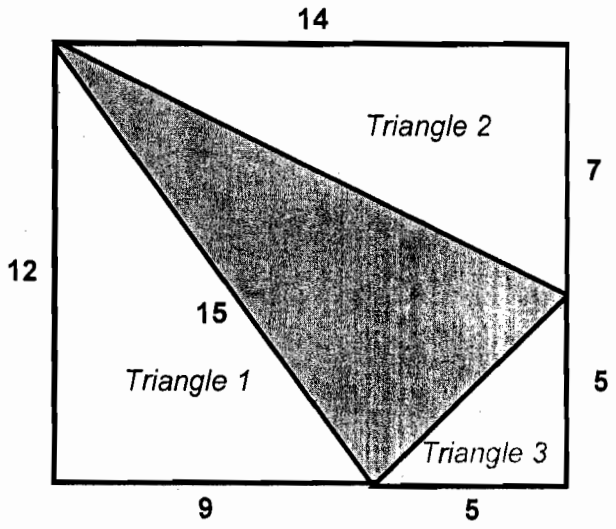
T4



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3. Which Hopewell triangle is similar to Triangle 1? Triangle A

Explain how you decided.

The ratio of the sides of △s is 3:1, making them similar.

4. Is the shaded triangle a right triangle? No

Prove your answer.

△3s hypotenuse = $\sqrt{50}$ △2s hypotenuse = $\sqrt{245}$ $(\sqrt{245})^2 \stackrel{?}{=} (\sqrt{50})^2$
$\stackrel{?}{=} 15^2$ → 245 ≠ 225. $15^2 + (\sqrt{50})^2 \stackrel{?}{=} (\sqrt{245})^2$ → 275 ≠ 245

No

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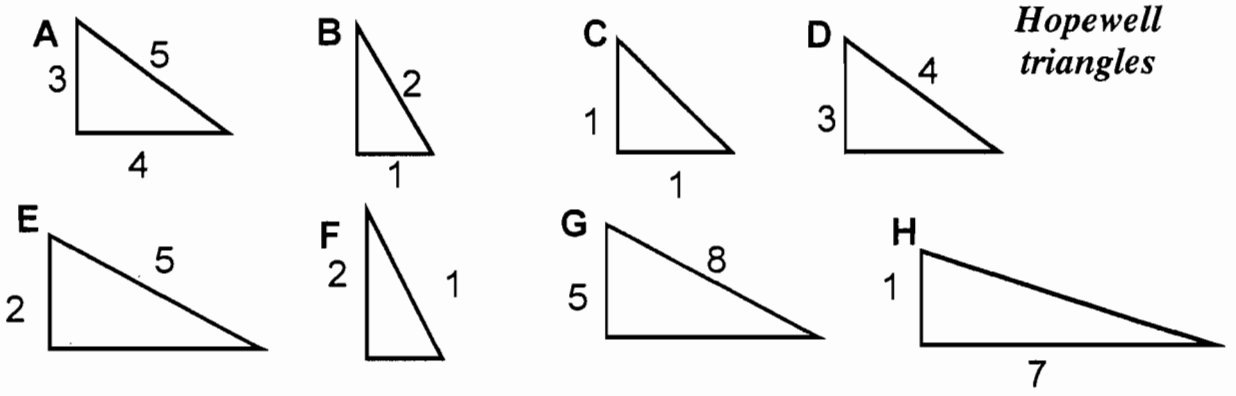

Hopewell triangles

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   Give your answer correct to one decimal place.
   Show your calculations.

   7.1

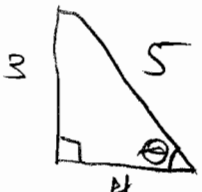
$1^2 + 7^2 = c^2$

$1 + 49 = c^2$

$50 = c^2 \quad c = \sqrt{50} = 7.0710 \rightarrow 7.1$

2. What is the size of the smallest angle in Triangle A?
   Give your answer correct to one decimal place.
   Show your calculations.

   36.9°



$\sin\theta = \frac{3}{5} = 0.6$

$\theta = \sin^{-1}(0.6) = 36.86989765 \rightarrow 36.9°$

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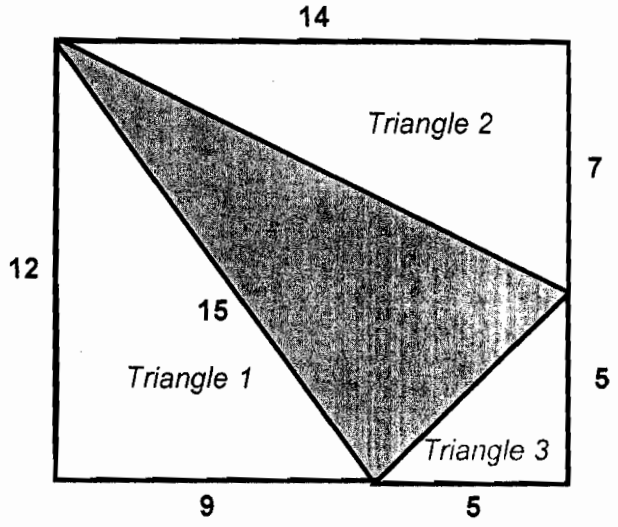

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3. Which Hopewell triangle is similar to Triangle 1? A

Explain how you decided.

9, 12, 15 $3\times3=9$, $4\times3=12$, $5\times3=15$

÷3

3, 4, 5

4. Is the shaded triangle a right triangle? No

Prove your answer.

Triangle 3 $5^2+5^2=c^2$ $50=c^2$ $c=\sqrt{50}$ None of the combinations work

$7^2+14^2=x^2$ $x^2=245$ $x=\sqrt{245}$

$(\sqrt{245})^2+(\sqrt{50})^2\stackrel{?}{=}225$ No

$(\sqrt{50})^2+15^2\stackrel{?}{=}(\sqrt{245})^2$

$50+50=245$ No