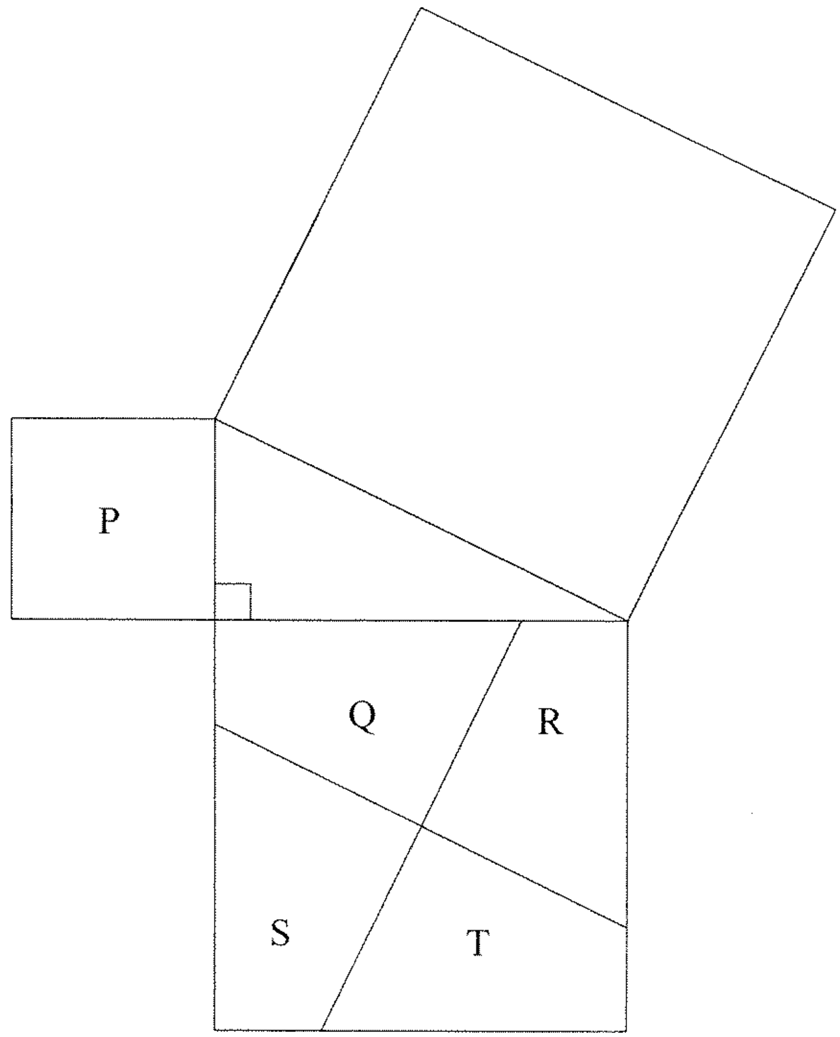
following activity shows an experimental way of verifying the relationship with the area interpretation, in a way that elementary students can understand.

the arrangement
for overhead
, make one leg
other leg. Then
of the Q-R-S-T
ruct lines parallel
the square on the
This gives
, S, and T.

Activity

Trace the lettered regions, cut them out, and reassemble them to match the square region drawn on the hypotenuse.



The Pythagorean theorem <u>starts</u> with a right triangle, and makes an assertion about the sides. The vice-versa situation, called the **converse** in logic, also turns out to be true in this case. If you <u>start</u> with $a^2 + b^2 = c^2$ for the sides of a triangle, then the triangle is a right triangle (the converse of the Pythagorean theorem). The ancient Egyptians knew this fact, and used it to make right angles, as do carpenters and fence-builders

Activity

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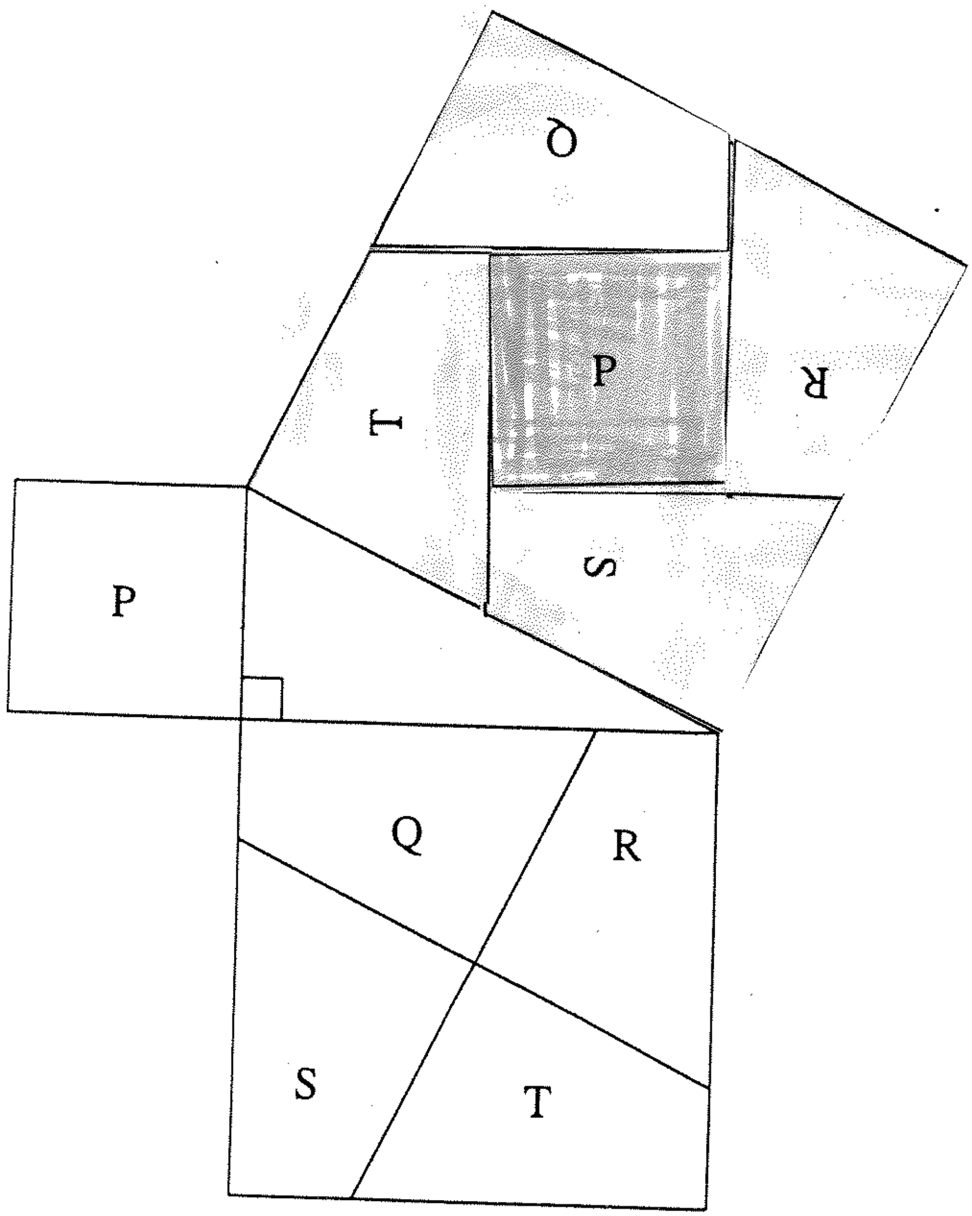
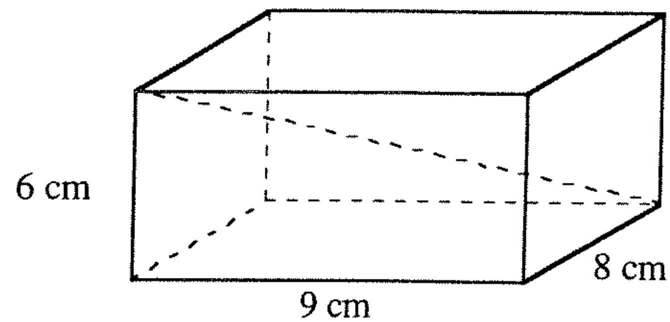
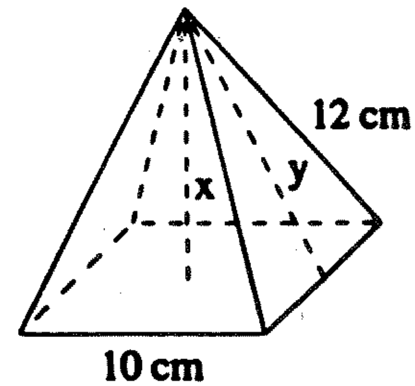


Draw and find the length of each diagonal of each face of the right rectangular prism below, and the "inside" diagonal of the prism, as shown. How long are the other "inside" diagonals?



Discussion (group)

A regular square pyramid has base with edges 10 cm long, and with its other edges 12 cm long. Find the volume and surface area of the pyramid.



Name ______________________________

Glass Gallant

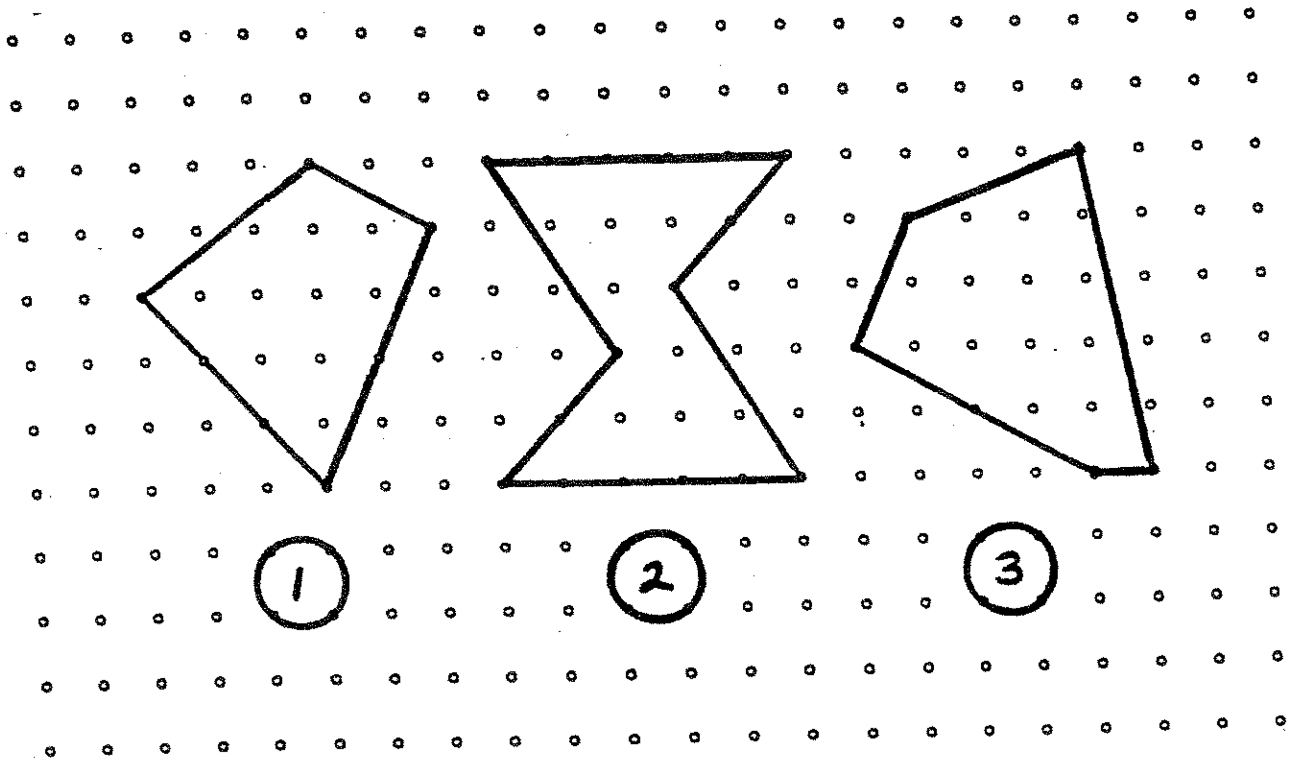
On May 18, 1996, Ashrita Furman of Jamaica, New York, made the *Guinness Book of World Records* when he balanced pint glasses from his chin for 11.89 seconds. How many of these pint glasses did he balance?

To find out, use the Pythagorean theorem to solve for the missing value in each problem. (Round decimals to the nearest hundredth.) Match each set of values in Column A to its matching solution in Column B. Read down the column of written letters to reveal the answer.

Column A	Column B
______ 1. $a = 8$, $c = 17$, $b = ?$	**S.** 9.54
______ 2. $a = 6$, $b = 2$, $c = ?$	**E.** 9.80
______ 3. $a = 6$, $b = 8$, $c = ?$	**F.** 10
______ 4. $b = 20$, $c = 29$, $a = ?$	**I.** 6.32
______ 5. $a = 7$, $c = 25$, $b = ?$	**E.** 30
______ 6. $a = 3$, $c = 10$, $b = ?$	**N.** 40
______ 7. $b = 40$, $c = 50$, $a = ?$	**Y.** 24
______ 8. $a = 1$, $b = 3$, $c = ?$	**F.** 15
______ 9. $b = 5$, $c = 11$, $a = ?$	**V.** 3.16
______ 10. $a = 9$, $c = 41$, $b = ?$	**T.** 21

Answer: ______________________________

Find the perimeter



① $p = \sqrt{13} + 3\sqrt{5} + 2\sqrt{3}$

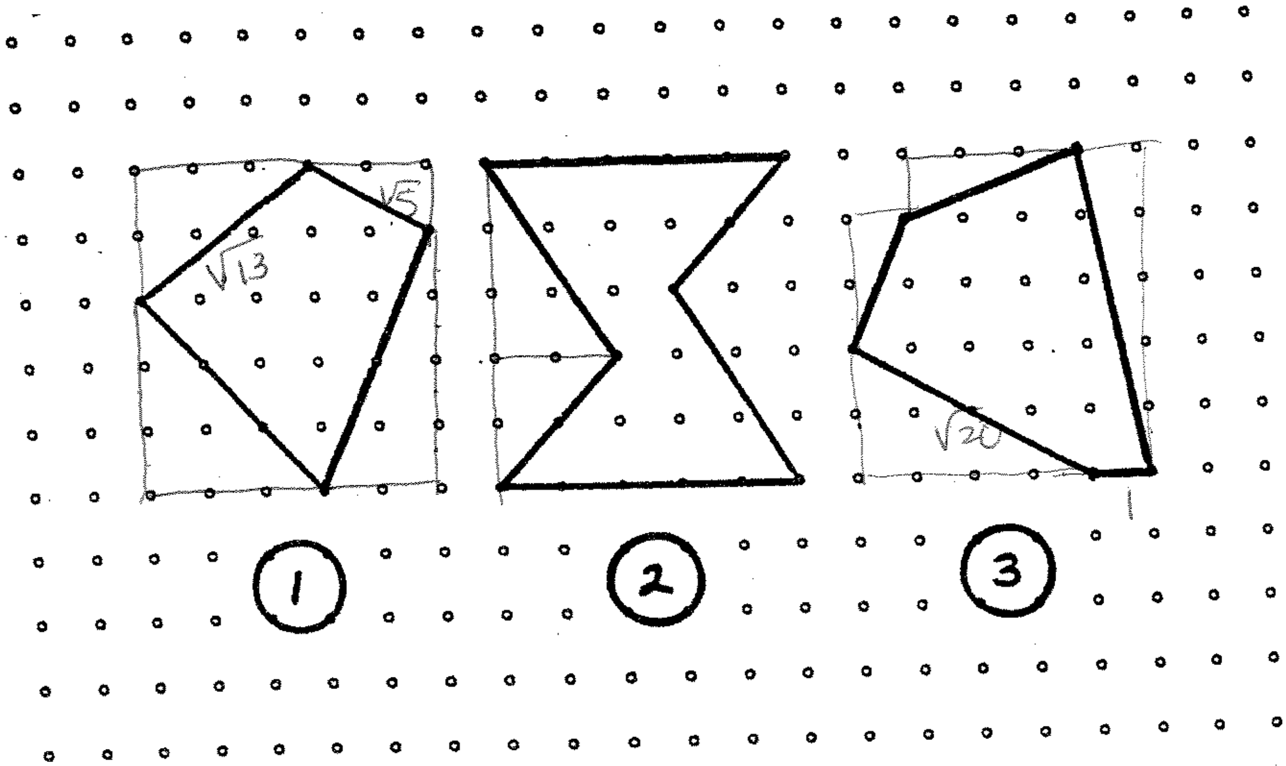
② $p = 2\sqrt{8} + 2\sqrt{13} + 10$

$(4\sqrt{2} + 2\sqrt{13} + 10)$

③ $p = 3\sqrt{5} + \sqrt{10} + \sqrt{26} + 1$

Perimeter

9.3



① $\sqrt{13} + \sqrt{5} + \sqrt{20} + \sqrt{18}$

$= \sqrt{13} + \sqrt{5} + 2\sqrt{5} + 2\sqrt{3}$

$= \sqrt{13} + 3\sqrt{5} + 2\sqrt{3}$

② $2\sqrt{8} + 2\sqrt{13} + 10$

$= 4\sqrt{2} + 2\sqrt{13} + 10$

③ $= \sqrt{20} + \sqrt{5} + \sqrt{10} + \sqrt{26} + 1$

$= 2\sqrt{5} + \sqrt{5} + \sqrt{10} + \sqrt{26} + 1$

$= 3\sqrt{5} + \sqrt{10} + \sqrt{26} + 1$

① $A = 12\frac{1}{2}$

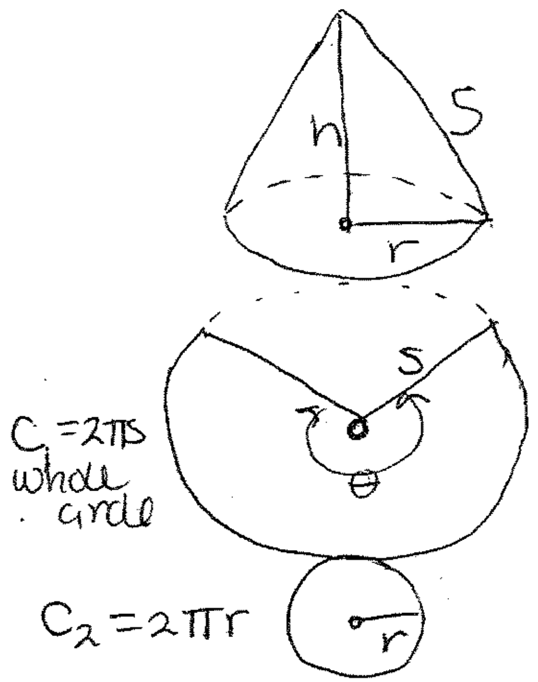
② $A = 15$

③ $A = 15$

Section 9.6

If a **right circular cone** has a base diameter of 6 cm and a volume of 12π cm^3, what is its surface area?

Hints:
(1) Draw the cone (3-D), labelling what you know.
(2) Determine the height of the cone.
(3) Determine the lateral length of the cone.
(4) Draw the cone's net (2-D), labelling what you know.
(5) Determine what portion of a whole circle the sector is.
(6) Calculate the cone's surface area.



☆ Also

$$s^2 = h^2 + r^2$$

$$s = \sqrt{h^2 + r^2}$$

part of C_1 used is

$$\frac{\theta}{360} = \frac{\text{partial arc length} = C_2}{\text{arc length whole circle} = C_1} = \frac{2\pi r}{2\pi s} = \frac{r}{s}$$

$$S = \pi r^2 + \frac{r}{s}(\pi s^2)$$

$$= \pi r^2 + \pi r s$$

$$= \pi r(r + s)$$

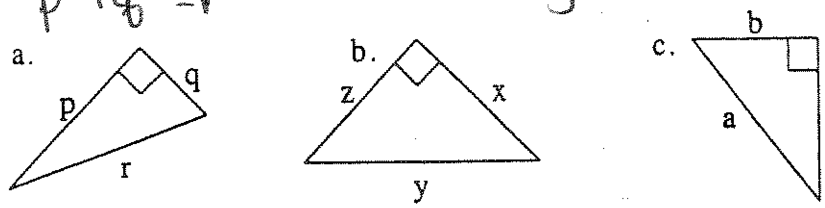
$$= \pi r\left(r + \sqrt{h^2 + r^2}\right)$$

Answers

Exercises

1. What does the Pythagorean theorem assert about each of these triangles?

$p^2+q^2=r^2$ $x^2+z^2=y^2$ $b^2+c^2=a^2$



2. A common mistake with square roots is this one: $\sqrt{a^2+b^2}=a+b$. Find a numerical example which shows that it is incorrect.

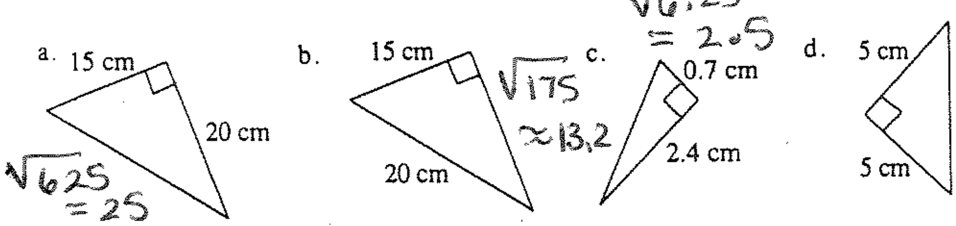
$\sqrt{3^2+4^2}=3+4$

$\sqrt{9+16}=7$

$\sqrt{25}=7$

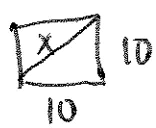
$5\neq 7$ NO

3. Find the perimeter and area in each part. Give an "exact" length and an approximation.



4. Find the length of a diagonal for...

a. a square, 10 cm on each side

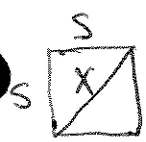


$x^2=10^2+10^2$

$x^2=200$

$x=\sqrt{200}=10\sqrt{2}$

b. a square, s cm on each side



$s^2+s^2=x^2$

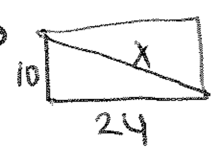
$2s^2=x^2$

$x=\sqrt{2s^2}$

$x=\sqrt{2}\cdot s$

$x=s\cdot\sqrt{2}$

c. a rectangle, 10 cm by 24 cm



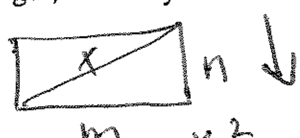
$10^2+24^2=x^2$

$100+576=x^2$

$676=x^2$

$x=26$

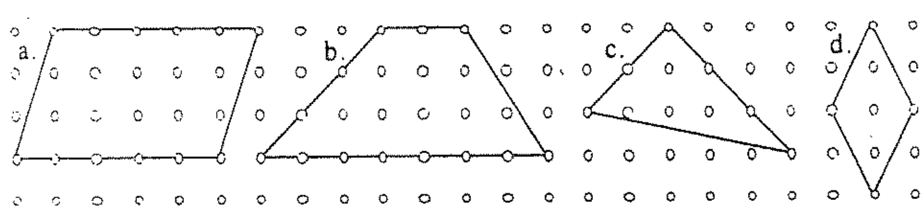
d. a rectangle, m cm by n cm



$x^2=m^2+n^2$

$x=\sqrt{m^2+n^2}$

8. Give the perimeter and area of each polygon. Use the natural units.



a) $A=15$
$P=10+2\sqrt{10}$

b) $A=13\frac{1}{2}$
$P=9+\sqrt{13}+\sqrt{18}$

c) $A=6$
$P=\sqrt{8}+\sqrt{18}+\sqrt{26}$

d) $A=4$ $P=4\sqrt{5}$

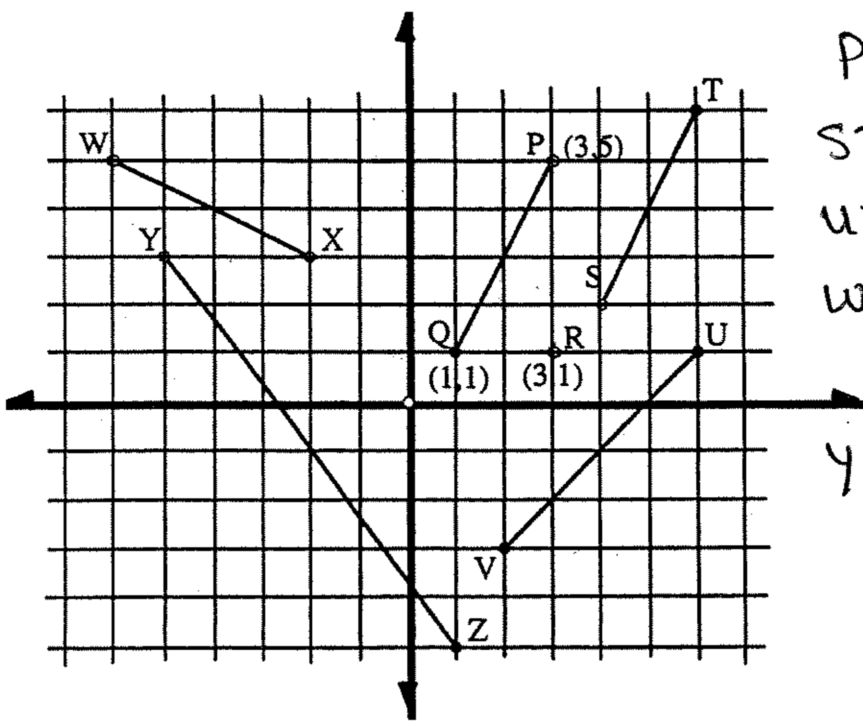
13. Triples of whole numbers like the earlier 3-4-5 and 5-12-13 are called **Pythagorean triples**. Which of these are Pythagorean triples?

a. 5, 6, and 7 no
b. 6, 8, and 10 yes
c. 9, 12, and 15 yes
d. 12, 16, and 20 yes
e. If x, y, and z give a Pythagorean triple, will kx, ky, and kz? yes
any multiple of a triple gives a triple
f. Use the idea in part e to generate 12 more Pythagorean triples.

14. a. Find the length of segment PQ on the coordinate system below.

b. Find the lengths of the other marked segments.

c. Give the coordinates of the lettered points. How can they be used to help find the lengths of the segments? For example, suppose you wanted to find the length of the segment joining the points with coordinates (50,30) and (43, 6)—can it be done without extending the graph?



$PQ = \sqrt{20}$
$ST = \sqrt{20}$
$UV = \sqrt{32}$
$WX = \sqrt{20}$

$YZ = \sqrt{100} = 10$