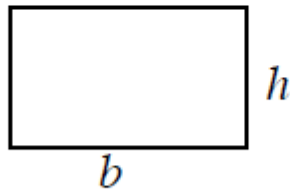## TOPIC 6: GEOMETRY

A. Formulas for perimeter *P* and area *A* of rectangles, squares, parallelograms, and triangles:

Rectangle with base *b* and altitude (height) *h*:

$P = 2b + 2h$
$A = bh$

h

b

If a wire is bent in this shape, the perimeter *P* is the length of the wire, and the area *A* is the number of square units enclosed by the wire.

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example: A rectangle with $b = 7$ and $h = 8$:
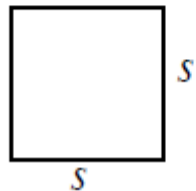
$P = 2b + 2h = 2 \bullet 7 + 2 \bullet 8 = 14 + 16 = 30$ units

$A = bh = 7 \bullet 8 = 56$ square units

A *square* is a rectangle with all sides equal, so the rectangle formulas apply (and simplify). If the side length is *s*:

$P = 4s$
$A = s^2$

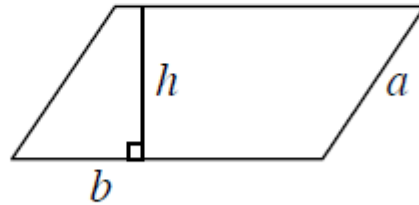s

s

example: A square with side $s = 11$cm has
$$P = 4s = 4 \times 11 = 44 \text{ cm}$$
$$A = s^2 = 11^2 = 121 \text{cm}^2 \text{ (sq. cm)}$$

A *parallelogram* with base b and height h and other side a:
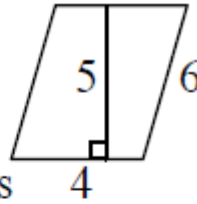
$A = bh$
$P = 2a + 2b$

example: A parallelogram has sides 4 and 6; 5 is the length of the altitude perpendicular to the side 4.
$$P = 2a + 2b = 2 \bullet 6 + 2 \bullet 4$$
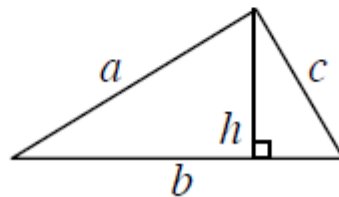$$= 12 + 8 = 20 \text{ units}$$
$$A = bh = 4 \bullet 5 = 20 \text{ square units}$$

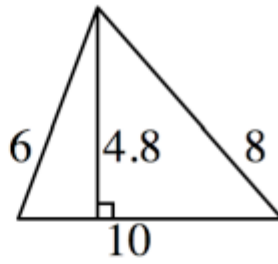In a *triangle* with side lengths a, b, and c, and altitude height h to side b:

$P = a + b + c$
$A = \frac{1}{2}bh = \frac{bh}{2}$

example:

$P = a + b + c$

$\quad = 6 + 8 + 10$

$\quad = 24 \text{ units}$

$A = \frac{1}{2}bh = \frac{1}{2}(10)(4.8) = 24 \text{ square units}$

Problems 1-8: Find P and A:

1. Rectangle with sides 5 and 10.

2. Rectangle with sides 1.5 and 4.

3. Square with sides 3 miles.

4. Square with sides $\frac{3}{4}$ yards.

5. Parallelogram with sides 36 and 24, and height 10 (on side 36).

6. Parallelogram, all sides 12, altitude 6.

7. Triangle with sides 5, 12, and 13. Side 5 is the altitude on side 12.
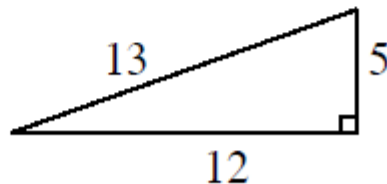
8. Triangle shown:
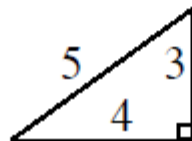
Answers

1. $30 \; units, \; 50 \; units^2$
   ($units^2$ means square units)
2. $11 \, units, \; 6 \, units^2$
3. $12 \; miles, \; 9 \; miles^2$
4. $3 \; yards, \; \frac{9}{16} \, yards^2$
5. $120 \; un., \; 360 \; un.^2$
6. $48 \; un., \; 72 \; un.^2$
7. $30 \; un., \; 30 \; un.^2$
8. $12 \; un., \; 6 \; un.^2$

B. Formulas for circumference C and area A of a circle:

A circle with radius r
(and diameter $d = 2r$)
has a distance around
(circumference) $C = \pi d = 2\pi r$ (If a piece of
wire is bent into a circular shape, the
circumference is the length of the wire.)
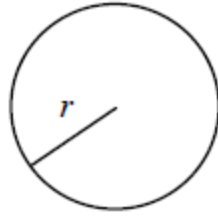
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example: A circle with radius $r = 70$ has
  $d = 2r = 140$ and exact circumference
  $C = 2\pi r = 2 \bullet \pi \bullet 70 = 140\pi$ units

If π is approximated by $\frac{22}{7}$,

$C = 140\pi \approx 140\left(\frac{22}{7}\right) \approx 440$ units (approx.)

If π is approximated by 3.1,

$C \approx 140(3.1) = 434$ units

The area of a circle is $A = \pi r^2$

example: If $r = 8$, exact area is
  $A = \pi r^2 = \pi \bullet 8^2 = 64\pi$ square units

Problems 9-11: Find the exact C and A for a
circle with:

9. radius $r = 5$ units

10. $r = 10$ feet

11. diameter $d = 4$km

Answers

9. $10\pi\, un.,\ 25\pi\, un.^2$

10. $20\pi\, ft.,\ 100\pi\, ft.^2$

11. $4\pi\, km,\ 4\pi\, km^2$

Problems 12-14: A circle has area 49π:

12. What is its radius length?
13. What is the diameter?
14. Find its circumference.

Problems 15-16: A parallelogram has area 48 and two sides each of length 12:

15. How long is the altitude to those sides?

16. How long are each of the other two sides?

17. How many times the P and A of a 3cm square are the P and A of a square with sides all 6 cm?

18. A rectangle has area 24 and one side 6. Find the perimeter.

Problems 19-20: A square has perimeter 30:

19. How long is each side?

20. What is its area?

21. A triangle has base and height each 7. What is its area?

Answers

12. 7
13. 14
14. 14π
15. 4
16. Cannot tell
17. *P* is 2 times, *A* is 4 times
18. 20
19. $7\frac{1}{2}$
20. $\frac{225}{4}$
21. $24\frac{1}{2}$