

$$P = Sn$$

Perimeter of regular polygons

Lesson 42

1. Complete the table by giving the name of each regular polygon.

Name	hex	Pent	Oct.	hept.	Dec.
Side Length	9.3cm	5.6cm	13.5cm	4.7cm	0.081cm
Perimeter	55.8cm	28cm	108cm	32.9cm	97.2cm

2. Complete the table.

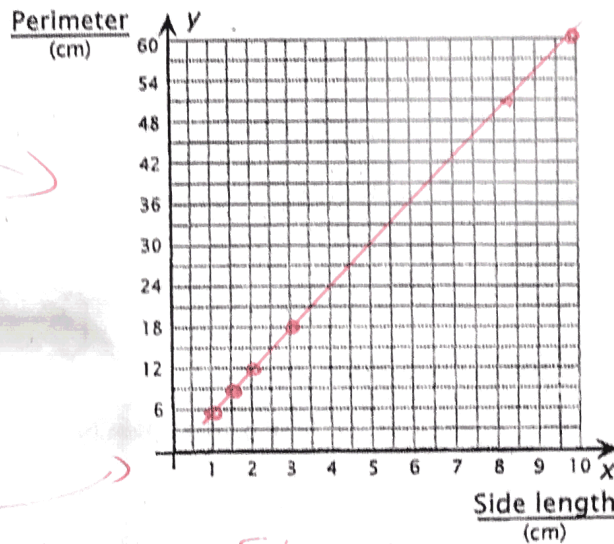
	Square	Pentagon	Hexagon	Octagon	Decagon
Side Length (cm)	7.5	4.3	13.7	9.8	8.26
Perimeter (cm)	$30 \div 4$	21.5	82.2	$78.4 \div 8$	82.6

3.

a) Complete the table (the values given are for regular hexagons)

Side Length (cm)	1	1.5	2	3	8.4	10
Perimeter (cm)	6	9	12	18	50.4	60

b) Draw the graph of this situation on the grid.



c) Is this a proportional situation?

No (0,0)

origin.

Draw line

yes!!

4. A regular pentagon has a perimeter of 36.5cm.

$$36.5 \div 5 = S.L. 7.3$$

a) Find the perimeter of a regular decagon with the same side length.

$$7.3 \times 10 = 73$$

b) Give the ratio: decagon perimeter/pentagon perimeter.

$$73 : 36.5$$

2 : 1 Ratio

5. An equilateral triangle has a perimeter of 18cm. $\div 3 = 6$

a) Determine the side length of a regular octagon with the same perimeter.

~~$18 \div 8 = 2.25$~~ $18 \div 8 = 2.25$

b) Determine the perimeter of a square whose sides are twice the length of the sides of the triangle.

$12 \times 4 = 48$

6. A regular heptagon has a perimeter of 84cm. Find the side length.

$84 \div 7 = 12$

7. The traffic signs indicating a turn are shaped like squares. Some have 61cm sides, and other have 91.5cm sides.

a) Calculate the perimeter of each type of sign.

$61 \times 4 = 244$ $91.5 \times 4 = 366$

b) What is the ratio of these perimeters?

$244 : 366 = 2 : 3$ $366 : 244 = 3 : 2$

c) Is the ratio of the perimeters equal to the ratio of sides?

yes

8. Julie spent \$102 fencing in her garden which is shaped like a regular octagon. The fence costs \$4.25 a metre. Determine the length of one side of her garden.



102\$
for all
8 sides

$102 \div 8 = 12.75$
\$12.75 per side

$\$12.75 \div \$4.25 = 3$

3m

9. The Canadian dollar (the famous loony) is shaped like a regular hendecagon (11 sides) with each side measuring approximately 7mm.

a) Determine the perimeter of a \$1 coin?



$11 \times 7 = 77$ mm

b) To the nearest unit, give the measure of an interior angle of such a polygon

$\frac{(11-2) \times 180}{11} = 147^\circ$

10. Calculate the perimeter of a regular hexagon with 6.5cm sides.

$6.5 \times 6 = 39$

39

Lesson 42

11. True or false?

- a) Two regular polygons with the same number of sides will always have proportional sides.
- b) A regular pentagon and its image are associated by a similarity transformation with ratio 3. The ratio of perimeters is therefore 15.
- c) When the length of the sides of a regular polygon are reduced by 20%, its perimeter is also reduced by 20%.

T
F
T

12. What is the side length of a regular octagon with a perimeter of 70cm?

$$P = Sn$$

$$70 = ?(8)$$

$$70 \div 8$$

8.75

13. Write an expression for the perimeter of each regular hexagon for the side length given by the following algebraic expressions.

a) r units: $6r$

c) $(2y - 5)$ units: $12y - 30$

b) $3v$ units: $18v$

d) $(x + 4)$ units: $6x + 24$

14. A regular pentagon has a perimeter of 43 cm. what would its perimeter be if its side lengths were doubled?

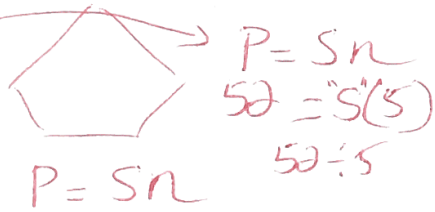
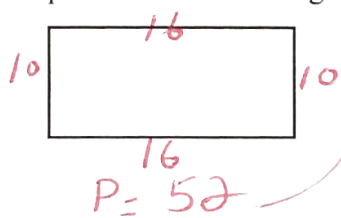
$$n = 5$$

$$P = 43$$

$$SL = 8.6 \times 2$$

$$17.2 \times 5 = 86$$

15. A rectangle has a 16cm base and a 10cm height. Give the side length of a regular pentagon with the same perimeter as this rectangle.



10.4

16. A regular decagon with a 70cm perimeter is linked to another regular decagon by a similarity transformation centred at O and with a ratio of 0.4. What is the side length of the image decagon?

$$P = 70$$

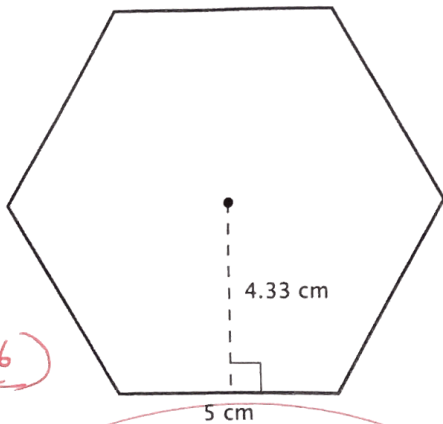
$$n = 10$$

$$SL = ??$$

$$7 \rightarrow \times 0.4 = 2.8 \text{ cm}$$

1. Calculate the area

a)



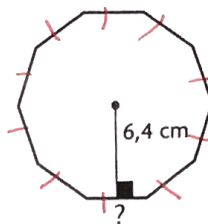
$$A = \frac{San}{2}$$

$$A = \frac{5(4.33)(6)}{2}$$

Area: 64.95 cm²

b)

The area of the regular polygon is 66.56 cm².



$$A = \frac{San}{2}$$

$$66.56 = \frac{S(6.4)(n)}{2}$$

$$66.56 = \frac{32 \cdot 6.4 \cdot S}{2}$$

Answer:

Side = 2.08 cm

2) Find the length of the apothem for a regular pentagon with 4 cm sides and an area of 27.5 cm².

$$A = \frac{San}{2}$$

$$27.5 = \frac{(4)(a)(5)}{2}$$

a = 2.75 cm

$$27.5 = 10a$$

$$a = 2.75$$

3) A regular polygon with 5 cm sides and an apothem of 6.04 cm has an area of 120.8 cm². Which regular polygon is it?

$$A = \frac{San}{2}$$

$$120.8 = \frac{(5)(6.04)(n)}{2}$$

$$n = 8$$

$$120.8 = 15.1n$$

Octagon

4) Complete the following table.

Name of the regular polygon	Number of sides	Measure of one side (cm)	Measure of the apothem (cm)	Perimeter of the polygon (cm)	Area of the polygon (cm ²)
Pentagon	5	6	4.1	6(5) = 30	61.5
Octagon	8	9	10.9	8(9) = 72	392.4
hept.	7	8	8.3	7(8) = 56	232.4
un dec decagon sher	11	4	6.8	11(4) = 44	149.6

5 Semi-circles are constructed on each side of a regular pentagon. The perimeter of the pentagon is 20 cm. What is the area of the shaded sections?

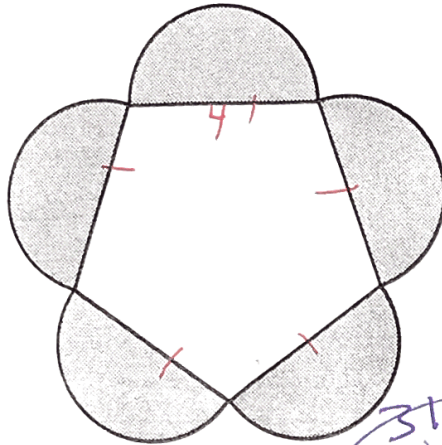
$P = 20$
 $P = \frac{20}{5} = 4 \text{ S.L.}$

$S.L. = 4 = D = 4$
 $r = 2$

$A = \pi r^2$
 $A = \pi a^2$

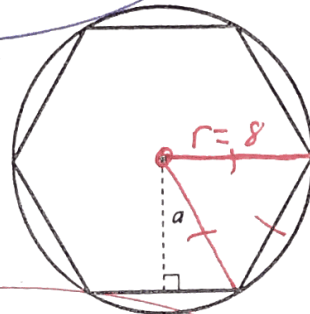
$A = 12.57 \text{ cm}^2 \times 2.5 = 31.43$

Use $\pi \approx 3.14$



6 A hexagon is inscribed in a circle. If the radius of the circle is 8 cm, and the area of the hexagon is 166.32 cm², determine the length of the apothem.

$A = \frac{S \cdot a}{2}$ $166.32 = \frac{(8)(a)(6)}{2}$
 $166.32 = \frac{24a}{2}$



$a = 6.93 \text{ cm}$

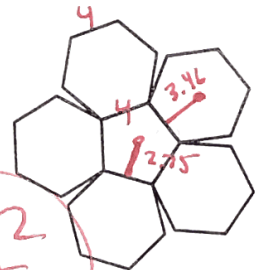
7 In the figure below, all the polygons are regular and all the hexagons are congruent. The measure of one side of one hexagon is 4 cm and the apothem measures 3.46 cm. The measure of the apothem of the pentagon is 2.75 cm. What is the difference between the area of one hexagon and the area of one pentagon? Express your answer in square metres.

$\frac{S \cdot a}{2} - \frac{S \cdot a}{2}$
 $\frac{(4)(3.46)(6)}{2} - \frac{(4)(2.75)(5)}{2}$

$41.52 - 27.5$
 14.02

Answer:

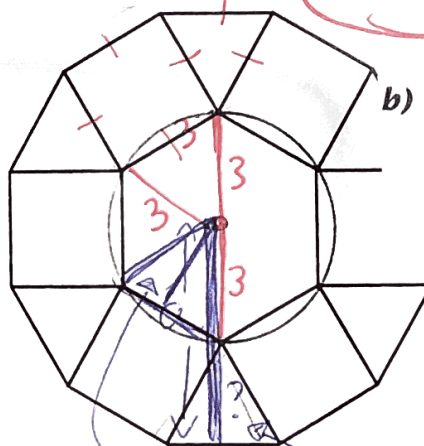
14.02 m^2



8 Squares and equilateral triangles have been placed around the edges of a regular hexagon to form a regular dodecagon.

a) The regular hexagon is inscribed in a circle with a diameter of 6 cm. Determine the perimeter of the regular dodecagon.

$n = 3$
 $P = 3n$
 $P = 3(12)$
 $P = 36$



b) The area of the hexagon is 23.4. Calculate the area of the regular dodecagon.

$A = \frac{S \cdot a}{2}$
 $23.4 = \frac{(3)(a)(6)}{2}$
 $23.4 = 9a$
 $a = 2.6$

$A = \frac{S \cdot a}{2}$
 $A = \frac{(3)(12)(2.6)}{2}$

100.8
 46.8