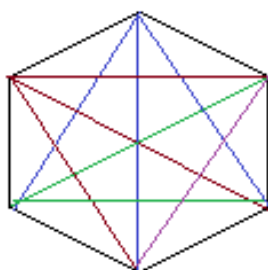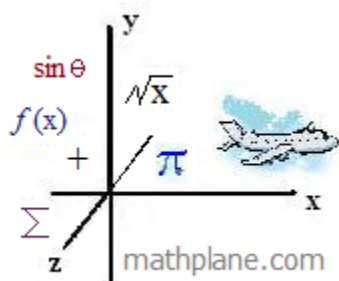# Polygons

Definitions, notes, examples, and practice test (w/solutions)

Including concave/convex, exterior/interior angle sums, diagonals, n-gon names, and more…

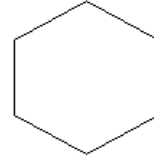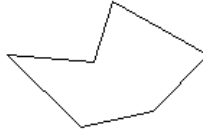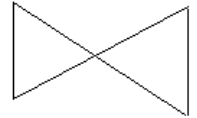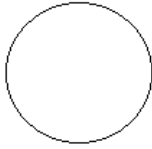Polygons

What is a *polygon*?

A closed figure in a plane where all the sides are line segments.

Polygons:

NOT polygons:

The number of sides determines the name of the polygon.

3 sides: triangle
4 sides: quadrilateral
5 sides: pentagon
6 sides: hexagon
7 sides: heptagon (or septagon) n-gon has n number of sides
8 sides: octogon
9 sides: nonagon
10 sides: decagon   example: a 25-gon polygon has 25 sides
11 sides: undecagon
12 sides: dodecagon

If all the sides (and angles) are congruent, the polygon is a *regular polygon*.
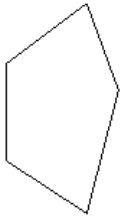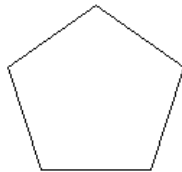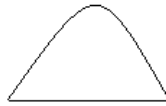
Pentagon   Regular Pentagon

Polygons

Concave vs. Convex

A convex figure has no indentations, or if every line segment connecting every point is inside the figure.
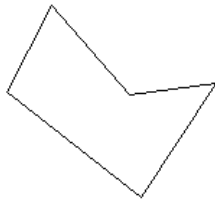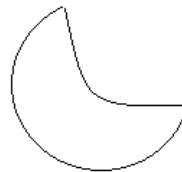
Convex polygon   Convex shape

A concave figure has dents. One or more of the parts is "caved in". Therefore, there is at least one line segment connecting points that lies outside the figure!

Concave pentagon   Concave shape
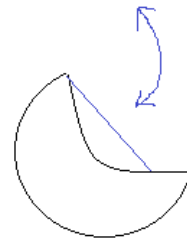
Concave and Convex Polygons: working with vertices and diagonals

What is a vertex?   A corner point of a polygon

What is a side? A line segment connecting 2 consecutive vertices.

What is a diagonal? A line segment that connects 2 non-consecutive vertices

NOTE: all the diagonals in a convex polygon are inside the figure
         but, in a concave polygon, at least one of the diagonals goes outside the figure!

Polygons

Interior and Exterior Angle measures

interior
angle

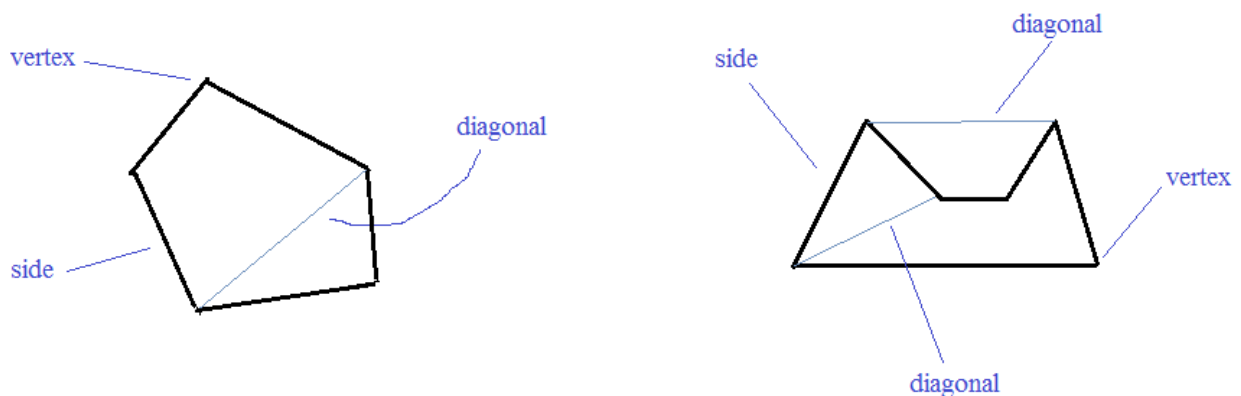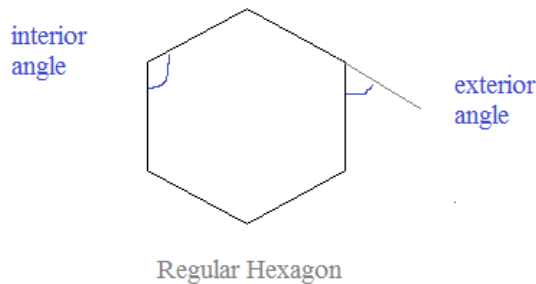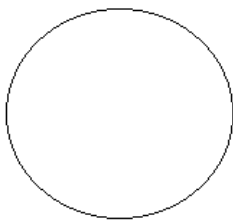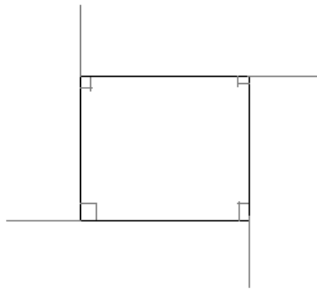exterior
angle

Regular Hexagon

Finding the sum of the exterior angles:

360 degrees in a circle

Each exterior angle of a
square is 90 degrees.
The sum: 360 degrees
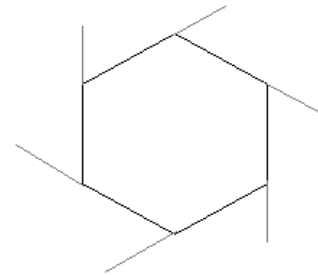
In fact, the sum of the exterior angles of
any polygon is 360 degrees!

Question: what is the measure of an exterior angle of a <u>regular</u> hexagon?

Answer: since a regular hexagon has 6 equal sides, it has 6 congruent exterior angles.
Since the sum of the angles is 360, each angle is 60 degrees.

Question: what is the measure of an exterior angle of a non-regular pentagon?

Answer: it depends on the measure of the other 4 angles! Nevertheless, all 5 of the exterior
angles must add up to 360 degrees.

Example:

60

x

93

90

70
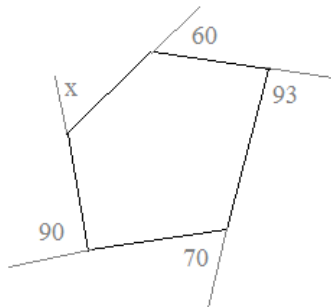
$$x + 60 + 93 + 70 + 90 = 360$$

$$x + 313 = 360$$

$$x = 47 \text{ degrees}$$

polygons

Finding the sum of the <u>interior</u> angles of a polygon:

The sum of the interior angles of a triangle is 180 degrees
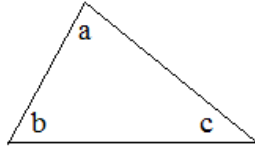
$$a° + b° + c° = 180°$$

For any polygon, the sum of the interior angles is $(n-2)$ x 180

where n is the number of sides

Why? Because, polygons can be cut into triangles.

Examples:
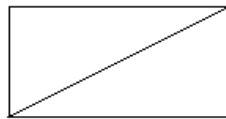
n = 4 (sides)

$(n-2) \longrightarrow$ 2 triangles

$(n-2)$ x $180° = 360°$

Interior angles of a quadrilateral add up to 360 degrees...
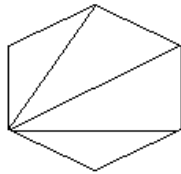
n = 6 (sides)

$(n-2) \longrightarrow$ 4 triangles

$(n-2)$ x $180° = 720°$

The sum of the interior angles of a hexagon is 720 degrees.

Therefore, for any *regular polygon,* <u>each</u> interior angle is

$$\frac{(n-2) \text{ x } 180°}{n}$$

Example:

n = 5
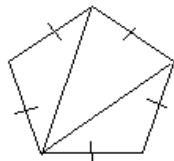
$(n-2)$ x $180° = 540°$

then, $\dfrac{180(n-2)}{n} = 108°$

Each interior angle of a *regular* pentagon is 108 degrees.

Example:

35

110

115

40

X

80

What is the measure of X?

Using supplementary angles, we can add all the exterior angles....

$35 + 70 + 40 + 80 + x + 65 = 360$

$x + 290 = 360$

$x = 70$

35

110   70

65

115

40

X

80
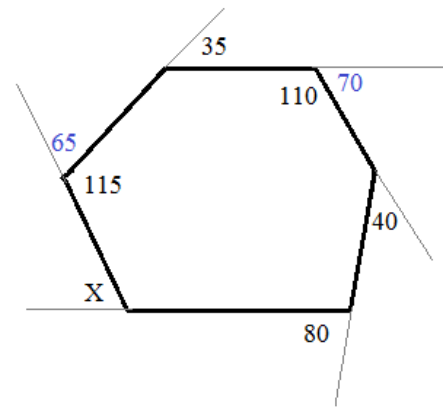
Example: What is the measure of <u>each interior angle</u> of a regular 18-gon?

method 1: Using the formula

$$\text{measure of interior angle of an n-gon} = \frac{180^\circ (n-2)}{n}$$

$$\text{measure in 18-gon} = \frac{180^\circ (18-2)}{18}$$

$$= \frac{2880^\circ}{18} = 160^\circ$$

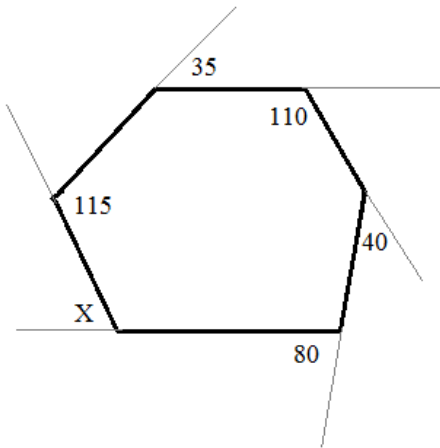method 2: Find "supplement of the exterior angle"

$$\text{measure of exterior angle of an n-gon} = \frac{360^\circ}{n}$$

$$\text{exterior angle measure in 18-gon} = \frac{360^\circ}{18} = 20^\circ$$

since each exterior angle is 20 degrees, each interior angle is 160 degrees!

interior
160°

20°
exterior
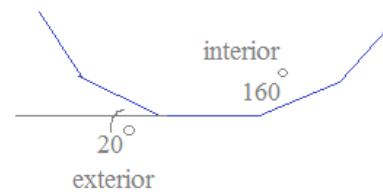
Assume all the figures are *regular* polygons.

Find the angle measures.

a) _____

b) _____

c) _____

d) _____

e) _____

f) _____

g) _____

h) _____

i) _____
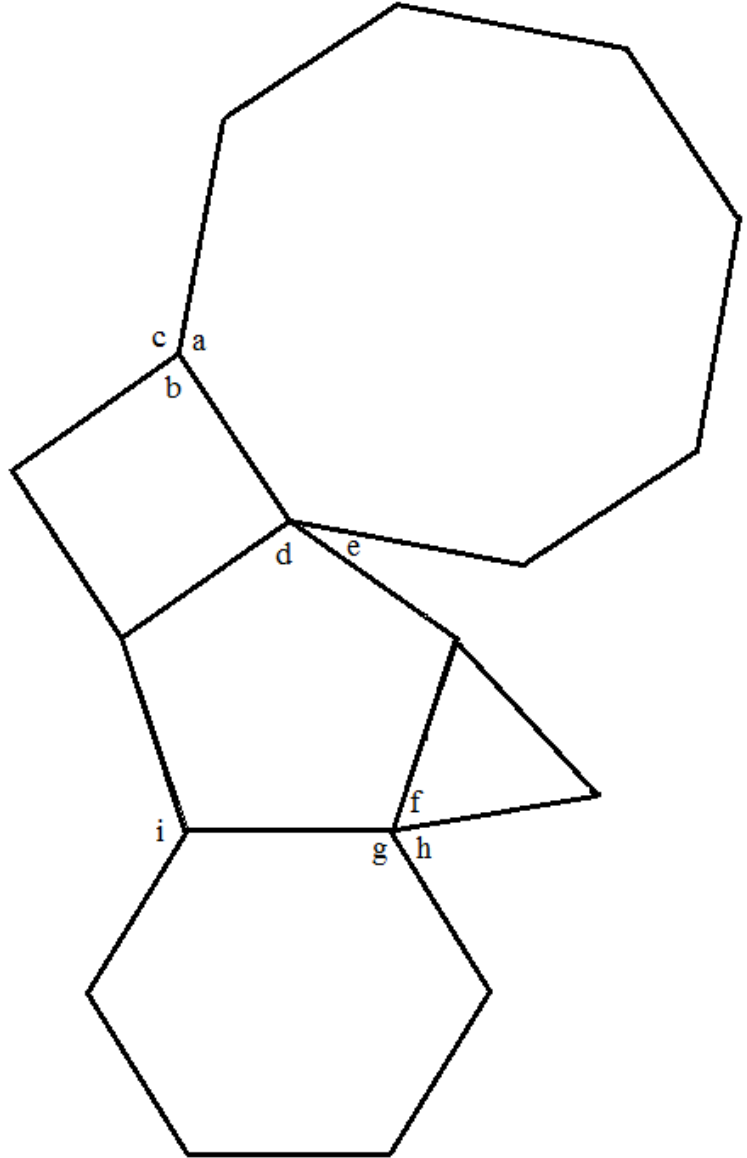
Assume all the figures are *regular* polygons.

Find the angle measures.

SOLUTIONS

a) 135

b) 90

c) 135

d) 108

e) 27

f) 60

g) 120

h) 72

i) 132

To find the 'letter' angles, we first determine the measure of each interior angle...

triangle: 60

square: 90

pentagon: 108

hexagon: 120

octagon: 135

Then, we recognize that each "cluster" must have angle measures add up to 360 degrees!

135 360
c a 135
b
90

90 135
d e 27
108

360 132 108 108 f 60
i g h 72
120 120

For regular polygons with n sides:

exterior angle = $\frac{360}{n}$

interior angle = $\frac{180(n-2)}{n}$

interior angle = $180 - \left(\frac{360}{n}\right)$

What is a diagonal?

A line segment that joins 2 non-adjacent vertices of a polynomial.
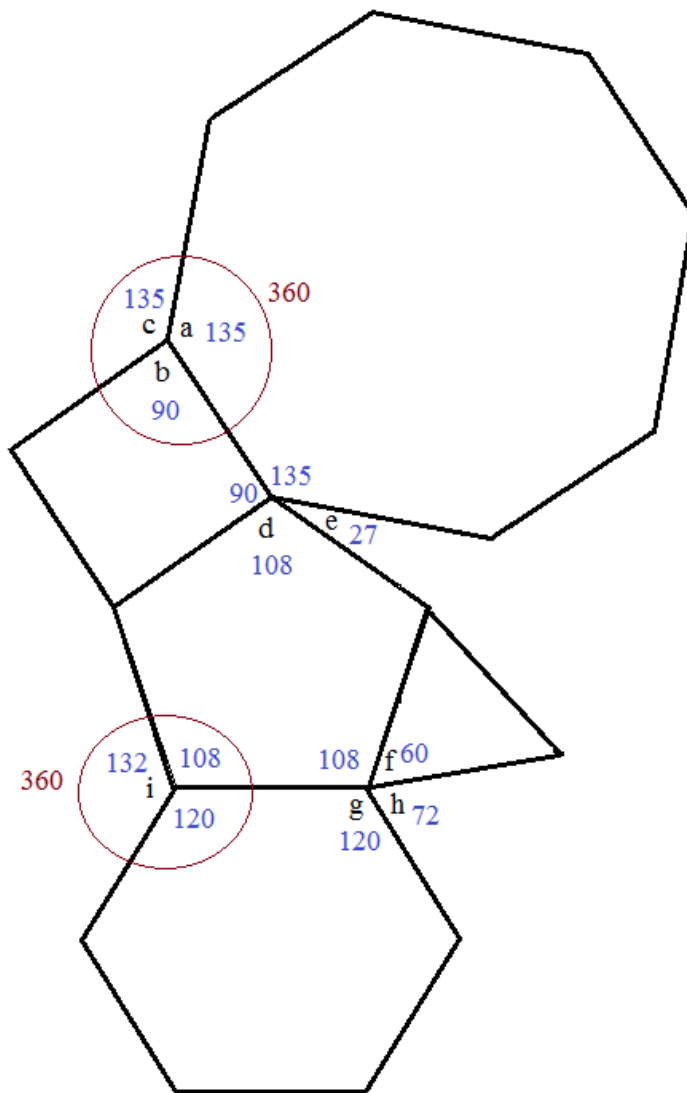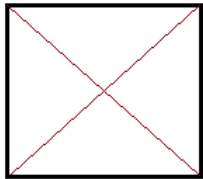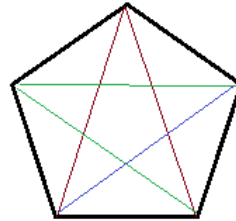
How many diagonals are in a polygon? $\dfrac{n(n-3)}{2}$ = number of diagonals in n-gon

Square: 4 sides
2 diagonals

Pentagon: 5 sides
5 diagonals
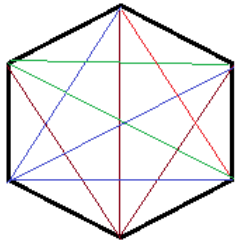
Hexagon: 6 sides
9 diagonals
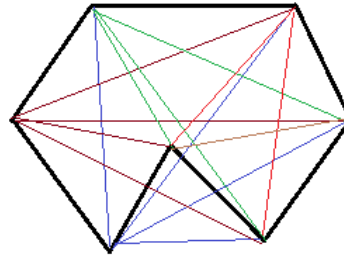
(convex)
Heptagon: 7 sides

14 diagonals
(some go outside the figure)

Octagon: 8 sides

How many diagonals?

?

answer: n = 8 sides

# of diagonals = $\dfrac{8(8-3)}{2}$

= 20 diagonals

Formula Explanation:

You can draw a line segment to every other vertex except 3: the 2 adjacent vertices and itself....

$$(n-3)$$

And, there are n vertices in an n-sided polygon..

$$n(n-3)$$

Then, to eliminate the overlap (i.e. double counting: a segment from A to B is identical to a segment from vertex B to vertex A), divide the total in half!

$$\dfrac{n(n-3)}{2} = \text{number of diagonals in n-gon}$$

PRACTICE QUIZ (with SOLUTIONS)

Polygons Quiz
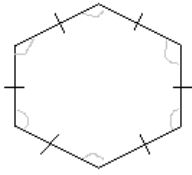
I. Classifying Polygons

Match the figure with its description:

1)

2)
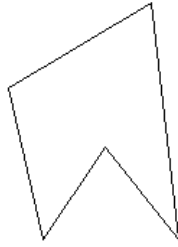
3)
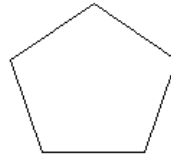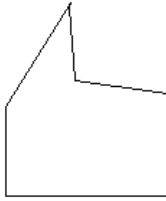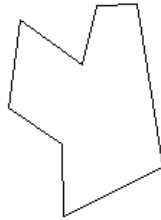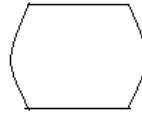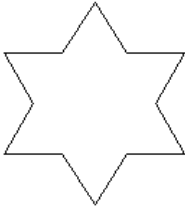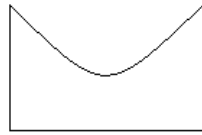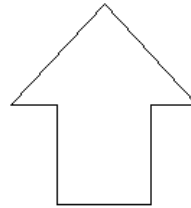
a) regular pentagon

b) concave pentagon

c) regular hexagon

d) convex pentagon

4)

5)

6)

e) non-polygon

f) concave octagon

g) convex octagon

h) hexagon

i) quadrilateral

7)

8)

9)

j) dodecagon

k) heptagon

II. Polygon Parts

1) Draw the diagonals in the polygons

a)
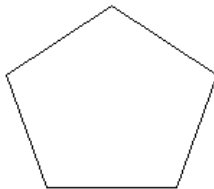
b)
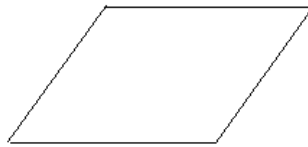
c)
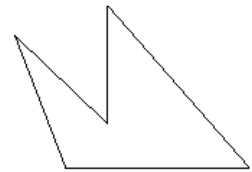
2) How many vertices are in a nonagon?

3) How many diagonals are in a triangle?

III. Interior and Exterior Angles

Determine the variables:

1) Given: A regular pentagon

2) Given: Degree measures of interior angles

115   160   4a

3a

100

93
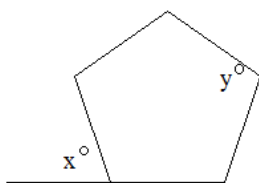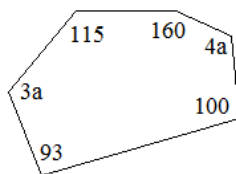
3) Given: Degree measures of exterior angles
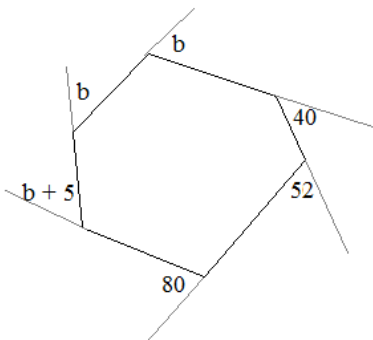
4) Given: The polygram as shown

b

b

40

b + 5

52

80

A

w°

F

B

E

z°

C

D

$\angle B \cong \angle C \cong \angle E \cong \angle F$

$\angle A \cong \angle D$
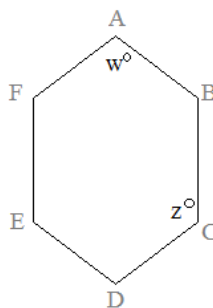
Angle A is 15 degrees less than angle B

IV. Miscellaneous

1) In a regular octagon, what is the measure of an interior angle? Exterior angle?

2) What is the sum of the interior angles of a 18-gon (polygon)?

3) An interior angle of an n-sided regular polygon is 144 degrees. How many sides are there? (i.e. what is n?)

Challenge: How many diagonals are in a convex octagon?
How many diagonals are in a regular 20-gon?
How many diagonals exist for a given polygon?

V. Extra math topics

1) A decagon contains 7 angles that total 1220.
   Of the 3 remaining angles, exactly 2 are supplementary and exactly 2 are complementary.
   What are the 3 angles?

2) In an equiangular polygon, each *exterior* angle is 25% of the measure of each *interior* angle.
   What is the name of the polygon?

3) Identify the coordinates of each vertex in the following regular polygons:
   (contains topics beyond basic geometry)
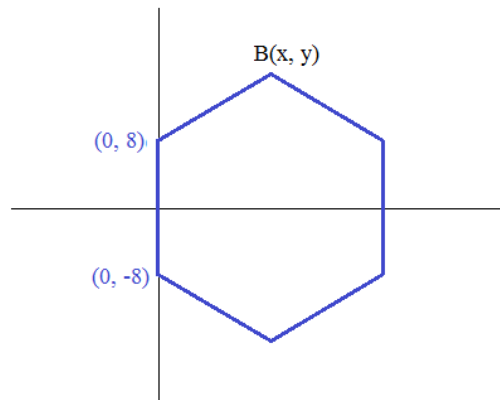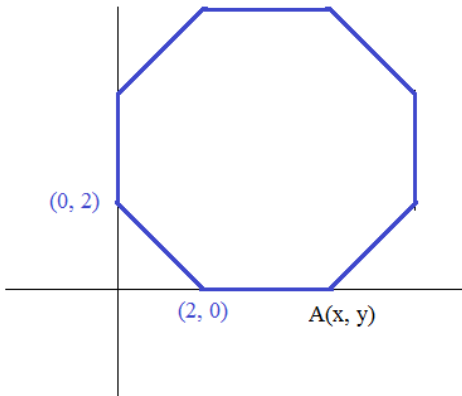
4) Is the figure ABCDEF a polygon? Explain.
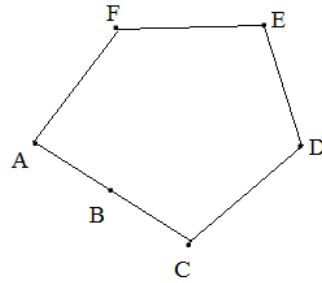
5) The sum of 5 angles inside an "octagon" is 400 degrees.
   What can you conclude about this figure?

6) Find the angles formed by

   a) 2 consecutive radii

   b) the radius and adjoining side

       in a regular   1) pentagon

                         a)

                         b)

            2) hexagon

                         a)

                         b)

            3) octagon

                         a)

                         b)

            4) decagon

                         a)

                         b)

7) The sum of the measures of the interior angles of a regular polygon is 5040.
   How many sides in this polygon?

8) True or False

   a) A regular polygon is equilateral

   b) An equilateral polygon is regular.

   c) When the midpoints of each side of a rhombus are consecutively joined,
      the figure is a rhombus.

   d) A scalene quadrilateral can have 2 congruent angles.

9) ABCDE is a regular semi-hexagon

   If $\angle C = 2x + 3y + 10$ Find x and y.

   $\angle CDB = x - 3y + 20$
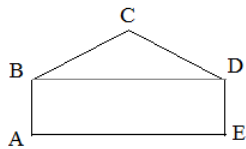
10) ***Challenge: What is the sum of the angle measures A, B, C, D, and E?
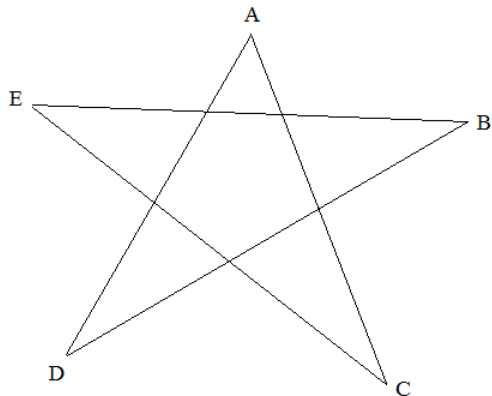
11) Assume the polygon is a regular octagon.
   Find the numbered angles:
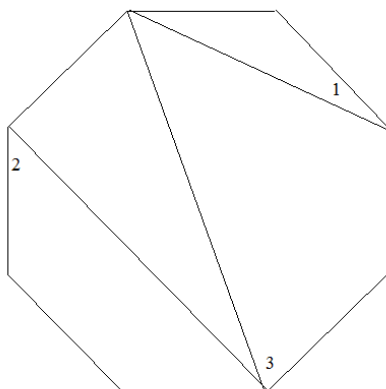
12) What is the perimeter of a regular octagon if the <u>longest</u> diagonal is 10 inches? if the <u>shortest</u> diagonal is 10 inches?
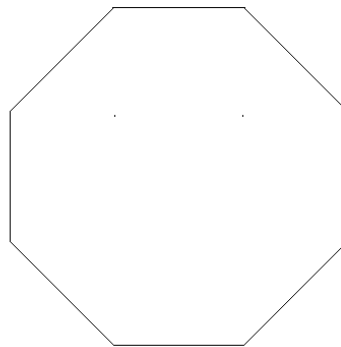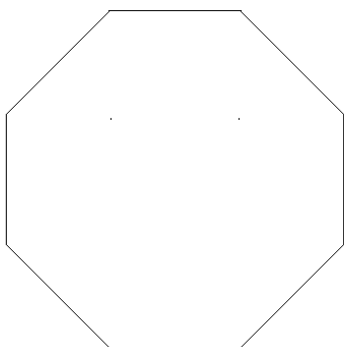
13) A, B, C are consecutive vertices on a (convex) 16 n-gon...

   How many diagonals in the 16 n-gon will contain A, B, or C?

14) Symmetric pencils with tips that form a 20-degree angle are
   aligned in the following manner...
   How many pencils can be constructed?

   Suppose the pencil tips had a 6-degree angle at the tip?

Assume all the figures are *regular* polygons.
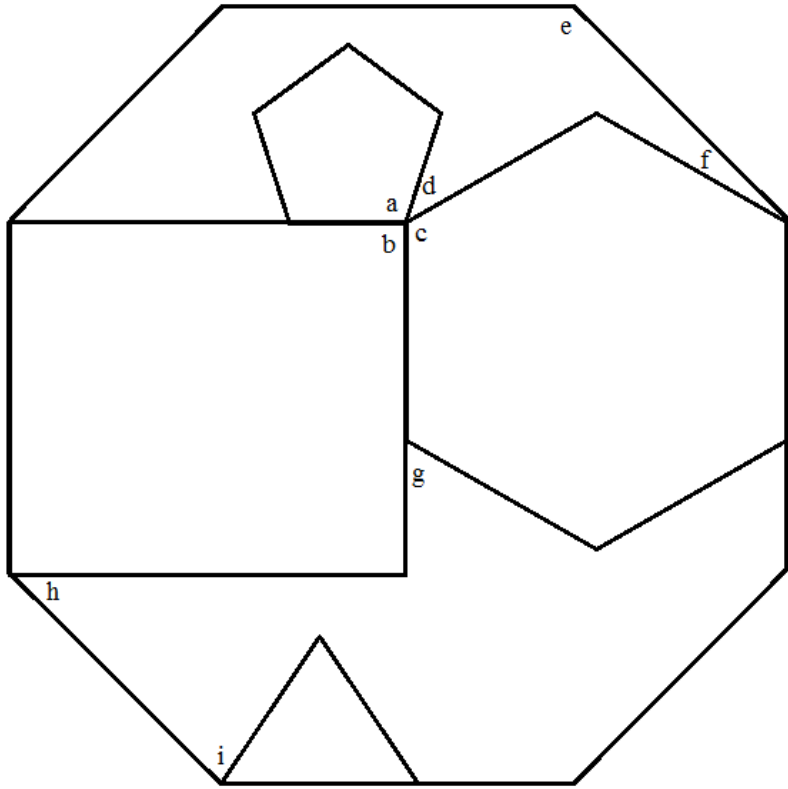
Find the angle measures.

a) _____

b) _____

c) _____

d) _____

e) _____

f) _____

g) _____

h) _____

i) _____

mathplane.com

1) The measure of one interior angle in a regular polygon is 172 degrees.
   How many diagonals does the polygon have?

2) If the sum of the interior angles of a polygon is 1260 degrees,
   then how many diagonals does it have?

3) If a regular polygon has 65 diagonals, what is the measure of
   each exterior angle?

4) If the sum of the interior angles of a regular polygon is 5580 degrees,
   then what is the measure of each interior angle?

5) If 90 diagonals can be drawn in a regular polygon, then
   what is the measure of each interior angle?
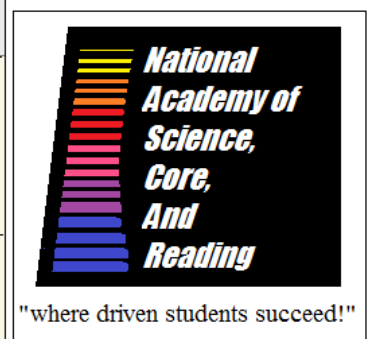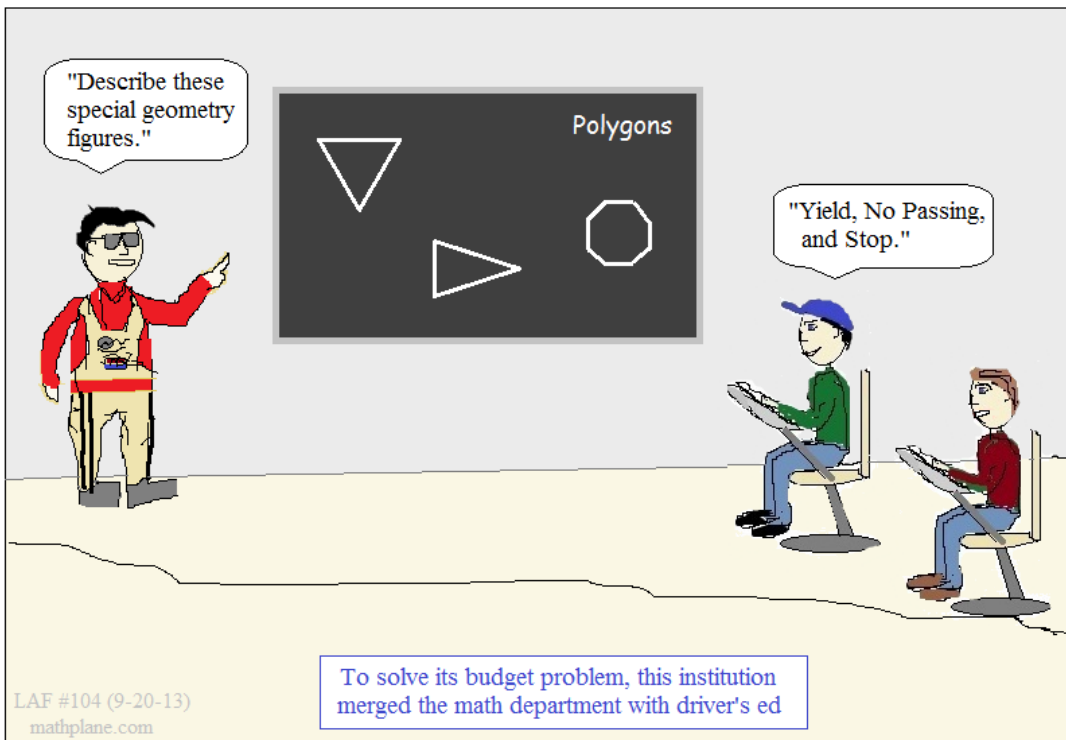
Solutions-→

Polygons Quiz

I. Classifying Polygons

Match the figure with its description:

1)
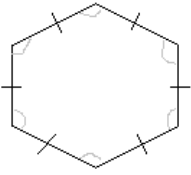
c) regular hexagon

2)

b) concave pentagon
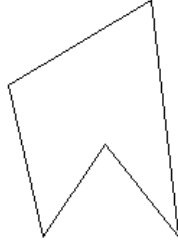
3)

d) convex pentagon
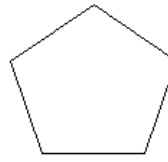
(if the sides/ angles were congruent, then it is regular as well...)

a) regular pentagon

b) concave pentagon

c) regular hexagon

d) convex pentagon

e) non-polygon

f) concave octagon

g) convex octagon

h) hexagon

i) quadrilateral

j) dodecagon

k) heptagon

4)
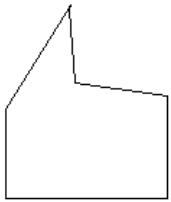
h) hexagon (concave)

5)
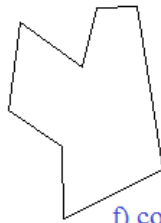
f) concave octagon (8-sides)

6)
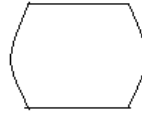
e) non-polygon
(not all sides are line segments)

7)
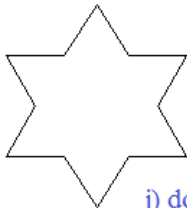
j) dodecagon (12-sided polygon)

8)
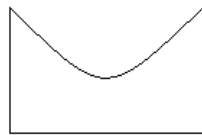
e) non-polygon

9)
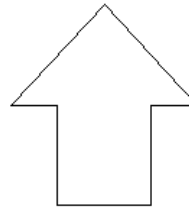
k) heptagon (7-sided)

II. Polygon Parts

1) Draw the diagonals in the polygons

a)
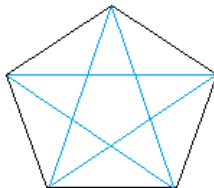
5 total diagonals

b)
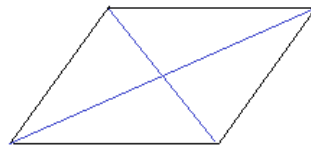
c)
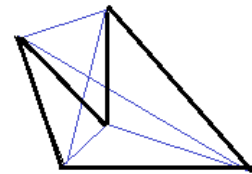
(pentagon: 5 total diagonals)

2) How many vertices are in a nonagon?   A nonagon has 9 sides, so it has 9 vertices

3) How many diagonals are in a triangle?   A triangle has ZERO diagonals
(because there are no 'non-consecutive' sides)

III. Interior and Exterior Angles

Polygons Quiz

Determine the variables:

1) Given: A regular pentagon

$\dfrac{360}{5} = 72$

x = 72

y = 108

$x°$ \ 108

supplementary angles

$y°$

2) Given: Degree measures of interior angles

115   160   4a

3a

100

93
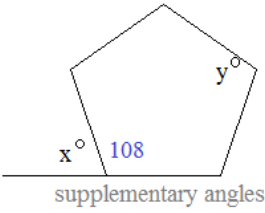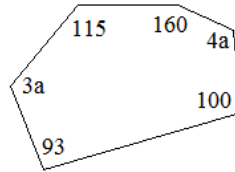
6 sides, so the sum of interior angles is

(6 - 2) x 180 = 720 degrees

3a + 4a + 115 + 160 + 100 + 93 = 720

7a = 252

a = 36

3) Given: Degree measures of exterior angles

exterior angles must add up to 360

b

b

40

b + 5

52

80
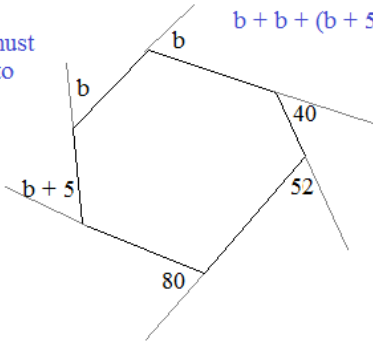
b + b + (b + 5) + 40 + 52 + 80 = 360

3b + 177 = 360

3b = 183

b = 61

4) Given: The polygram as shown

A

$w°$

F   z   z   B

E   z $z°$ C

w

D

$\angle B \cong \angle C \cong \angle E \cong \angle F$

$\angle A \cong \angle D$
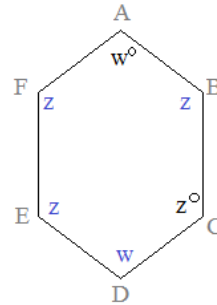
Angle A is 15 degrees less than angle B

Sum of interior angles is 720

2w + 4z = 720

w + 15 = z

using substitution:

2w + 4(w + 15) = 720

6w + 60 = 720

6w = 660

w = 110   z = 125

IV. Miscellaneous

1) In a regular octagon, what is the measure of an interior angle? Exterior angle?

the sum of exterior angles is 360...
therefore, each exterior angle is 360/8 = 45 degrees

then, each interior angle is supplementary:
180 - 45 = 135 degrees

2) What is the <u>sum</u> of the interior angles of a 18-gon (polygon)?

n = 18 sides   sum of interior angles = (n - 2) x 180 = (18 - 2) x 180 = 2880 degrees

3) An interior angle of an *n*-sided regular polygon is 144 degrees. How many sides are there? (i.e. what is *n*?)

If the interior angle of a regular polygon is 144 degrees, then each exterior angle is 36 degrees..
360/36 degrees -----> 10 sided figure....

OR, $\dfrac{(n - 2) \times 180}{n} = 144$

144n = 180(n - 2)
144n = 180n - 360
-36n = -360
n = 10

NOTE: each interior and exterior angle are supplementary

Challenge: How many diagonals are in a convex octagon?
How many diagonals are in a regular 20-gon?
How many diagonals exist for a given polygon?

Find a pattern:

3 sides: 0 diagonals
4 sides: 2 diagonals
5 sides: 5 diagonals
6 sides: 9 diagonals
7 sides: 14 diagonals

From each vertex, there are n - 3 non-consecutive vertices...

So, for octagon there are 5 available vertices for each vertex... 5 x 8 = 40 total diagonals..
THEN, divide by two to avoid 'double counting'..
20 diagonals...

Again, 20 sides implies 17 diagonals for each vertex...
340 total diagonals..
then, divide by 2 to discount 'double counting'.
340/2 = 170 diagonals...

# of diagonals = $\dfrac{(n - 3)n}{2}$

1) A decagon contains 7 angles that total 1220.

Of the 3 remaining angles, exactly 2 are supplementary and exactly 2 are complementary.
What are the 3 angles?

Let x, y, and z be the 3 angles:

sum of interior angles of decagon

1440

1440 - 1220 = 220

2 angles are complementary

2 angles are supplementary

$x + y + z = 220$

$x + y = 90$

$y + z = 180$

(solve using substitution)

$x = 90 - y$

$z = 180 - y$

$(90 - y) + y + (180 - y) = 220$

$270 - y = 220$

$y = 50$

since y = 50,

$x = 40,$

and $z = 130$

2) In an equiangular polygon, each *exterior* angle is 25% of the measure of each *interior* angle.
What is the name of the polygon?

Method A: Use the formulas

Exterior Angle $= \dfrac{360}{n}$

Interior Angle
(regular polygon) $= \dfrac{(n-2)180}{n}$

$\dfrac{360}{n} = .25\left(\dfrac{(n-2)180}{n}\right)$

$\dfrac{360}{n} = \dfrac{.25\,(180n - 360)}{n}$

$360 = 45n - 90$

$n = 10$

Decagon

Method B: Recognize exterior/interior angles are supplementary

$x + .25x = 180$

$1.25x = 180$

$x = 144$

and, $.25x = 36$
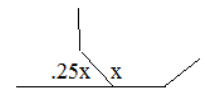
Since the exterior angle is 36, the polygon is 10-sided

3) Identify the coordinates of each vertex in the following regular polygons:
(contains topics beyond basic geometry)
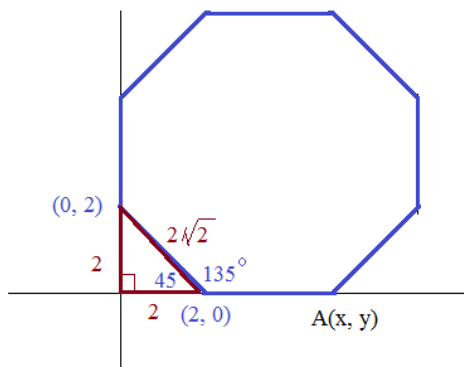
The exterior angles of a regular octagon: 360/8 = 45 degrees
The interior angles are 135 degrees...

Note: a 45-45-90 right triangle has side ratios $1:1:\sqrt{2}$

Since the length of each side is $2\sqrt{2}$,

the coordinate of A is $(2 + 2\sqrt{2},\ 0)$
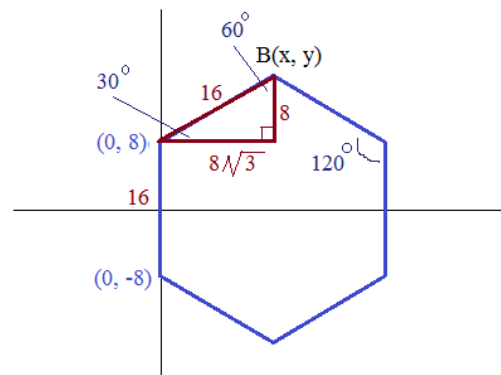
The exterior angles of a regular hexagon are
360/6 = 60

The interior angles are $\dfrac{(6-2)180}{6} = 120$

Distance from (0, 8) to (0, -8) is 16 units..
so, each side is 16 units...

Note: a 30-60-90 right triangle has side ratios $1:\sqrt{3}:2$

the coordinate of B is $(8\sqrt{3},\ 16)$

4) Is the figure ABCDEF a polygon? Explain.

This is NOT a polygon..

The polygon ABCDEF describes a figure with
6 vertices, and therefore 6 sides...
However, this figure only has 5 sides...
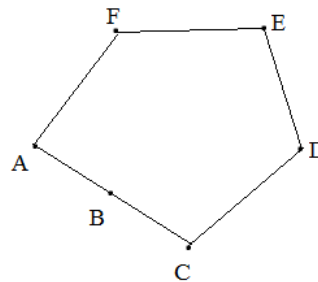
5) The sum of 5 angles inside an "octagon" is 400 degrees.
What can you conclude about this figure?

possible sketch:

The sum of the interior angles of an octagon would be

$(8 - 2)(180) = 1440$...   So, if 5 of the angles are 400 degrees, then the
other 3 must add up to 890?!?!?

The figure must be CONCAVE..
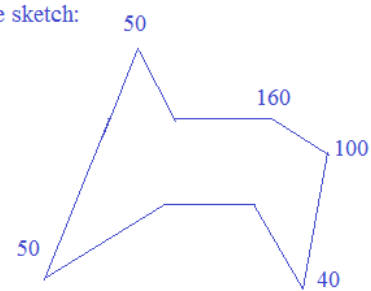
6) Find the angles formed by

a) 2 consecutive radii

b) the radius and adjoining side

in a regular   1) pentagon

a) 72°

b) 54°
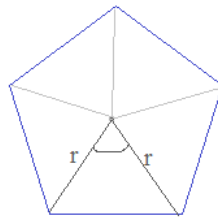
$360 \div 5 = 72^{\circ}$
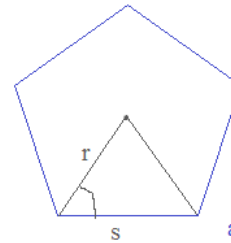
Since the 5 triangles are
isosceles....

angle + angle + 72 = 180

angle = 54°

2) hexagon

a) 60°

b) 60°
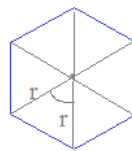
$360 \div 6 = 60^{\circ}$
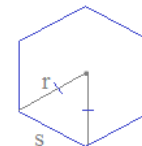
Since the radii angle
is 60, the other two
angles add up to 180..

Therefore, the other
angles are 60 and 60..

3) octagon

a) 45°

b) 67.5°

An octagon has 8 congruent
radii angles...

$360 \div 8 = 45^{\circ}$

Since the radii angle is 45 degrees..
the 2 base angles must add up to 135 degrees...

67.5 and 67.5

4) decagon

a) 36°

b) 72°

Decagon has 10 sides..
10 congruent radii angles.. 36 degrees

The radius/side angles are
72 degrees...

7) The sum of the measures of the interior angles of a regular polygon is 5040. How many sides in this polygon?

$$\text{Sum of measures of interior angles} = (n-2) \cdot 180$$

$$5040 = (n-2) \cdot 180$$

$$28 = n - 2$$

$$\boxed{n = 30 \text{ sides}}$$

8) True or False

a) A regular polygon is equilateral   True: a regular polygon is equlateral and equiangular

b) An equilateral polygon is regular.   False: a polgon can be equilateral, but not equiangular..

c) When the midpoints of each side of a rhombus are consecutively joined, the figure is a rhombus.   False: the result is a rectangle

d) A scalene quadrilateral can have 2 congruent angles.
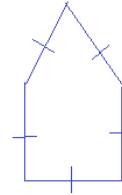
True : here is an example
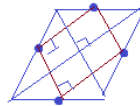
A scalene quadrilateral has 4 different side lengths...

9) ABCDE is a regular semi-hexagon

If $\angle C = 2x + 3y + 10$

$\angle CDB = x - 3y + 20$

C
B   D
A   E

·120
60
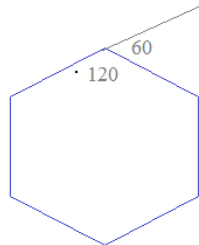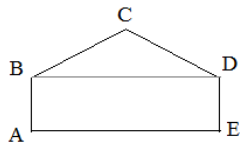
since $\triangle$ BCD has 2 congruent sides, it is isosceles.. and, the opposite angles are congruent... (sum of 3 angles = 180)

C
30   30
B   D
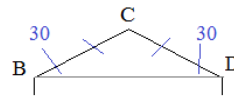
$120 + 30 + 30 = 180$ degrees..

$120 = 2x + 3y + 10$

$30 = x - 3y + 20$

$110 = 2x + 3y$

$10 = x - 3y$

$120 = 3x$

$\boxed{x = 40 \text{ and } y = 10}$

10) ***Challenge: What is the sum of the angle measures A, B, C, D, and E?

Looking at the inside pentagon, we know the exterior angle measures add up to 360 degrees..

(Let's assume it's a regular pentagon...)

Then, looking at each isosceles triangle, we know the vertex angle must be 36 (because $36 + 72 + 72$ equals 180)

72   72
72
72   72

72
72   72
72

A
E   72 72
72   72
72   72
72   72
72 72   B
72 72

D   C
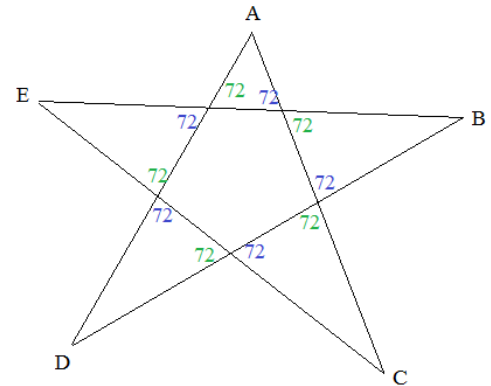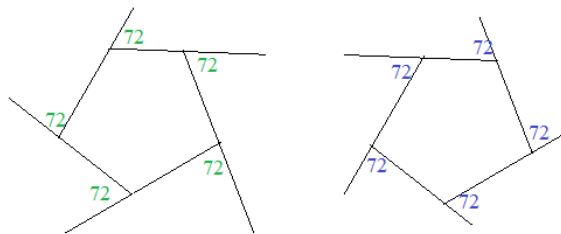
$\boxed{A + B + C + D + E = 180 \text{ degrees...}}$

11) Assume the polygon is a regular octagon.
   Find the numbered angles:

   1) 22.5 degrees

   2) 45 degrees

   3) 67.5 degrees
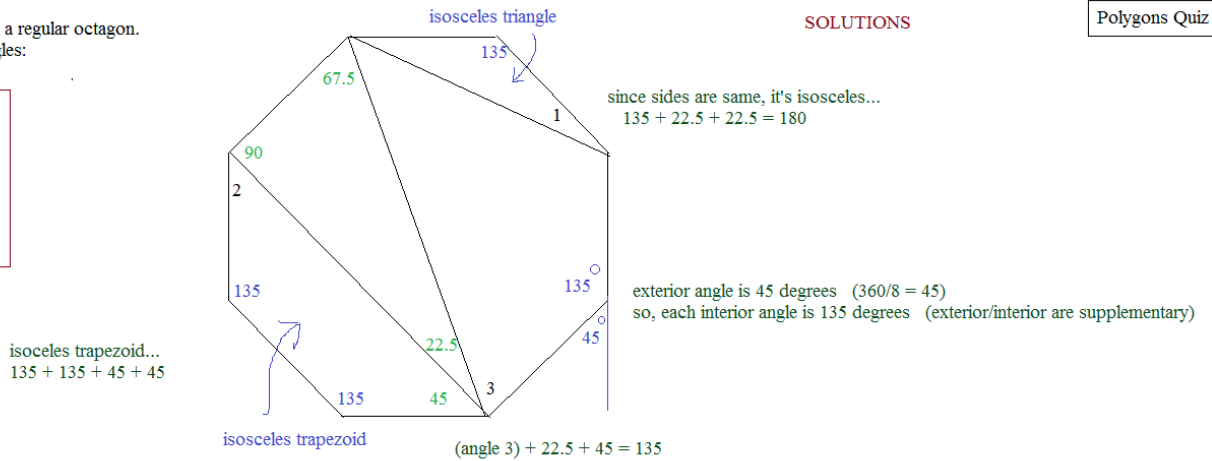
isosceles triangle
135
67.5
since sides are same, it's isosceles...
135 + 22.5 + 22.5 = 180
1
90
2
135
135
exterior angle is 45 degrees   (360/8 = 45)
   so, each interior angle is 135 degrees   (exterior/interior are supplementary)
22.5
45
isoceles trapezoid...
135 + 135 + 45 + 45
135   45   3

isosceles trapezoid
(angle 3) + 22.5 + 45 = 135

12) What is the perimeter of a regular octagon if the longest diagonal is 10 inches? if the shortest diagonal is 10 inches?

135
45
quadrilateral angles
add to 360....
135
10
135
45   67.5

$\cos(67.5) = \dfrac{\text{side}}{10}$ side = 3.827   perimeter = 30.6 (approx.)

22.5
135
10
5
22.5
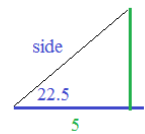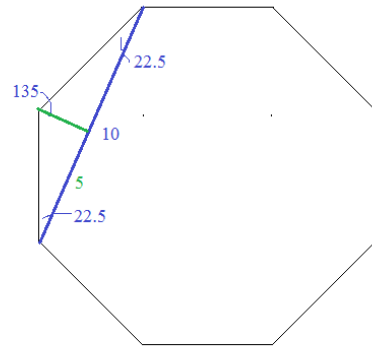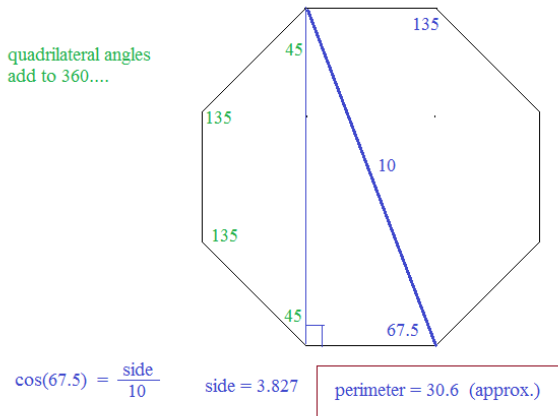
side
22.5
5

$\cos(22.5) = \dfrac{5}{\text{side}}$

side = 5.41

perimeter = 43.3 (approx.)

13) A, B, C are consecutive vertices on a (convex) 16 n-gon...

   How many diagonals in the 16 n-gon will contain A, B, or C?

   Every vertex will have diagonals extending
   to other vertices, EXCEPT to it's 'neighbors'
   or itself...

   In other words, A will have 13 diagonals
   B will have 13 diagonals, and C will
   have 13 diagonals...

   Then, since diagonal BC is the same as CB, we subtract
   one "double count"...

B   C
A
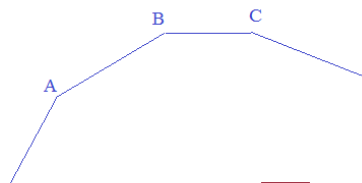
13 + 13 + 12 = 38

14) Symmetric pencils with tips that form a 20-degree angle are
   aligned in the following manner...
   How many pencils can be constructed?

   Suppose the pencil tips had a 6-degree angle at the tip?

      80 + 90 + 20 + A = 360

      Each cluster will contain a 170-degree (interior) angle...

      (Then, each exterior angle would be 10 degrees)

      Therefore, this can become a 36-gon

         36 pencils

80
20
90
A
20
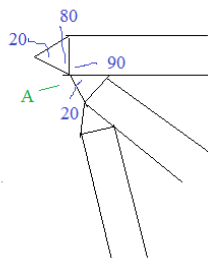
87 + 90 + 6 + A = 360

A = 177

Exterior angle would
be 3

360/3 = 120

120 pencils...

87
90
A
6
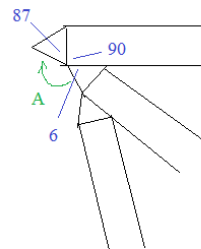
Assume all the figures are *regular* polygons.

SOLUTIONS

Find the angle measures.

a) _108_   interior angle of pentagon

b) _90_   each angle in a square
            is a right angle

c) _120_   hexagon -- 6 sides: each exterior
            angle is 60.. each interior is 120

d) _42_   sum of a, b, c, and d must
            be 360 degrees

e) _135_   regular octagon has
            exterior angles 45..
            interior angles 135

f) _15_   octagon angle − hexagon angle
              135   −   120 = 15

g) _60_   exterior angle of regular
            hexagon

h) _45_   octagon interior angle − square right angle
              135   −   90   = 45

i) _75_   octagon angle − equilateral triangle angle
              135   −   60   =   75
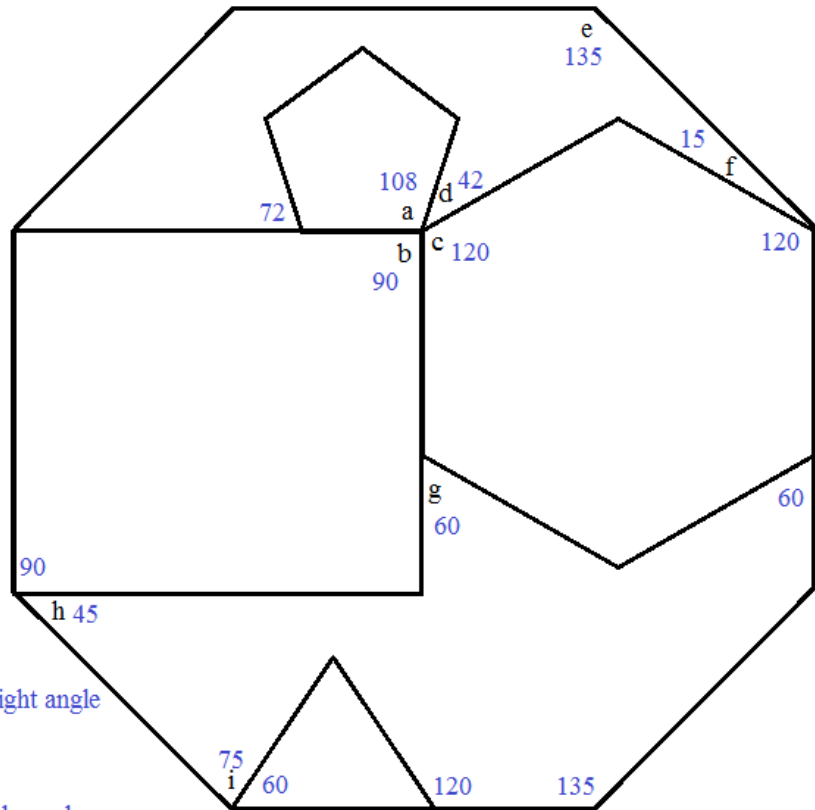
e
135

15
f

108 d 42
a
72   120

b c 120
90

90

g
60   60

90

h 45

75
i 60   120   135

mathplane.com

SOLUTIONS

1) The measure of one interior angle in a regular polygon is 172 degrees.
   How many diagonals does the polygon have?

   First, we must identify the polygon...

   interior angle is 172 degrees ----> exterior angle is 8 degrees...
   Since sum of exterior angles is 360 degrees, there must be

   $$\frac{360}{8} = 45 \text{ sides}$$

   Now, we know it's a 45-gon, we can apply the formula to find the number of diagonals...

   $$\text{diagonals} = \frac{45(45 - 3)}{2} = \boxed{945}$$

2) If the sum of the interior angles of a polygon is 1260 degrees,
   then how many diagonals does it have?

   $$1260 \text{ degrees} = 180 \text{ degrees} * (n - 2) \text{ sides}$$

   $$n = 9 \text{ sides} \quad \text{(nonagon)}$$

   $$\text{diagonals} = \frac{9(9 - 3)}{2} = \boxed{27}$$

3) If a regular polygon has 65 diagonals, what is the measure of
   each exterior angle?

   $$65 \text{ diagonals} = \frac{n(n - 3)}{2}$$

   $$130 = n^2 - 3n$$

   $$(n - 13)(n + 10) = 0$$

   $$n = 13 \text{ sides}$$

   $$n \neq -10$$

   If there are 13 sides, then each exterior angle measure is

   $$\frac{360}{13} = \boxed{27.69 \text{ degrees}}$$

4) If the sum of the interior angles of a regular polygon is 5580 degrees,
   then what is the measure of each interior angle?

   First, we'll find out what type of polygon:

   $$5580 = 180(n - 2)$$

   $$31 = n - 2$$

   $$n = 33 \text{ sides}$$

   $$\text{each exterior angle} = \frac{360}{33} = 10.91^{\circ}$$

   $$\Longrightarrow \quad \text{each exterior angle} = 180 - 10.91 = \boxed{169.09^{\circ}}$$

5) If 90 diagonals can be drawn in a regular polygon, then
   what is the measure of each interior angle?

   $$90 \text{ diagonals} = \frac{n(n - 3)}{2}$$

   $$180 = n^2 - 3n$$

   $$(n - 15)(n + 12) = 0$$

   $$n = 15 \text{ sides}$$

   (there cannot be -12 sides)

   $$\text{each exterior angle is } \frac{360}{15} = 24 \text{ degrees}$$

   and, each interior angle is supplementary...

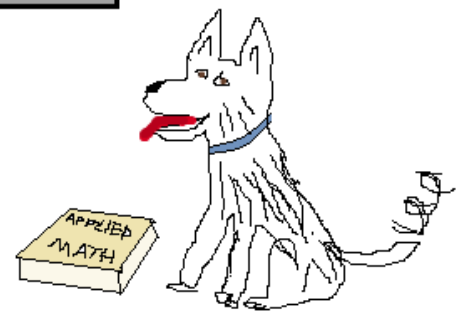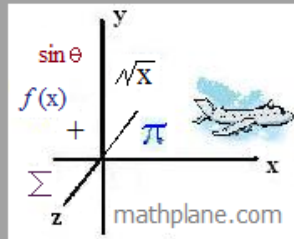 $$180 - 24 = \boxed{156 \text{ degrees}}$$

Thanks for visiting. (Hope it helped!)

If you have questions, suggestions, or requests, let us know.

Good luck,

Lance

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One more Polygon Question:

What is the name of the regular polygon whose ratio of interior angle measure to exterior angle measure is 4:1?

Answer on next page….

What is the name of the regular polygon
  whose ratio of each interior angle measure to each exterior angle measure is 4:1?

In a polygon, each interior angle is supplementary to its exterior angle!

If the measures are 4:1, then $4x + 1x = 180$

   $5x = 180$

   $x = 36$ and $4x = 144$

If a regular polygon has an exterior angle measure of 36, then it has $\dfrac{360}{36} = 10$ sides

  A polygon with 10 sides is a *decagon*.

144

36