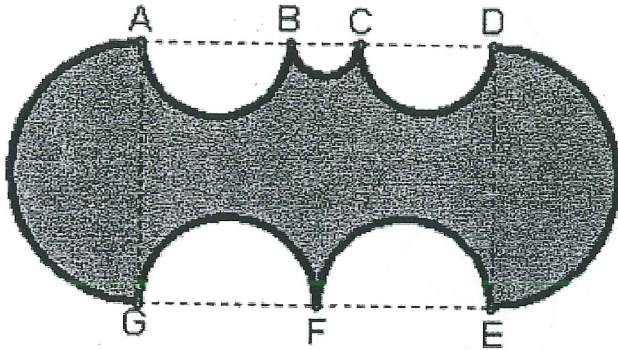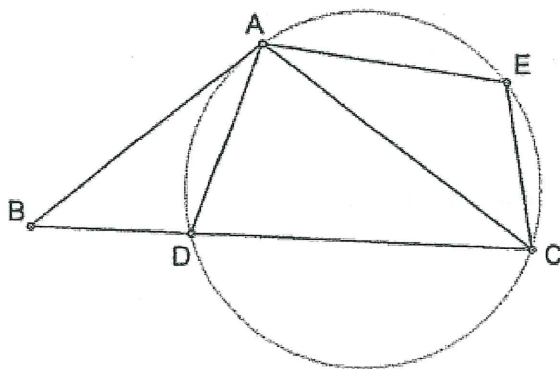1.

The figure below is a rectangle with semicircular appendages and indentations. Given that AB = CD = 8, GF = FE = 10, AG = DE = 25, and BC = 4, what is the length of the border of the shaded region?

2.

In the figure below, points A, D, C, and E all lie on the same circle, and D lies between points B and C. Furthermore, ∠BAD ≅ ∠CAE. If AE = 6, AC = 10 and AD = 9, what is the length of segment $\overline{AB}$?
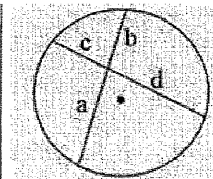
3.

Points A, B, C, and M lie on the same circle, as shown in the diagram below. Point M is the midpoint of the arc from B to C that does not contain A, and lines AM and BC intersect at P. Given that $AP \cdot PM = 12$ and $AB/AC = 3$, what is the length of BC?
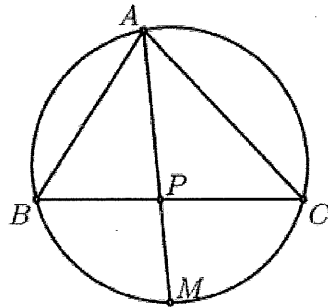
Recall:
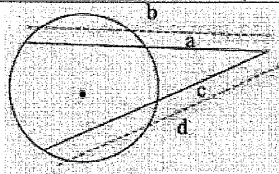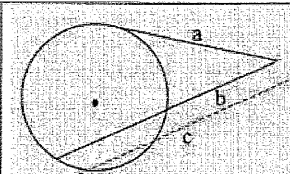
4.

In trapezoid $ABCD$, lines AB and DC are parallel. Points E and F lie on segments DA and CB, respectively, in such a way that

$$\frac{AE}{ED} = \frac{BF}{FC} = \frac{2}{3}.$$

Lines EF, AC, and BD all pass through a common point P. If segment DC has length 36, then what is the length of segment AB?
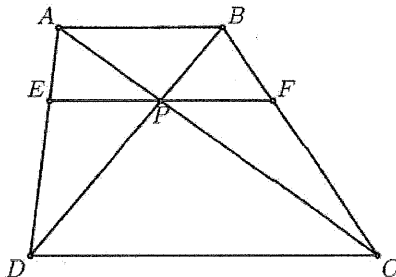
5.

If a and b are integers such that $ab = 2008$, then what is the maximum possible value of $a + b$?

(A) 2009   (B) 2008   (C) 259   (D) 2007   (E) 1006

6.

Suppose that segments DA, DP, and DS all have equal length. If angle PDS has measure $72°$, then what is the measure of angle PAS?

(A) 72°   (B) 36°   (C) 144°   (D) 54°   (E) Impossible to say

Recall:

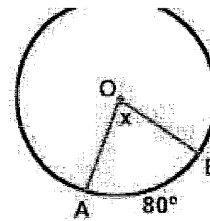Central Angle
A central angle is an angle formed by two intersecting radii such that its vertex is at the center of the circle.

Central Angle = Intercepted Arc
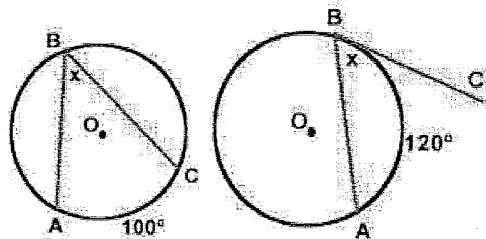$$m\angle AOB = m\overparen{AD}$$

$m\angle AOB = 80°$

Inscribed Angle
An inscribed angle is an angle with its vertex "on" the circle, formed by two intersecting chords.

Inscribed Angle = $\frac{1}{2}$ Intercepted Arc
$$m\angle ABC = \frac{1}{2}m\overparen{AC}$$

7.

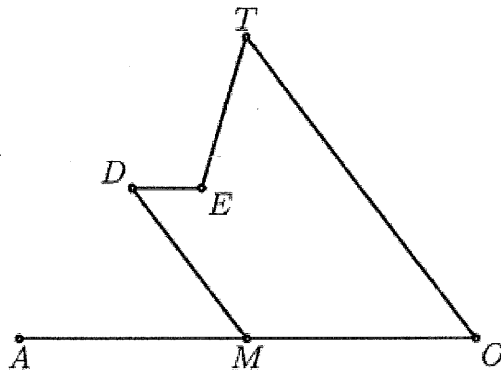If x and y are positive integers such that

$$x^2 - 4y^2 = 36,$$

then what is the greatest possible value of $x + 2y$?

(A) 36   (B) 18   (C) 6   (D) 12   (E) 9

8.

In the figure below, angles DMA, MDE, MOT, and OTE are all congruent. If segement MO has length 10 and segment ET has length 7, then what is the length of segment DE?

9.

Let $f(x) = \dfrac{2x - 2}{x}$. What is $f^{2010}(2008)$?

Note : $f^n(x)$ means

$$\underbrace{f\big(f(\cdots f(x)\cdots)\big)}_{n\ \text{times}},$$

the composition of f with itself n times, evaluated at x. For example $f^3(x) = f(f(f(x)))$.