What is the perimeter of an equilateral triangle inscribed in a circle of radius 4?

(A) $6\sqrt{2}$

(B) $6\sqrt{3}$

(C) $12\sqrt{2}$

(D) $12\sqrt{3}$

(E) 24

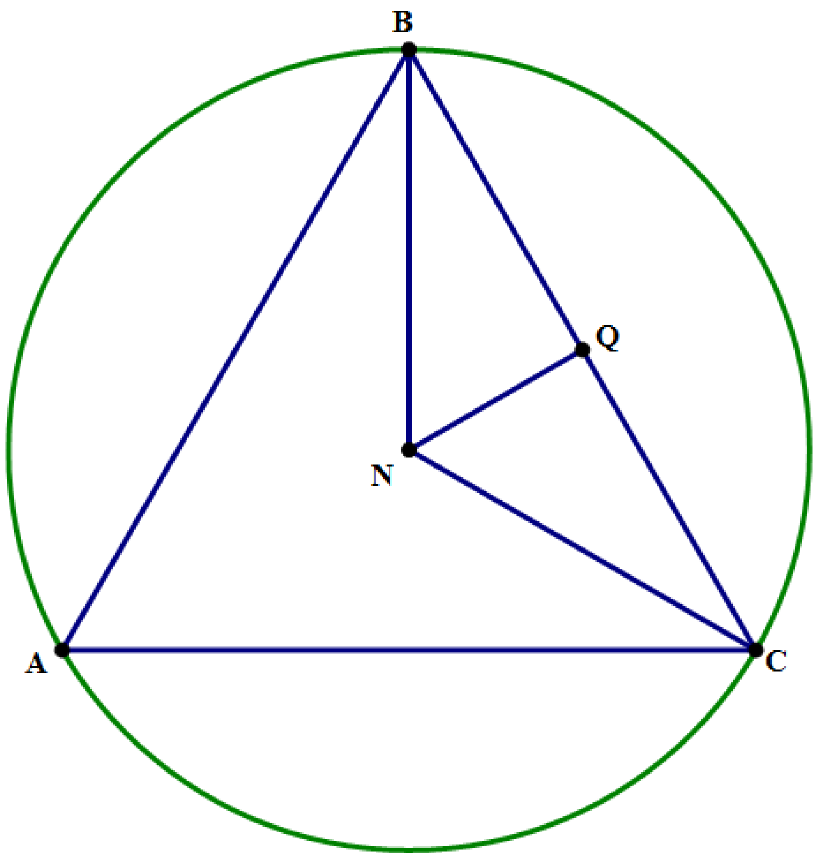
First of all, the square root of two comes up only when 45° angles are involved. When 30° and 60° angles are involved you get numbers involving the square-root of three instead. On this basis alone we can eliminate (A) & (C).

Also, if (E) were the right answer, then each side of the triangle would equal 8. But the diameter, the longest possible chord, equals 8, because the radius = 4. The side of the equilateral triangle cannot equal the diameter of the circumscribing circle. (E) is impossible and can be eliminated.

There, before doing any solving, we can narrow the answer choices down to two, (B) or (D).

The strategy I will employ is to chop the equilateral triangle up into 30-60-90 triangles, which will allow us to relate the lengths we know to the lengths we want to find.

Explanation starts on the next page.



The equilateral triangle in question is triangle ABC. We are told only that the radius of the circle r = 4. N is the center of the circle.

Notice that both NB and NC are radii, so NB = NC = 4.

Q is the midpoint of BC, and because NBC is an isosceles triangle, ∠NQB = 90°. Therefore, triangle NBQ is a 30-60-90 triangle.

Know that NB = 4. We would like to find BQ. Well, in a 30-60-90 triangle, NQ, the side opposite the 30° angle is half the hypotenuse. NQ = 2 --- this is the "short leg". The "long leg" of a 30-60-90 triangle is the short leg times the square-root of 3.

BQ = $2\sqrt{3}$

BC = 2*(BQ) = $4\sqrt{3}$

Perimeter = 3*(BC) = $12\sqrt{3}$

Answer = **(D)**