Problem 20

Triangle ABC has a right angle at B. $AB = 1$. and $BC = 2$. The bisector of $\angle BAC$ meets $\overrightarrow{BC}$ at D. What is $\overrightarrow{BD_7}$

(A) $\frac{\sqrt{3}-1}{2}$

(B) $\frac{\sqrt{5}-1}{2}$

© $\frac{\sqrt{5}+1}{2}$

(D) $\frac{\sqrt{6}+\sqrt{2}}{2}$

(E) $2\sqrt{3}-1$

Problem 22

A cubical cake with edge length 2 inches is iced on the sides and the top. It is cut vertically into three pieces as shown in this top view, where $\mathcal{M}$ is the midpoint of a top edge. The piece whose top is triangle $\mathcal{B}$ contains $\mathcal{C}$ cubic inches of cake and $\mathcal{S}$ square inches of icing. What is $\mathcal{C}+\mathcal{S}$?

(A) $\frac{24}{5}$

(B) $\frac{32}{5}$

© $8+\sqrt{5}$

(D) $5+\frac{16\sqrt{5}}{5}$

(E) $10+5\sqrt{5}$

The keystone arch is an ancient architectural feature. It is composed of congruent isosceles trapezoids fitted together along the non-parallel sides, as shown. The bottom sides of the two end trapezoids are horizontal. In an arch made with 9 trapezoids, let $\mathcal{X}$ be the angle measure in degrees of the larger interior angle of the trapezoid. What is $\mathcal{X}$?

(A) 100
(B) 102
© 104
(D) 106
(E) 108

10a

Problem 16

Nenogenerate $\triangle ABC$ has integer side lengths, $\overrightarrow{BD}$ is an angle bisector, $AD = 3$, and $DC = 8$. What is the smallest possible value of the perimeter?

(A) 30
(B) 33
© 35
(D) 36
(E) 37