BRITISH COLUMBIA COLLEGES

Junior High School Mathematics Contest, 2001

Preliminary Round

Wednesday March 7, 2001

1. A man drives 150 kilometres to the seashore in 3 hours and 20 minutes. He returns from the seashore to his starting point in 4 hours and 10 minutes. Let r be the average speed for the entire trip. Then the average speed for the trip to the seashore exceeds r, in kilometres per hour, by:

   (a) 5 (b) $4\frac{1}{2}$ (c) 4 (d) 2 (e) 1

2. If a pup is worth a pooch and a mutt, a pup and a pooch are worth one bird dog, and two bird dogs are worth three mutts, then the number of pooches a pup is worth is:

   (a) 2 (b) 3 (c) 5 (d) 6 (e) 9

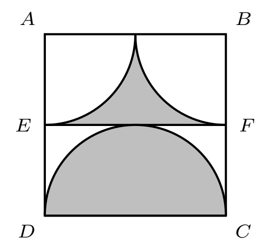
3. If x is a positive integer, then $x + \sqrt{x}$ cannot possibly equal:

   (a) 20 (b) 30 (c) 60 (d) 90 (e) 110

4. In the diagram $ABCD$ is a square. Points E and F are midpoints of the sides AD and BC, respectively. Line segments AE and BF are radii of quarter circles with centres at A and B, respectively. Line segment DC is the diameter of the shaded semi-circle. If $\overline{DC} = 8$, then the area of the shaded region is:

   (a) $8 + 8\pi$ (b) 32 (c) $16 + 4\pi$

   (d) $64 - 16\pi$ (e) $32 - 8\pi$



5. If $c^d = 3$, then the value of $c^{4d} - 5$ is:

   (a) 7 (b) $3c^4 - 5$ (c) 22 (d) 76 (e) 81

6. An amoeba propagates by simple division; each split takes three minutes to complete. When such an amoeba is put into a glass dish with a nutrient fluid, the dish is full of amoeba in one hour. The number of minutes it takes for the dish to fill if it initially contains two amoeba is:

   (a) $\sqrt{60}$ (b) 19 (c) 30 (d) $\sqrt{120}$ (e) 57

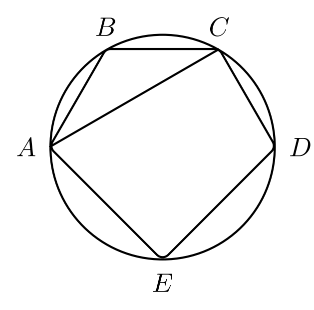
7. An integer is prime if it is greater than one and is divisible by no positive integers other than one or itself. The sum of the prime divisors of 2001 is:

   (a) 55 (b) 56 (c) 670 (d) 671 (e) 2001

8. A (non-regular) pentagon $ABCDE$ is inscribed in a circle, as shown. Segment AD is a diameter of the circle, sides AB, BC, and CD are equal, and sides AE and DE are equal. Angle CAE in degrees is:

   (a) 60 (b) 72 (c) 75

   (d) 78 (e) 90



9. The digit that must be placed in front of the five digit number 56734 to produce a six digit number that is divisible by 11 is:

(a) 3 (b) 5 (c) 6 (d) 7 (e) 8

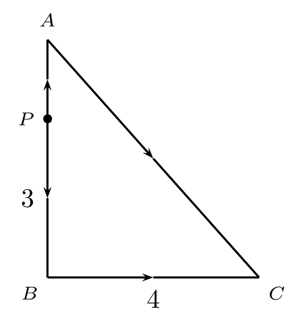
10. Points A, B and C are collinear. Point B is the midpoint of the line segment AC. Point D is a point not collinear with the other points for which $\overline{DA} = \overline{DB}$ and $\overline{DB} = \overline{BC} = 10$. Then $\overline{DC}$ is:

(a) $\dfrac{20}{\sqrt{3}}$ (b) $10\sqrt{2}$ (c) $10\sqrt{3}$ (d) 20 (e) $\dfrac{40}{\sqrt{3}}$

11. Let D be a two digit number. If half of D exceeds one third of D by the sum of the digits in D, then the sum of the digits in the number D is:

(a) 4 (b) 6 (c) 9 (d) 12 (e) 15

12. Two hikers at P want to go to their campsite at C. (See the diagram.) One decides to go south from P to B, a distance of 3 kilometres, and then east from B to C, a distance of 4 kilometres. The other decides to go north from P to A and then along the straight line path from A to C. If the distances the two hikers travel are equal, the distance from P to A, in kilometres, is:



(a) $1\frac{1}{2}$ (b) $1\frac{1}{3}$ (c) $1\frac{1}{4}$

(d) $1\frac{1}{5}$ (e) 1

13. The number of distinct triangles with integer sides and perimeter 10 that can be constructed is:

(a) 1 (b) 2 (c) 3 (d) 4 (e) 8

14. A small school has 100 students and rooms A, B and C. After the first period, half of the students in room A move to room B, one-fifth of the students in room B move to room C, and one-third of the students in room C move to room A. After the move, the total number of students in each room is the same as it was before. How many students are in room A?

(a) 10 (b) 20 (c) 30 (d) 40 (e) 50

15. If n is an integer for which $n \geq 2$, the value of the product

$$\left(1-\frac{1}{4}\right)\left(1-\frac{1}{9}\right)\cdots\left(1-\frac{1}{n^2}\right)$$

is:

(a) $\dfrac{2n-1}{n}$ (b) $\dfrac{n^2-1}{n^2}$ (c) $\dfrac{3(n-1)}{n^2}$ (d) $\dfrac{n+1}{2n}$ (e) $\dfrac{n+1}{n^2}$