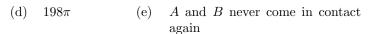
# BRITISH COLUMBIA COLLEGES

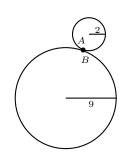
## Senior High School Mathematics Contest, 2003

### **Preliminary Round**

#### Wednesday March 5, 2003

- 1. If the price of an article is increased by the fraction p of the original price, where  $0 \le p \le 1$ , then the corresponding decrease in sales must not exceed the fraction d of the original sales, again  $0 \le d \le 1$ , in order to yield the same income. The value of d is:
  - (a)  $\frac{1}{1+p}$  (b)  $\frac{1}{1-p}$  (c)  $\frac{p}{1+p}$  (d)  $\frac{p}{p-1}$  (e)  $\frac{1-p}{1+p}$
- 2. The point B is between the points A(2,3) and C(5,-7) and collinear with A and C. If  $\overline{AB} : \overline{BC}$  is 3:7, the sum of the coordinates of point B is:
  - (a)  $\frac{3}{2}$  (b)  $\frac{29}{10}$  (c)  $\frac{3}{10}$  (d)  $\frac{1}{10}$  (e) 2
- 3. You have a pan balance and three different weights: one weight of 1 kg, one weight of 3 kg, and one weight of 9 kg. Objects of different weights, for which the weight is an integer number of kilograms, are to be weighed. If an object to be weighed and the given weights can be placed on either pan of the balance, the number of such differently-weighted objects that can be weighed is:
  - $(a) \quad 9 \qquad (b) \quad 11 \qquad (c) \quad 12 \qquad (d) \quad 13 \qquad (e) \quad 15$
- 4. A circular grass plot 4 m in diameter is cut by a straight gravel path 1 m wide, one edge of which passes through the center of the plot. The number of square meters in the remaining grass area is:
  - (a)  $\frac{10\pi}{3} \sqrt{3}$  (b)  $3\pi$  (c)  $4\pi 4$  (d)  $\frac{10\pi}{3}$  (e)  $\frac{4\pi}{3} \sqrt{3}$
- 5. A small circle of radius 2 cm is rotating without slipping around the edge of a larger circle of radius 9 cm. The small circle starts with point A on its circumference in contact with the larger circle at point B. The <u>exact</u> distance travelled by the centre of the small circle before the point A next comes in contact with the large circle at point B is:
  - (a)  $22\pi$  (b)  $36\pi$  (c)  $44\pi$





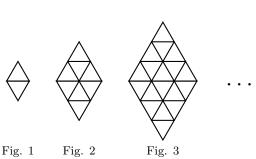
- 6. A number N is the product of P distinct prime numbers. The number of positive integer divisors of N is:
  - (a)  $2^{(P-1)}$  (b) P! (c) 2P (d)  $P^2$  (e)  $2^P$
- 7. At one point in a class vote for student rep on council, Anthony learned that exactly 45% of those voting had voted for him. After another five minutes of voting he had only 30% of the vote. The least number of people that could have voted during the five minute period is:
  - (a) 7 (b) 9 (c) 10 (d) 20 (e) 25

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- 8. In triangle ABC the longest side BC is of length 20 and the altitude from A to BC is of length 12. A rectangle DEFG is inscribed in ABC with D on AB, E on AC, and both F and G on BC. The maximum possible area of rectangle DEFG is
  - (a) 60 (b) 100 (c) 120 (d) 150 (e) 200
- 9. A fair six-sided die, with sides numbered 1 to 6, is tossed three times. The probability that the three outcomes are in <u>strict</u> descending order is:

(a) 
$$\frac{19}{216}$$
 (b)  $\frac{5}{54}$  (c)  $\frac{7}{72}$  (d)  $\frac{1}{2}$  (e)  $\frac{7}{27}$ 

- 10. On a normal 12-hour clock the minute and hour hands are perpendicular at 3:00. The hands are perpendicular again sometime <u>after 3:30</u>. The exact number of minutes after 3:30 when the hands of the clock are again perpendicular is:
  - (a) 2 (b)  $\frac{24}{11}$  (c)  $\frac{30}{11}$  (d) 3 (e)  $\frac{36}{11}$
- 11. Given the figures on the right, in which for Figure n the width at the center is n times the width of one small triangle and height is 2n times the height of one small triangle, the number of small triangles in the 2003<sup>rd</sup> figure is:



(e)

30

- (a) 4008004 (b) 4012009 (c) 8016008
- (d) 8024018 (e) 9000000
- 12. Twelve father and daughter pairs attended a Girl Guide barbecue. If each father shook hands with everyone except his own daughter and himself, the number of handshakes which involve at least one father is:
  - (a) 48 (b) 198 (c) 204 (d) 209 (e) 276
- 13. A three-by-three square grid is shown. Three of the squares in the grid are to be shaded in such a way that no two shaded squares have an edge in common. A possible shading is shown. The number of possible shadings of the grid is:
  - (a) 14 (b) 18 (c) 20 (d) 22
- 14. The value of the sum

$$1 + 3 - 5 + 7 + 9 - 11 + 13 + 15 - 17 + \dots 61 + 63 - 65$$

is:

- (a) 1089 (b) 770 (c) 704 (d) 451 (e) 319
- 15. The number of integers between 1400 and 2400, inclusive, which are an integer multiple of either 15 or 16 (or both) is:
  - (a) 65 (b) 120 (c) 125 (d) 130 (e) 150