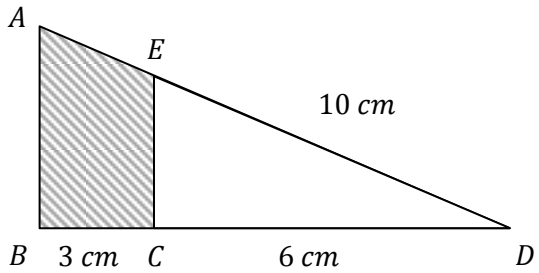
Part A: (5 credits each)

1. A square of side $4x + 3$ has another square of side $4x$ inside it. What is the area between the squares?

a) $12x$ b) 9 c) 3 d) $12x + 9$ e) $24x + 9$

2. What is the area, in cm^2 of the shaded region in the following figure if the length of ED is 10cm and $\angle B = \angle C = 90°$?



a) 15 b) 30 c) 36 d) 54 e) 60

3. The graph of $y = 2x^2 + 2x - 12$ intersects the x-axis at two points P and Q. The length of line segment PQ is:

a) 1 b) 10 c) 5 d) 2 e) $\frac{1}{2}$

4. Which statement is true?

a) if $x^2 > x$, then $x < 0$ b) if $x^2 > 0$, then $x > 0$ c) if $x^2 > x$, then $x > 0$
d) if $x < 1$, then $x^2 < x$ e) if $x < 0$, then $x^2 > x$

5. The mathematician Augustus De Morgan lived in the nineteenth century. He once said that he was x years old in the year x^2. In what year was De Morgan born?

a) 1801 b) 1806 c) 1848 d) 1849 e) 1860

6. If the lines with equations: $x + y - 6 = 0$, $3x - y - 14 = 0$, & $kx + 3y + 7 = 0$ all pass through the same point, the value of k is:

a) 2 b) -2 c) 8 d) $\frac{1}{2}$ e) $-\frac{1}{2}$

7. A parabolic tunnel through a mountain is 4 m tall, 4 m wide at the base, & 5 m deep. What is the maximum height of a 2 m wide truck that can drive through the tunnel?

a) 3 m b) 2 m c) $\frac{15}{4}$ m d) $\frac{99}{25}$ m e) 1 m

8. One thousand unit cubes are fastened together to form a large cube with edge length 10 units. This is painted and then separated into the original cubes. The number of these unit cubes which have no painted faces is:
a) 400 b) 480 c) 512 d) 520 e) 600

9. For a regular pentagon with sides of length 1, the length of the line segment, from the centre of the pentagon to the midpoint of one of the sides is approximately:
a) 0.162 cm b) 0.325 cm c) 0.688 cm d) 0.866 e) 1.376

10. There are two cards: one is red on both sides & the other is red on one side and blue on the other. The cards have the same probability of being chosen. One card is chosen and placed on the table. If the top side of the card on the table is red, then the probability that the bottom side is also red is:
a) $\frac{1}{4}$ b) $\frac{1}{3}$ c) $\frac{1}{2}$ d) $\frac{2}{3}$ e) $\frac{3}{4}$

Part B: (6 credits each)

11. A man starts at his home, walks x miles due west, turns 150° to his left and walks 3 miles in the new direction. If he finishes at a point $\sqrt{3}$ miles from his home, then x is:
a) $\sqrt{3}$ b) $2\sqrt{3}$ c) $\frac{3}{2}$ d) 3 e) $\sqrt{6}$

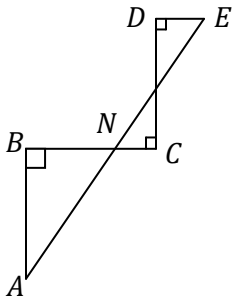
12. For the equation $x^2 - 3kx^2 + 3x - 4 = 0$ to have real roots, the largest possible integer value of k is:
a) -2 b) -1 c) 0 d) 1 e) 2

13. It takes 852 digits to number every page in a book. How many pages are there?
a) 284 b) 320 c) 321 d) 410 e) 411

14. If $xy = 4$ and $x^2 + y^2 = 20$, what is the value of $x + y$?
a) 4 b) 5 c) $2\sqrt{3}$ d) $2\sqrt{5}$ e) $2\sqrt{7}$

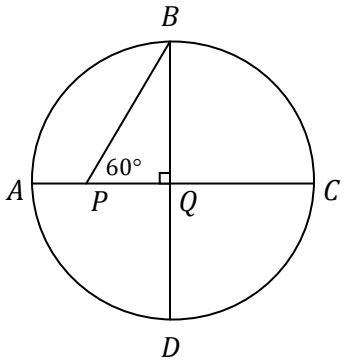
15. Maria drove from Owen Sound to Ottawa, a distance of 550 km. The trip took 7 hours. Maria drove at 70 km/h for part of the trip, and at 85 km/h for the remainder of the trip. How far did she drive at 70 km/h?
a) 210 km b) 225 km c) 248 km d) 302 km e) 340 km

16. In the diagram below, $AB = BC = CD = 4$ units, & $DE = 1$ unit. What is the length of BN?



a) $\frac{5}{2}$ b) 2 c) 3 d) $\frac{3}{2}$ e) $\frac{5}{8}$

17. Line segments AC and BD are perpendicular diameters of the circle with centre Q. If $\angle BPQ = 60°$, the ratio of side lengths PQ to AQ is approximately:



a) 0.866 b) 0.577 c) 0.707 d) 0.500 e) 0.666

18. If $3^{17} + 3^{17} + 3^{17} + 3^{17} + 3^{17} + 3^{17} + 3^{17} + 3^{17} + 3^{17} = 81^n$, then the value of n is:

a) 6 b) $\frac{17}{4}$ c) $\frac{17}{2}$ d) $\frac{19}{4}$ e) $\frac{16}{9}$

19. If $A = 3^x + 3^{-x}$ and $B = 3^x - 3^{-x}$, then $A^2 - B^2$ equals:

a) $2(3^{2x})$ b) $2(3^{-2x})$ c) 0 d) 4 e) 12

20. What is the volume of the largest cylinder that can be made from a rectangular sheet of metal 6 cm by 8 cm if the circular bases are not made from the sheet of metal.

a) $\frac{72}{\pi}$ b) $\frac{96}{\pi}$ c) 48 d) 72π e) 96π

Part C: (8 credits each)

21. A cube rests inside a sphere so that each vertex touches the sphere. If the inner radius of the sphere is 4 cm, the volume of the cube, in cm^3, is:

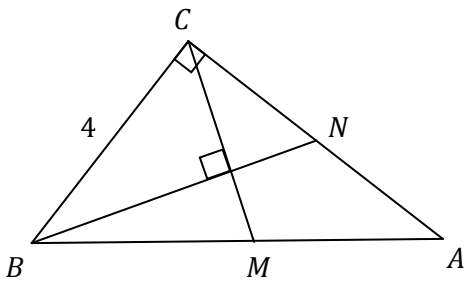
a) $3\sqrt{3}$ b) $2\sqrt{2}$ c) $\frac{512}{9}\sqrt{3}$ d) $54\sqrt{2}$ e) $8\sqrt{3}$

22. How many different ways can you spell the word "CONTEST" by only moving right and /or down.

C O N T E S T
O N T E S T
N T E S T
T E S T
E S T
S T
T

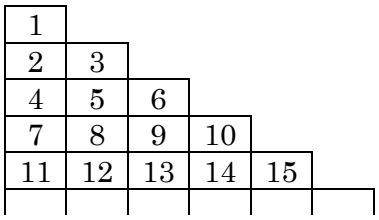
a) 30 b) 32 c) 64 d) 128 e) none of these

23. In the figure below, triangle ABC is a right triangle, with $\angle BCA = 90°$. Median CM is perpendicular to median BN, and side $BC = 4$. The length of BN is:



a) $4\sqrt{2}$ b) $6\sqrt{2}$ c) $8\sqrt{2}$ d) $2\sqrt{5}$ e) $2\sqrt{6}$

24. The positive integers are arranged in the pattern indicated in the diagram below. What number will be found in the square that is in the 71st (horizontal) row and the 34th (vertical) column?



a) 2414 b) 2484 c) 2518 d) 2519 e) none of these

25. There are 24 four-digit numbers that can be formed by arranging the digits: 1, 2, 3, and 4 (for example, 1234, 1324, 2431). What is the sum of all of these numbers?

a) 11 110 b) 11 111 c) 60 000 d) 66 660 e) none of these