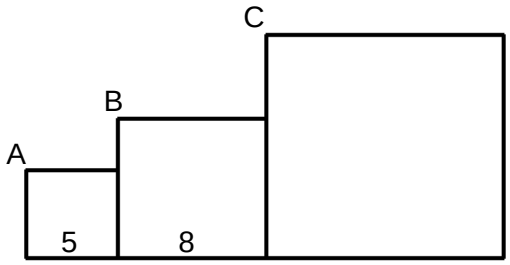
## Part A: (5 credits each)

1. A convenience store sells 2 chocolate bars at $1.20 each. Based on the costs, the profit on one was 20%, and the loss on the other was 20%. On the sale of the chocolate bars, the convenience store owner

a) broke even b) lost 4¢ c) gained 4¢ d) lost 10¢ e) gained10¢

2. In the adjacent squares shown below, the vertices A, B, and C lie in a straight line. The side length of the largest square is:




a) $\frac{64}{5}$ b) $\frac{24}{5}$ c) 11 d) 14 e) $\frac{32}{5}$

3. If $c^d = 3$, then $c^{4d} - 5$ equals:

a) 7 b) 16 c) 22 d) 76 e) 86

4. A line with a slope of 3 goes through the point $A(8, 12)$. If the point $B(p, -3)$ lies on the same line, then $p$ equals:

a) 3 b) $-7$ c) $-37$ d) 5 e) $-5$

5. Three stones are weighed on a scale, two at a time. The scale shows weights of 49 kg, 63 kg, and 80 kg. How much does the heaviest stone weigh?

a) 30 kg b) 36 kg c) 40 kg d) 47 kg e) 64 kg

6. Which of the following equations represents the line with slope of $-\frac{4}{3}$ & $y$-intercept of 4?

a) $y = 4x - \frac{4}{3}$ b) $4x + 3y - 12 = 0$ c) $4x + y - 4 = 0$
d) $4x - 3y - 12 = 0$ e) $3x + 4y - 4 = 0$

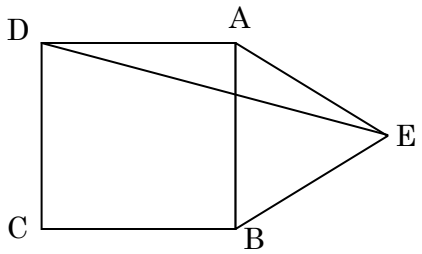
7. For how many ordered pairs of positive integers $(x, y)$ is $x + 2y = 100$.

a) 33 b) 49 c) 50 d) 99 e) 100

8. If $(x + 2)^2 = 4$, then $\sqrt{x + 2}$ equals:

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

9. In the figure below, $ABCD$ is a square and $ABE$ is an equilateral triangle. What is the measure of $\angle AED$?




a) 10° b) 12.5° c) 15° d) 20° e) 25°

10. A rectangular container with base 9 cm by 11 cm, has a height of 38.5 cm. Assuming that water expands 10% when it freezes, the depth to which the container can be filled, so that when the contents freeze, the ice does not go above the container's edge is:

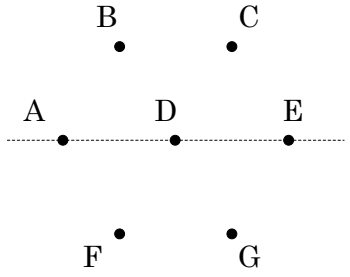
a) 32.65 cm b) 29.5cm c) 9 cm d) 42.35 cm e) 35 cm

**Part B: (6 credits each)**

11. Anna's age is 16 more than the sum of Daniel's age and Kiran's age. The square of Anna's age is 1632 more than the square of the sum of Daniel's age and Kiran's age. The sum of Anna, Daniel, and Kiran's ages is:

a) 64 b) 94 c) 96 d) 102 e) 140

12. Points A, B, C, D, E, & F are arranged as shown in the figure below, such that A, D, & E lie in a straight line. If three of these points are joined to form a triangle, how many such triangles are possible?




a) 20 b) 19 c) 16 d) 14 e) 12

13. The perimeter, in cm, of the figure below is numerically equal to its area, in $cm^2$. The radius of the semi-circle is:

a) $\pi$ b) $\frac{2}{\pi}$ c) 1 d) $\frac{1}{2}$ e) $\frac{4}{\pi}+2$

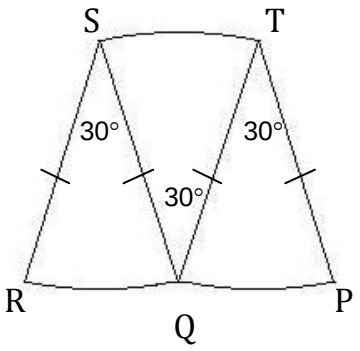
14. One point on the opposite side of the line $y = -3x + 10$ from the point $(2, 3)$ is:
a) $(0, 0)$ b) $(3, 1)$ c) $(2, 5)$ d) $(2, 4)$ e) $(2, -3)$

15. 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

16. Which statement is correct?
a) if $x < 0$, then $x^2 > x$ b) if $x^2 > 0$, then $x > 0$ c) if $x^2 > x$, then $x > 0$
d) if $x^2 > x$, then $x < 0$ e) if $x < 1$, then $x^2 < x$

17. How many integers between 600 and 700 have 14 as the sum of their digits.
a) 5 b) 9 c) 10 d) 14 e) 15

18. In the diagram below, circular arcs PQ, RS, and ST have centres T, S, and Q respectively. If $PT = 1$ unit, then the perimeter of PQRST is:




a) $2 + \pi$ b) $4 + \pi$ c) $2 + \frac{\pi}{2}$ d) $4 + \frac{\pi}{2}$ e) $\pi$

19. 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

20. If the lines defined by the equations $5x - 4y + 7 = 0$ and $2x - ky + 3 = 0$ are perpendicular, the value of $k$ is:

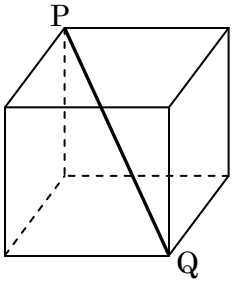
a) $\frac{8}{5}$ b) $-\frac{8}{5}$ c) $\frac{1}{4}$ d) $-\frac{1}{4}$ e) $-\frac{5}{2}$

## Part C: (8 credits each)

21. Opposite sides of a regular hexagon are 12 cm apart. The length of each side, in cm, is:

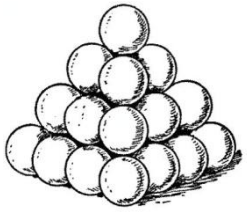
a) 7.5 b) $\sqrt{72}$ c) $\sqrt{50}$ d) $\sqrt{\frac{243}{4}}$ e) $\sqrt{48}$

22. In the figure below, PQ is a diagonal of the cube. If PQ has length $a$, then the surface area of the cube is:




a) $2a^2$ b) $2\sqrt{2}a^2$ c) $2\sqrt{3}a^2$ d) $3\sqrt{3}a^2$ e) $6a^2$

23. Balls are stacked in the shape of a triangular-based pyramid. Each triangular side has the same number of balls. A four layered display is shown below. What is the total number of balls needed to build a nine-layer pyramid? (Note: the interior is filled with as many balls as possible.)



a) 45 b) 117 c) 133 d) 135 e) 165

24. 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) $\frac{16}{9}$

25. How many ways can you spell the word "number" if you can only move down and/or right?

N U M B E R
U M B E R
M B E R
B E R
E R
R

a) 64 b) 32 c) 20 d) 12 e) 11