Booklet — Parts A and B

Part A **Questions 1 to 6**

In the *Student Booklet*, darken the letter that corresponds to your answer.

Each question is worth 4 marks.

TOPIC 4: PROBABILITY

1. There are 27 ping pong balls in a lottery. The ping pong balls are numbered 1 to 27. The first ping pong ball drawn is a multiple of 4.

What is the probability that the first ping pong ball drawn is the number 12?

A) $\frac{1}{4}$

B) $\frac{1}{6}$

C) $\frac{6}{27}$

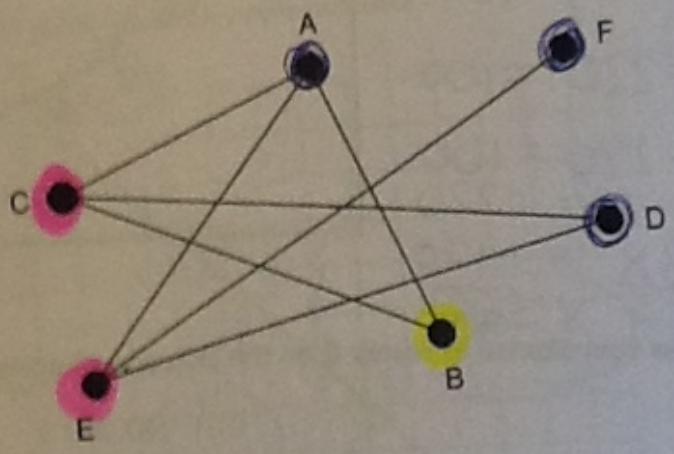
D) $\frac{4}{27}$

4
8
12
16
20
24

$\frac{1}{6}$ ← multiples of 4.

TOPIC 2: GRAPH THEORY

2. Given the graph below:



What is its chromatic number?

A) 3

B) 4

C) 5

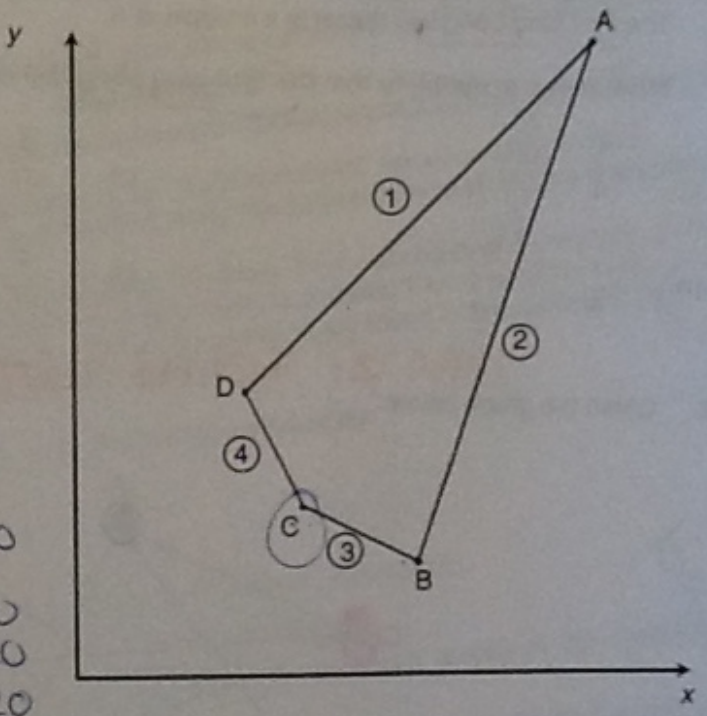
D) 6

TOPIC 1: OPTIMIZATION

3. A Secondary Five class sold mint chocolates and caramel chocolates to raise money for their graduation trip.

They were bound by certain constraints. These constraints are expressed by the following inequalities and are represented by the corresponding polygon of constraints below:

Let x = the number of caramel chocolates
Let y = the number of mint chocolates



① $x + y \leq 20$
② $y \geq 3x - 160$
③ $x + 2y \geq 100$
④ $y \geq -2x + 110$

$x + 2(-2x + 110) = 100$
$1x - 4x + 220 = 100$
$-3x + 220 = 100$
$-220 \quad -220$
$\frac{-3x}{-3} = \frac{-120}{-3}$
$x = 40$

What are the coordinates of vertex C on the polygon of constraints?

A) (30, 50)
B) (30, 40)
C) (40, 30)
D) (40, 60)

C(40, 30)

$Y = -2x + 110$
$Y = -2(40) + 110$
$Y = -80 + 110$
$Y = 30$

TOPIC 4: PROBABILITY

4. Students were asked to vote on where they would like to go for their end-of-year trip. The choices were Boston, Toronto, Halifax or New York. The results of the vote are displayed below.

Number of Students	24	20	16	10
1st	Toronto	Halifax	Boston	Boston
2nd	Boston	New York	New York	Toronto
3rd	New York	Boston	Toronto	Halifax

Which destination won the vote?

A) Toronto

B) New York

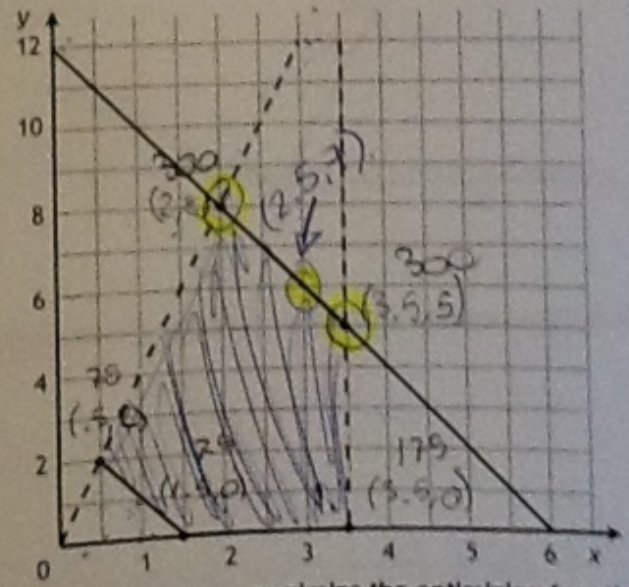
C) Halifax

D) Boston

TOPIC 1: OPTIMIZATION

5. The following polygon of constraints represents the solution to a situation whose optimizing function is:

$Z = 50x + 25y$, *where x and y must be whole numbers.*



$Z = 50(1) + 25(1)$
$Z = 50 + 25$
$Z = 75$

$Z = 50(2) + 25(8)$
$Z = 300$

How many whole number solutions maximize the optimizing function?

A) 1

B) 2

C) 3

D) 4

more

TOPIC 3 : TRANSFORMATIONS

6. The following series of transformations are performed on image ABC below:

$S_x(x, y) \rightarrow (x, -y)$ then $h_{\left(0, \frac{1}{2}\right)} \rightarrow \left(\frac{x}{2}, \frac{y}{2}\right)$ then $h_{(0,4)} \rightarrow (4x, 4y)$

A: ① (1,2) → (1,-2)
② (1,-2) → (0.5,-1)
③ (0.5,-1) → (2,-4)

C (2, 6)
(1, 2) A
B (4, 1)

C: ① (2,6) → (2,-6)
② (2,-6) → (1,-3)
③ (1,-3) → (4,-12)

By what factor has the length of side AC changed after the final transformation?

A) $\frac{1}{2}$

B) 1

C) 2

D) 4

Part B

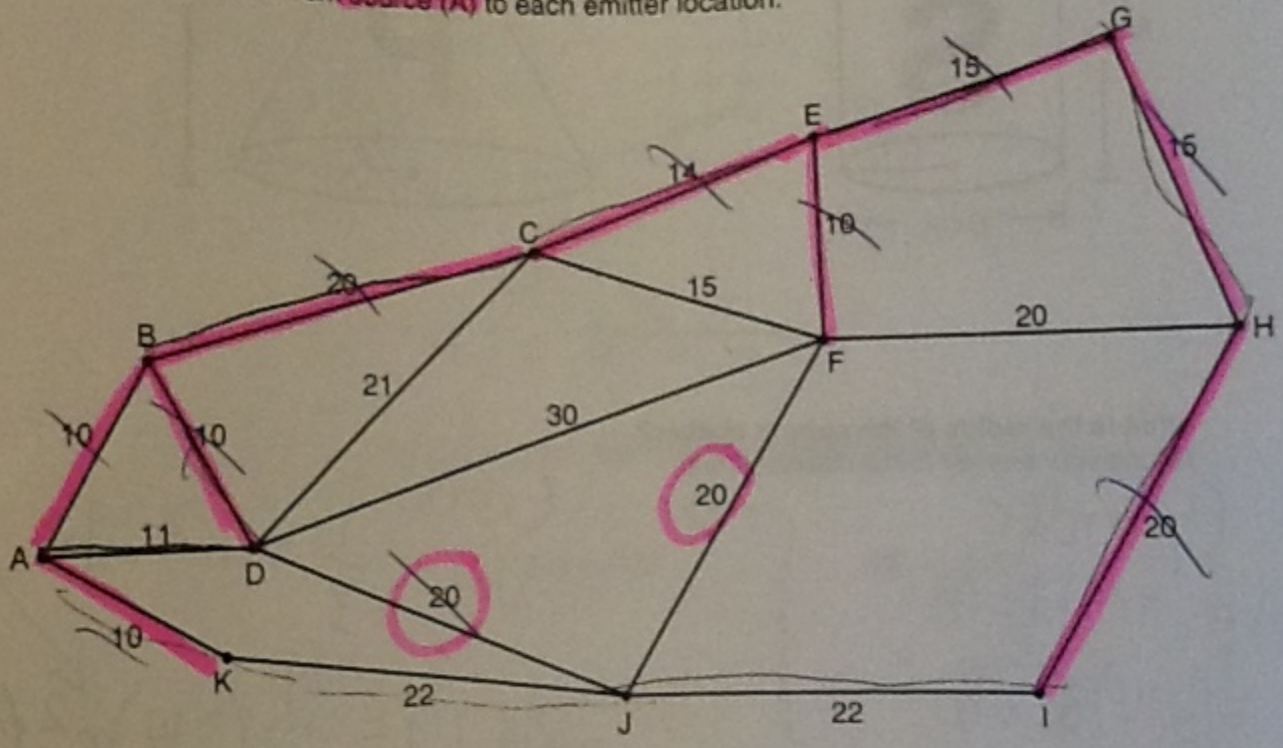
Questions 7 to 10

In the *Student Booklet*, write your answer in the space provided.

Each question is worth 4 marks.

TOPIC 2: GRAPH THEORY

7. Penny would like to install a crop irrigation system in her greenhouse. She draws up a plan (shown below) where each line represents a section of piping in metres and each point represents a water emitter (water exit) labeled using letters from B to K. The pipes must transport water from source (A) to each emitter location.



What is the minimum length of piping required to connect each emitter to the water source?

10 + 10 + 10 + 20 + 20 + 14 + 10 + 15 + 15 + 20 =

144

TOPIC 5 : EQUIVALENCY

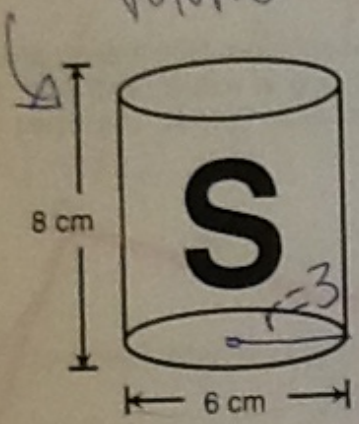
the ... volume

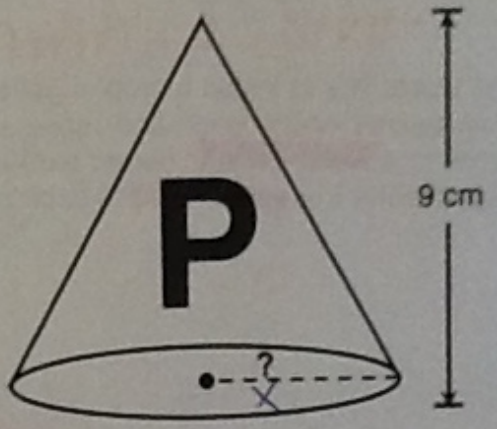
8. The salt and pepper shakers pictured below are equivalent solids.

The salt shaker is a cylinder with a diameter of 6 cm and a height of 8 cm.

The pepper shaker is a cone with a height of 9 cm.

Volume





What is the radius of the pepper shaker?
Round your answer to the nearest tenth.

Cylinder

$Vol = \pi r^2 \cdot h$

$= (3.14)3^2 \cdot 8$

$= 226.19$

or

226.08

Cone

$Vol = \frac{1}{3}\pi r^2 \cdot h$

$226.19 = \frac{9}{3}(3.14)r^2$

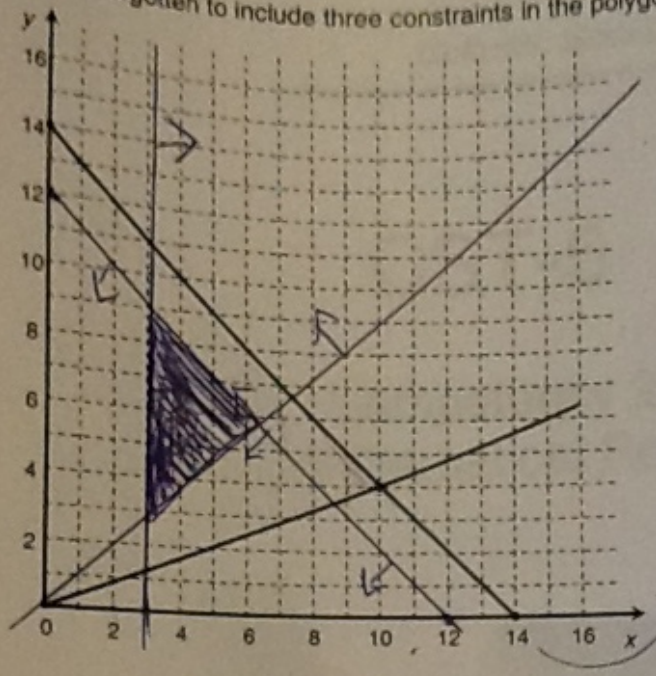
$\frac{226.19}{3\pi} = \frac{3\pi r^2}{3\pi}$

$\sqrt{24.01} = \sqrt{r^2}$

$4.90 = r$

TOPIC 1: OPTIMIZATION

9. Wendy has forgotten to include three constraints in the polygon of constraints below:



Add the following 3 constraints to the graph in the Student Booklet and indicate the resulting polygon of constraints.

i) $x \geq 3$ ii) $x + y \leq 12$ iii) $x - y \leq 0$

$x \leq y$

TOPIC 1: OPTIMIZATION

10. Students fundraise for their prom by selling two different types of cheese: Mozzarella and Cheddar. The mozzarella comes in a 450 g package and the cheddar in a 750 g package.

Each student is expected to sell at least twice as much mozzarella as cheddar. $x \geq 2y$

Each student must also sell at least 3 kg of cheese (1 kg = 1000 g).

Let x = the number of packages of mozzarella cheese
Let y = the number of packages of cheddar cheese

Translate the constraints that define this situation into inequalities.

$450x + 750y \geq 3000g$