

Part A (4 marks each)

Uniquely-identified page
NO PHOTOCOPIES!

1. Calculate

$$20 - 19 + 18 - 17 + \cdots - 3 + 2 - 1$$

(A) 9

(B) 10

(C) 11

(D) 12

2. Jack drove his sister Jill from home to the mall and then he drove back home. After spending 3 hours at the mall, Jill called her brother at home asking him to pick her up. It took Jack 30 minutes to drive from home to the mall and 45 minutes to drive back home from the mall. How long did Jack spend at home waiting for his sister's call?

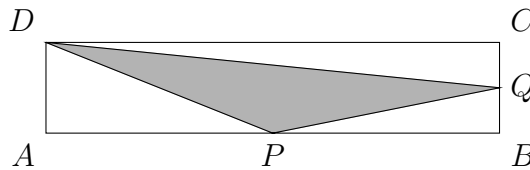
(A) 1 hour and 45 minutes.

(B) 2 hours and 15 minutes.

(C) 3 hours.

(D) 3 hours and 30 minutes.

3. In rectangle $ABCD$, AB is 20 cm long and BC is 4 cm long. P is the midpoint of AB and Q is the midpoint of BC . What is the area of triangle DPQ ?



(A) 20 cm^2

(B) 30 cm^2

(C) 40 cm^2

(D) 50 cm^2

Part A (4 marks each)

Uniquely-identified page
NO PHOTOCOPIES!

4. A teacher puts a square table next to a shaded circle drawn on the floor. She then divides the table surface into nine squares and numbers the squares as follows:

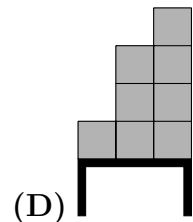
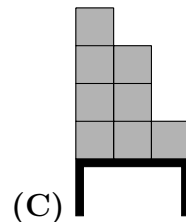
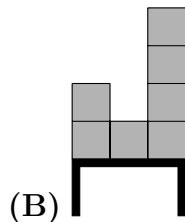
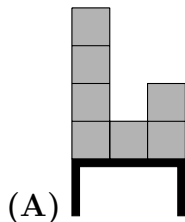
1	2	3
4	5	6
7	8	9



She then stacks equal-sized cubes on top of the numbered squares on the table as follows:

- Two cubes on square number 8.
- Three cubes on square number 2.
- One cube on square number 6.
- Four cubes on square number 1.

The teacher then asks Sam, a student, to stand on the shaded circle facing the cubes and asks him to draw what he sees. Which one of the following diagrams represents what Sam draws?



5. Martha got a piggy bank and started filling it with coins on January 1st. Every day, she puts as many dimes as the remainder of the division of the day of the month by 3. Also, on January 4 and every 4 days after she puts in 4 quarters. What is the probability that if she draws a coin on January 31st, after depositing the coins for the day, she will get a dime?

(A) $\frac{31}{59}$

(B) $\frac{1}{31}$

(C) $\frac{1}{28}$

(D) $\frac{61}{89}$



Part B (5 marks each)

Uniquely-identified page
NO PHOTOCOPIES!

6. Alice and Bill play a game. They go to separate rooms, flip a coin and try to predict what the other person flipped. They win if at least one of them predicts correctly. They decide that Alice will always guess the same thing that she flips and Bill will always predict the opposite of what he flips. What percentage of the time should they win?

- (A) 0% (B) 25% (C) 50% (D) 75% (E) 100%

7. What is the smaller angle between the two hands of a clock when it shows exactly 7:22?

- (A) 72° (B) 78° (C) 89° (D) 91° (E) 102°

8. Anna writes down all numbers from 1 to 100. How many times did she write the digit 2?

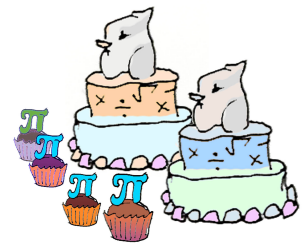
- (A) 18 (B) 19 (C) 20 (D) 21 (E) 22

Part B (5 marks each)

Uniquely-identified page
NO PHOTOCOPIES!

9. Adam is a cake supplier. He got an order to supply 26 large cakes and 800 cupcakes for a birthday party. However, he faced certain challenges. The kitchen was available only for 3 hours. Each chef could make either 2 large cakes or 35 cupcakes every hour. During any hour, chefs may work on cakes or cupcakes and then switch for later hour(s), if needed. Adam hired the minimum number of chefs needed to prepare the order. How many chefs did he hire?

(A) 11 (B) 12 (C) 13 (D) 35 (E) 36



10. A bag contains red, blue, green and orange marbles. The red marbles represent $\frac{1}{3}$ of the total number of marbles, the blue marbles represent $\frac{1}{5}$ of the total number of marbles and the green marbles represent $\frac{2}{7}$ of the total number of marbles. If the bag contains as few marbles as possible, how many orange marbles are there?

(A) 11 (B) 13 (C) 19 (D) 34 (E) 35

Part C (7 marks each)

Uniquely-identified page
NO PHOTOCOPIES!

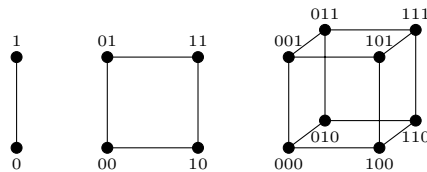
11. Alice types the fraction $\frac{30}{37}$ into an online calculator and it calculates the decimal form to thousands of decimal places. What is the sum of the first 2020 digits after the decimal?
(A) 6060 (B) 6061 (C) 6062 (D) 6063 (E) 6064 (F) 6065

12. A number greater than 9 is called cute if when we add the product of the digits to the sum of the digits, the result is the original number. For example 29 is cute since $2 + 9 + 2 \times 9 = 29$, but 513 isn't cute since $5 + 1 + 3 + 5 \times 1 \times 3 \neq 513$. How many cute numbers are there?
(A) 9 (B) 10 (C) 11 (D) 90 (E) 91 (F) Infinitely many.

Part C (7 marks each)

Uniquely-identified page
NO PHOTOCOPIES!

13. Gray codes are ways to assign a binary list of numbers to corners of a line segment, square or cube as shown. In every case, corners are joined if their Gray codes differ by exactly 1 digit.



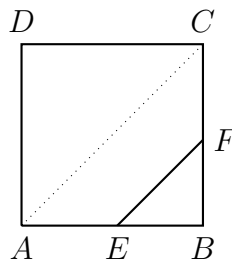
Imagine a hypercube, the 4-dimensional version of a cube, with 16 corners. A Gray code is used to label its corners. Alien Alice stands on corner 1010 of the hypercube, Alien Bob stands on corner 1011 and Alien Charlie stands on 0010. If each alien can only move to a corner joined to theirs or remain at their starting corner, is it possible for them to all meet at the same corner?

- (A) All 3 can meet after each moves to a nearby corner.
- (B) They can only meet if Alice doesn't move and the other 2 join her.
- (C) They can only meet if Bob doesn't move and the other 2 join him.
- (D) They can only meet if Charlie doesn't move and the other 2 join him.
- (E) They cannot meet, they are too far apart.
- (F) More than one of (B),(C),(D) is true.

Part C (7 marks each)

Uniquely-identified page
NO PHOTOCOPIES!

14. In the picture below, $ABCD$ is a square and EF is parallel to AC .



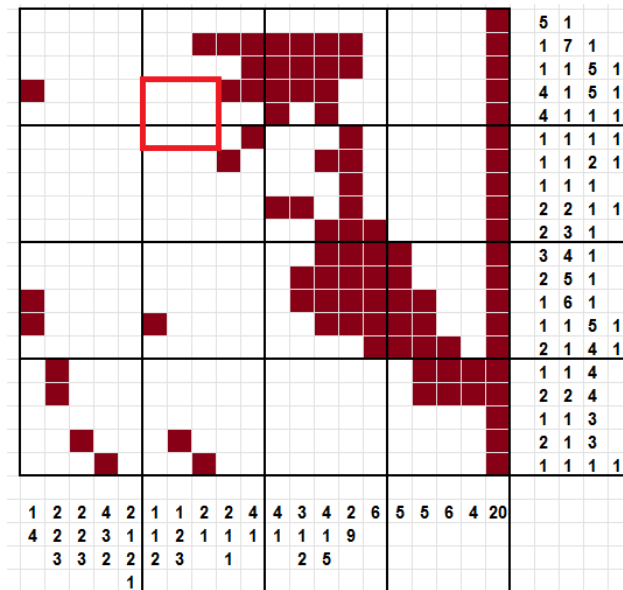
If the areas of $AEFCD$ and $ABCD$ are in a ratio of $8 : 9$, the ratio $EF : AB$ is

- (A) $1 : 2$ (B) $1 : 3$ (C) $1 : 6$ (D) $2 : 3$ (E) $1 : 1$ (F) $3 : 4$

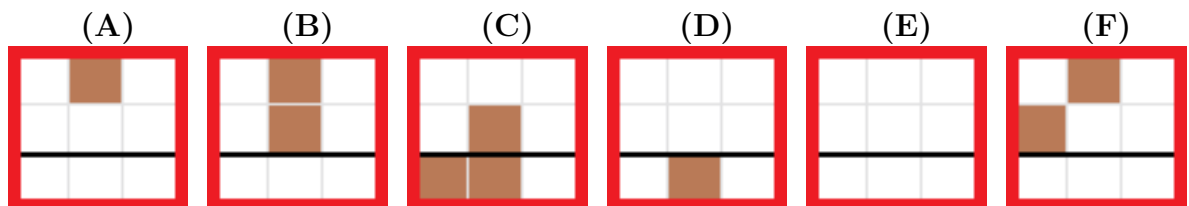
Part C (7 marks each)

Uniquely-identified page
NO PHOTOCOPIES!

15. A partially completed nonogram is shown in the picture below. Numbers along the sides describe blocks of shaded squares in that row/column; the numbers themselves show how many touching shaded squares are in each block; at least one blank square must be between blocks in each row/column.



What configuration is in the indicated 3x3 square?



Premier Sponsor



**Expertise. Insight.
Solutions.**

in association with 

Sponsors:

Actuarial Foundation of Canada
NSERC PromoScience
RBC Foundation

Government Sponsors:

Manitoba
New Brunswick
Nova Scotia
Nunavut
Ontario
Prince Edward Island