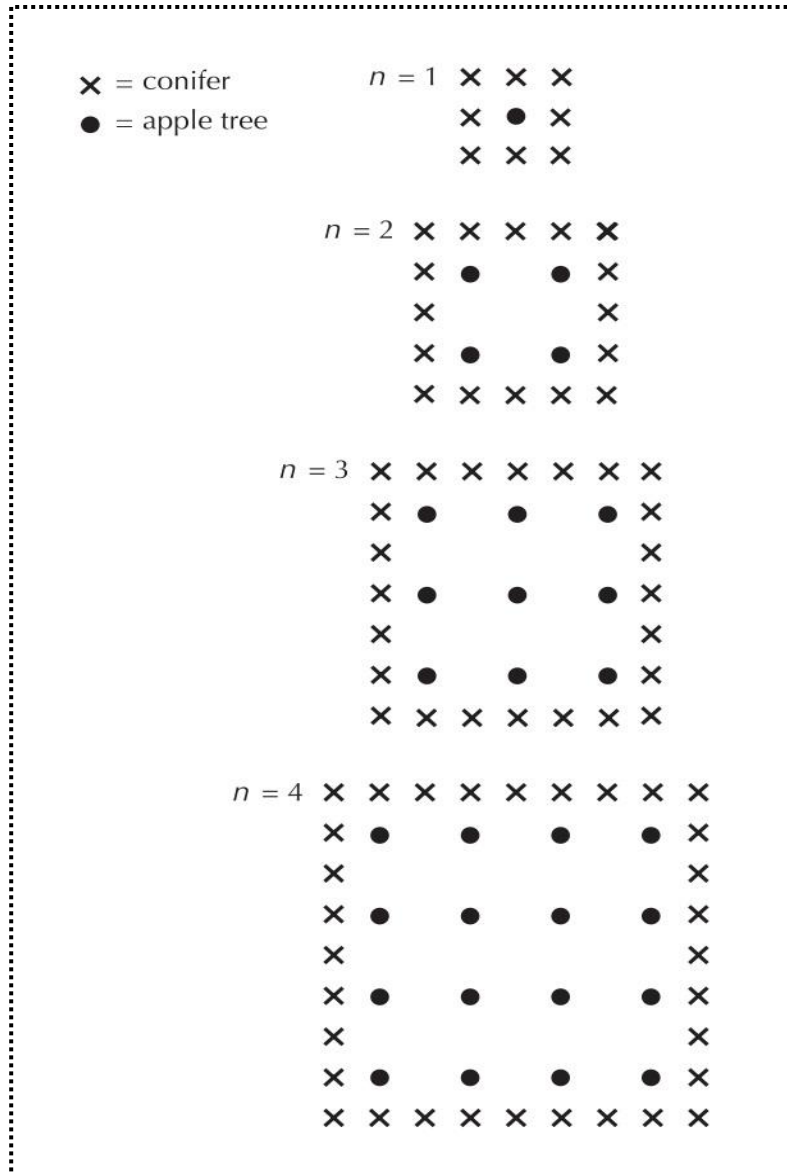


UNIT 01: APPLE ORCHARD

A farmer plants apple trees in a square pattern. In order to protect the apple trees against the wind he plants conifer trees all around the orchard.

Here you see a diagram of this situation where you can see the pattern of apple trees and conifer trees for any number (n) of rows of apple trees:



QUESTION 1: Complete the table:

n	Number of apple trees	Number of conifer trees
1	1	8
2	4	
3		
4		
5		

QUESTION 2: There are two formulae you can use to calculate the number of apple trees and the number of conifer trees for the pattern described on the previous page:

Number of apple trees = n^2

Number of conifer trees = $8n$

where n is the number of rows of apple trees.

There is a value of n for which the number of apple trees equals the number of conifer trees. Find the value of n and show your method of calculating this.

.....

.....

.....

QUESTION 3: Suppose the farmer wants to make a much larger orchard with many rows of trees. As the farmer makes the orchard bigger, which will increase more quickly: the number of apple trees or the number of conifer trees? Explain how you found your answer.

.....

.....


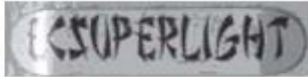



.....

UNIT 02: SKATEBOARD

Javed is a great skateboard fan. He visits a shop named SKATERS to check some prices.

At this shop you can buy a complete board. Or you can buy a deck, a set of 4 wheels, a set of 2 trucks and a set of hardware, and assemble your own board.

The prices for the shop’s products are:

Product	Price in zeds	
Complete skateboard	82 or 84	
Deck	40, 60 or 65	
One set of 4 Wheels	14 or 36	
One set of 2 Trucks	16	
One set of hardware (bearings, rubber pads, bolts and nuts)	10 or 20	

QUESTION 4: Javed wants to assemble his own skateboard. What is the minimum price and the maximum price in this shop for self-assembled skateboards?

- A. Minimum price:..... zeds.
- B. Maximum price: zeds.

QUESTION 5: The shop offers three different decks, two different sets of wheels and two different sets of hardware. There is only one choice for a set of trucks.

How many different skateboards can Javed construct?

- A. 6
- B. 8
- C. 10
- D. 12

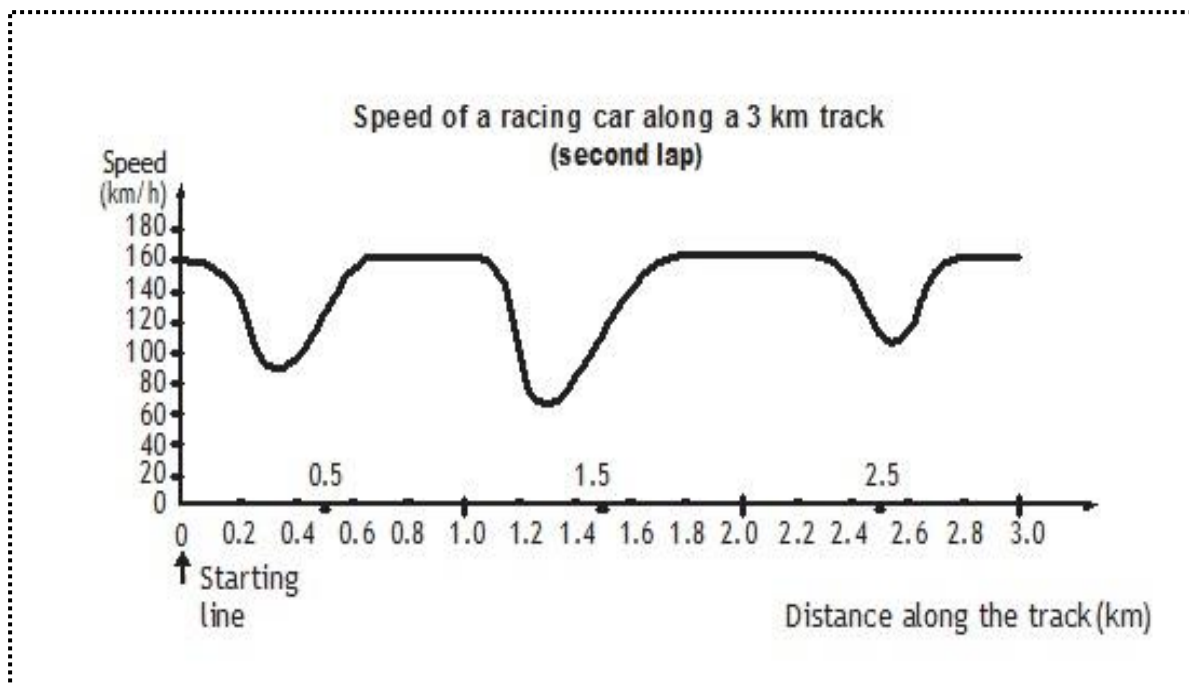
QUESTION 6:Javed has 120 zeds to spend and wants to buy the most expensive skateboard he can afford.

How much money can Javed afford to spend on each of the 4 parts? Put your answer in the table below.

Part	Amount (zeds)
Deck	
Wheels	
Trucks	
Hardware	

UNIT 03: SPEED OF RACING CAR

This graph shows how the speed of a racing car varies along a flat 3 kilometer track during its second lap.



Note: In memory of Claude Janvier, who died in June 1998. Modified task after his ideas in Janvier, C. (1978): The interpretation of complex graphs – studies and teaching experiments. Accompanying brochure to the Dissertation. University of Nottingham, Shell Centre for Mathematical Education, Item C-2. The pictures of the tracks are taken from Fischer, R. & Malle, G. (1985): Mensch und Mathematik. Bibliographisches Institut: Mannheim-Wien-Zurich, 234-238.

QUESTION 7: What is the approximate distance from the starting line to the beginning of the longest straight section of the track?

- A. 0.5 km
- B. 1.5 km
- C. 2.3 km
- D. 2.6 km

QUESTION 8: Where was the lowest speed recorded during the second lap?

- A. at the starting line.
- B. at about 0.8 km.
- C. at about 1.3 km.
- D. halfway around the track.

QUESTION 9: What can you say about the speed of the car between the 2.6 km and 2.8 km marks?

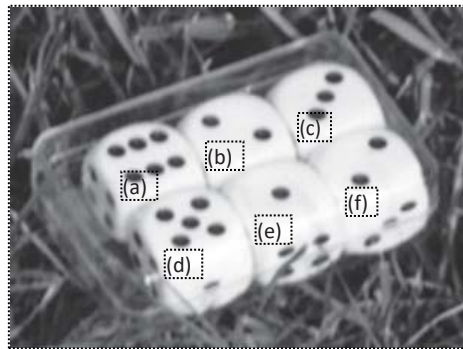
- A. The speed of the car remains constant.
- B. The speed of the car is increasing.
- C. The speed of the car is decreasing.
- D. The speed of the car cannot be determined from the graph.

UNIT 04: NUMBER CUBES

Dice are special number cubes for which the following rule applies:
The total number of dots on two opposite faces is always seven

QUESTION 10: In this photograph you see six dice, labelled (a) to (f).

Write in each box the number of dots on the bottom face of the dice corresponding to the photograph.



(a)	(b)	(c)
(d)	(e)	(f)

QUESTION 11: On the right, there is a picture of two dice.

You can make a simple number cube by cutting, folding and gluing cardboard. This can be done in many ways. In the figure below you can see four cuttings that can be used to make cubes, with dots on the sides.



Which of the following shapes can be folded together to form a cube that obeys the rule that the sum of opposite faces is 7? For each shape, circle either “Yes” or “No” in the table below.

I

II

III

IV

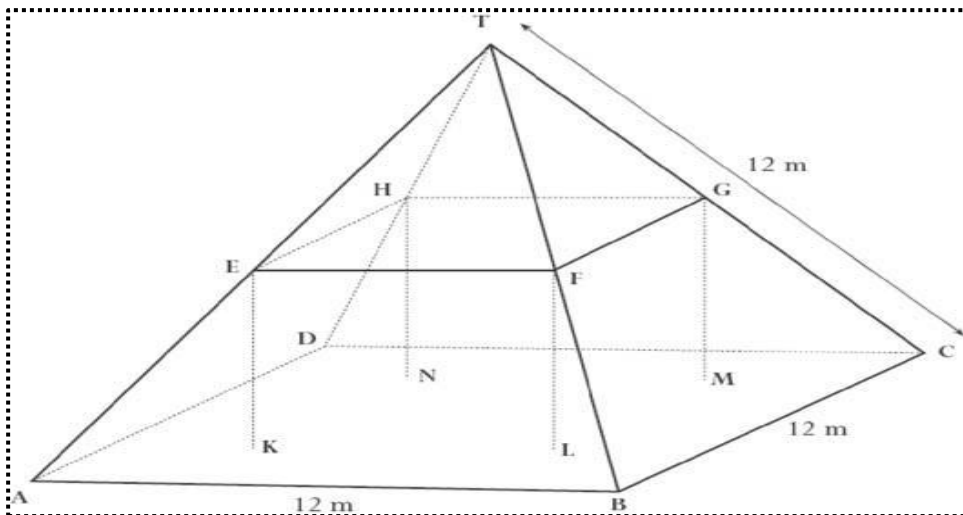
Shape	Obeys the rule that the sum of opposite faces is 7?
I	Yes / No
II	Yes / No
III	Yes / No
IV	Yes / No

UNIT 05: FARMS

Here you see a photograph of a farmhouse with a roof in the shape of a pyramid.



Below is a student’s mathematical model of the farmhouse **roof** with measurements added.



The attic floor, ABCD in the model, is a square. The beams that support the roof are the edges of a block (rectangular prism) EFGHKL MN. E is the middle of AT, F is the middle of BT, G is the middle of CT and H is the middle of DT. All the edges of the pyramid in the model have length 12m.

QUESTION12: Calculate the area of the attic floor ABCD.

The area of the attic floor ABCD = _____ m²

QUESTION 13: Calculate the length of EF, one of the horizontal edges of the block.

The length of EF = ____m

UNIT 06: EXCHANGE RATES

Myra from Singapore was preparing to go to South Africa for 3 months as an exchange student. She needed to change some Singapore dollars (SGD) into South African rand (ZAR).

QUESTION 14: Myra found out that the exchange rate between Singapore dollars and South African rand was: 1 SGD = 4.2 ZAR

Myra changed 3000 Singapore dollars into South African rand at this exchange rate. How much money in South African rand did Myra get?

.....

QUESTION 15: On returning to Singapore after 3 months, Myra had 3900 ZAR left. She changed this back to Singapore dollars, noting that the exchange rate had changed to:

1 SGD = 4.0 ZAR

How much money in Singapore dollars did Myra get?

.....

QUESTION 16: During these 3 months the exchange rate had changed from 4.2 to 4.0 ZAR per SGD.

Was it in Myra’s favour that the exchange rate now was 4.0 ZAR instead of 4.2 ZAR, when she changed her South African rand back to Singapore dollars? Give an explanation to support your answer.

.....

.....

UNIT 07: LICHEN

A result of global warming is that the ice of some glaciers is melting. Twelve years after the ice disappears, tiny plants, called lichen, start to grow on the rocks.

Each lichen grows approximately in the shape of a circle.

The relationship between the diameter of this circle and the age of the lichen can be approximated with the formula:

$$d=7.0 \times \sqrt{(t - 12)} \text{ for } t \geq 12$$

where d represents the diameter of the lichen in millimetres, and ‘t’ represents the number of years after the ice has disappeared.

QUESTION 17: Using the formula, calculate the diameter of the lichen, 16 years after the ice disappeared. Show your calculation.

.....
.....
.....

QUESTION 18: Alok measured the diameter of some lichen and found it was 35 millimetres. How many years ago did the ice disappear at this spot? Show your calculation.

.....
.....
.....

UNIT 08: CHOICES

QUESTION 19: In a pizza restaurant, you can get a basic pizza with two toppings: cheese and tomato. You can also make up your own pizza with extra toppings. You can choose from four different extra toppings: olives, capsicum, mushrooms and paneer.

Rashmi wants to order a pizza with two different extra toppings.

How many different combinations can Rashmi choose from?

.....

UNIT 09: EARTHQUAKE

QUESTION 20: A documentary was broadcast about earthquakes and how often earthquakes occur. It included a discussion about the predictability of earthquakes.

A geologist stated: “In the next twenty years, the chance that an earthquake will occur in Zed City is two out of three”.

Which of the following best reflects the meaning of the geologist’s statement?

- A. $\frac{2}{3} \times 20 = 13.3$, so between 13 and 14 years from now there will be an earthquake in Zed City.
- B. $\frac{2}{3}$ is more than $\frac{1}{2}$, so you can be sure there will be an earthquake in Zed City at some time during the next 20 years.
- C. The likelihood that there will be an earthquake in Zed City at some time during the next 20 years is higher than the likelihood of no earthquake.
- D. You cannot tell what will happen, because nobody can be sure when an earthquake will occur.