

## SESSION 15: SOLVING REAL WORLD PROBLEMS

### X-planation

In this session we practise solving real world problems that may involve applying your knowledge from different learning outcomes. You need to develop the skills necessary to solve these types of problems to do well in Paper 2 of the examination.

### X-amples

#### Question 1

Here is an example of information given to consumers about electricity costs for households in a city in South Africa. The amount of electricity used is given as a number of 'units'.

#### Domestic rate 1

33,28c/unit: a service charge of R1,46 per day applies whether electricity is consumed or not.

#### Domestic rate 2

45,99c/unit: would ideally be used if your consumption is below about 350 units per month. The service charge is *not* applicable to this rate.

**Note:** In all the questions that follow, we will consider a month that has 31 days in it.

- a) If a household used 380 units of electricity in a month and they were charged using Domestic rate 1, what would they have to pay for electricity (in Rands) for that month?  
(3)
- b) If a household used 380 units of electricity in a month and they were charged using Domestic rate 2, what would they have to pay for electricity (in Rands) for that month? (2)
- c) Write an equation that relates the monthly payment (in Rands) for electricity ( $P$ ) to the number of units of electricity consumed ( $N$ ):
  - i) for Domestic rate 1 (3)
  - ii) for Domestic rate 2. (2)
- d) There is one value for the number of units consumed per month where you will pay the same whether you are charged using Domestic rate 1 or Domestic rate 2. Use your two equations to work out which number of units per month this is. (4)

- f) The 'units' used for measuring electricity are kilowatt-hours (kW.h). One kilowatt-hour is the amount of electricity used by an appliance that uses 1 000 watts (W) of power if it runs for 1 hour. For example, a 100 W light bulb will use 1 kW.h in 10 hours.

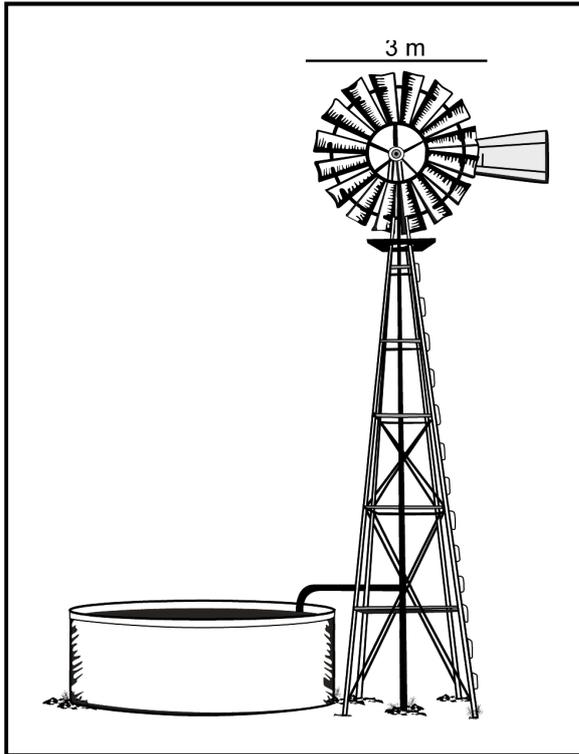
Copy and complete the following table that shows how the number of hours a light bulb will burn on 1 unit (kW.h) of electricity depends on the power rating of the bulb (W). Fill in the values for 'hours on 1 kW.h of electricity'.

Hours of burning ordinary light bulbs: relationship between power rating (W) and number of hours it will burn on 1 unit (1 kW.h)		
Power rating (W)	Rating (kW)	Hours on 1 kW.h of electricity
100	0,10	10
75	0,075	
40	0,04	

(4)

### Question 2

A windmill used for pumping water from underground consists of the circular windmill mounted on a tower as shown in the scale drawing below. The tower is constructed using four main poles that lean inwards and meet at the point that is at the centre of the windmill. The height of the tower excluding the blades is 9 m. The length of the windmill blades is 1,5m and the tail has to be 50% longer than the longest blade. The dam is 0,4m away from the structure.



- a) What is the circular area that is covered by the windmill when it is turning? (Area =  $\pi r^2$ ) (3)
- b) How far is the top of the windmill from the ground? (2)
- c) A cube with side length of 10 cm can contain exactly one 1 litre of water.
- d) What volume, in cubic metres, does 1 kilolitre of water occupy? (3)
- e) A farmer digs a borehole and installs a windmill to pump out the water. He needs to build a circular dam to store the water. This dam is in the form of a cylinder that has a diameter of 12 m. If the dam must be able to contain at least 180 kilolitres of water, how high should the walls of the dam be all around? (Volume of a cylinder =  $\pi r^2 h$ .) (4)
- f) If the dam is only 80% full, how many litres of water does it contain? (3)

**Question 3**

Mukala is busy building his new house. The length of the house is 11 m and the width is 6,10 m. The building is a double storey. The details below are found in his notebook

**TABLE 3**

STAGE OF WORK	LABOUR COST
1. Foundations	R5 500,00
2. Building of walls below the top floor	R7 000,00
3. Plastering of walls inside and outside below the top floor	R6 000,00
4. Preparing for throwing the concrete on the top floor	R4 500,00
5. Throwing the concrete on the top floor	R18 000,00
6. Building of support columns	R4 500,00
7. Roofing	R14 000,00
8. Electrical installation	R3 600,00
9. Building of walls on the top floor up to the roof	R9 000,00
10. Plastering of walls inside and outside on the top floor	R11 000,00

- (a) Express the cost of the most expensive stage of the work as a percentage of the total labour cost. (3)
- (b) The length of the top floor is 11 m; the width, including the balcony, is 7,60 m and the thickness is 17 cm. Calculate the volume of the concrete used for the top floor.  
Volume of a rectangular prism = length  $\times$  width  $\times$  height (4)
- (c) A cubic metre of concrete costs R850,00. How much did Mukala pay for the concrete for the top floor? (3)
- (d) If the maximum load of concrete that the lorry can carry is 6 m<sup>3</sup>, how many loads of concrete were delivered to pour the top floor? Explain your answer. (4)
- (e) The distance on the plan between two walls is 27,5 cm and the actual distance between the two walls is 11 m. What is the scale used on the plan? (4)
- (f) Mukala measures the height of the steps in his new house and finds that the height between two consecutive steps is the same. The first step is 15 cm above the floor, the second step is 30 cm above the floor, the third step is 45 cm above the floor, and the fifth step is 75 cm above the floor. What is the height of the 17<sup>th</sup> step above the floor? (3)

**Question 4**

Travellers to South Africa come from all over the world. A researcher in the tourism office of South Africa is interested in finding out more about the travellers who are from the rest of Africa as well as those from Europe.

She has collected the following information about the number of travellers arriving in South Africa from the rest of Africa and from Europe for each month in the year 2000.

**Group A:** From the rest of Africa

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
368 000	290 000	332 000	372 000	362 000	334 000	362 000	362 000	351 000	348 000	335 000	421 000

**Group B:** From Europe

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
90 000	103 000	95 000	89 000	67 000	44 000	67 000	76 000	79 000	109 000	106 000	99 000

- For both groups, calculate values for these statistics: mean, median, mode and range. (8)
- Which of the two groups has the larger number of travellers? How many times bigger is this group than the other? Explain how you know this. (3)
- Which statistic (mean, median or mode) should the travel agent use to determine the number of brochures she needs to print for one year? Explain why. (2)
- Draw a multiple bar chart that shows the number of travellers from the rest of Africa and from Europe. (5)
- Use your chart in question d) to answer the following question.  
If a South African travel agency needs to decide when to allow their staff to go off on holiday, which two months of the year would be the most appropriate if the travel agency deals mainly with travellers from:
  - The rest of Africa (1)
  - Europe? (1)

**X-ercise**

**QUESTION 1:** (Adapted from November Exam 2008 Paper 2)

Mrs Maharaj makes duvet sets, which she sells at the local street market at R150,00 per set (including VAT).

- If she makes 50 or less duvet sets per month, her production costs are R100,00 per set.
- If she makes more than 50 duvet sets per month, her production costs are reduced by 15% per set.

Mrs Maharaj has to pay R8 400 annually for the rental of her stall, and she has weekly transport costs of R75.

- (a) Mrs Maharaj prepares a monthly budget.
- (i) Show that her fixed cost for the month of February is R1 000,00. (2)
- (ii) How does her fixed cost for February compare to her average monthly fixed costs? Show ALL calculations. (5)
- (b) Calculate the production cost per duvet set if 90 sets are made per month. (2)
- (c) The table below shows Mrs Maharaj's production cost for different quantities of duvet sets made in February.

TABLE 1: Cost of duvet sets made in February

Number of duvet sets	0	30	50	51	56	60	70	<b>D</b>
Total cost per month (in rand)	1 000	4 000	6 000	5 335	5 760	6 100	<b>C</b>	7 800

The formula used to calculate the total cost is:

$$\text{Total cost} = \text{fixed monthly cost} + (\text{number of duvet sets} \times \text{cost per set})$$

Use the formula and the given information to determine the missing values **C** and **D**. (5)