# 1.6 Approximation and estimation

**1a.** *[1 mark]*

The width of a rectangular garden is 4.5 metres shorter than its length, which is  metres.

Write down an expression for the width of the garden in terms of .



**1b.** *[1 mark]*

The perimeter of the garden is 111 m.

Write down an equation for the perimeter of the garden in terms of .



**1c.** *[2 marks]*

Find the value of .



**1d.** *[2 marks]*

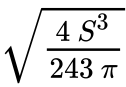
A gardener measured the length of the garden as 25 m.

Find the percentage error in his measurement.



**2a.** *[3 marks]*

The volume of a hemisphere, *V*, is given by the formula

*V* = ,

where *S* is the total surface area.

The total surface area of a given hemisphere is 350 cm.

Calculate the volume of this hemisphere in cm.

Give your answer correct to **one decimal place**.



**2b.** *[1 mark]*

Write down your answer to part (a) correct to the nearest integer.



**3a.** *[2 marks]*

Each year the soccer team, Peterson United, plays 25 games at their home stadium. The owner of Peterson United claimed that last year the mean attendance per game at their home stadium was 24500.

Based on the owner’s claim, calculate the total attendance for the games at Peterson United’s home stadium last year.



**3b.** *[2 marks]*

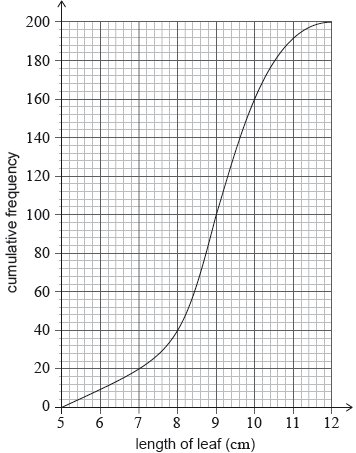
The actual total attendance last year was 617700.

Calculate the percentage error in the owner’s claim.



**4a.** *[1 mark]*

For a study, a researcher collected 200 leaves from oak trees. After measuring the lengths of the leaves, in cm, she produced the following cumulative frequency graph.



Write down the median length of these leaves.



**4b.** *[1 mark]*

Write down the number of leaves with a length less than or equal to 8 cm.



**4c.** *[2 marks]*

The researcher finds that 10% of the leaves have a length greater than  cm.

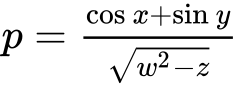
Use the graph to find the value of .

**4d.** *[2 marks]*

Before measuring, the researcher estimated  to be approximately 9.5 cm. Find the percentage error in her estimate.



**5a.** *[2 marks]*

Let ,

where  and .

Calculate the value of . Write down your full calculator display.



**5b.** *[2 marks]*

Write your answer to part (a)

(i)     correct to two decimal places;

(ii)     correct to three significant figures.



**6a.** *[1 mark]*

Passengers of Flyaway Airlines can purchase tickets for either Business Class or Economy Class.

On one particular flight there were 154 passengers.

Let  be the number of Business Class passengers and  be the number of Economy Class passengers on this flight.

Use the above information to write down an equation in  and .



**6b.** *[1 mark]*

On this flight, the cost of a ticket for each Business Class passenger was 320 euros and the cost of a ticket for each Economy Class passenger was 85 euros. The total amount that Flyaway Airlines received for these tickets was .

Use the information about the cost of tickets to write down a second equation in  and .



**6c.** *[2 marks]*

Find the value of  and the value of .



**6d.** *[2 marks]*

The airline’s finance officer wrote down the total amount received by the airline for these tickets as .

Find the percentage error.



**7a.** *[2 marks]*

One of the locations in the  Olympic Games is an amphitheatre. The number of seats in the first row of the amphitheatre,  , is . The number of seats in each subsequent row forms an arithmetic sequence. The number of seats in the sixth row,  , is .

Calculate the value of the common difference, .



**7b.** *[2 marks]*

There are  rows in the amphitheatre.

Find the **total** number of seats in the amphitheatre.



**7c.** *[2 marks]*

Anisha visits the amphitheatre. She estimates that the amphitheatre has  seats.

Calculate the percentage error in Anisha’s estimate.



**8a.** *[3 marks]*

Assume the Earth is a perfect sphere with radius 6371 km.

Calculate the volume of the Earth in . Give your answer in the form , where  and .



**8b.** *[3 marks]*

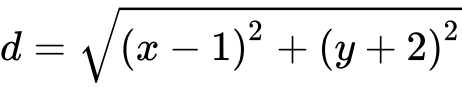
The volume of the Moon is .

Calculate how many times greater in volume the Earth is compared to the Moon.

Give your answer correct to the nearest **integer**.



**9a.** *[1 mark]*

The distance  from a point  to the point  is given by 

Write down your answer to **part (a)** correct to three significant figures.



**9b.** *[2 marks]*

Write down your answer to **part (b)** in the form , where  and .



**10a.** *[3 marks]*

Minta deposits 1000 euros in a bank account. The bank pays a nominal annual interest rate of 5%, **compounded quarterly**.

Find the amount of money that Minta will have in the bank after 3 years. Give your answer correct to two decimal places.



**10b.** *[3 marks]*

Minta will withdraw the money from her bank account when the interest earned is 300 euros.

Find the time, in years, until Minta withdraws the money from her bank account.

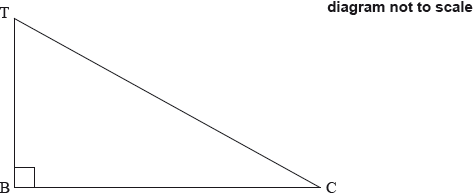


**11a.** *[2 marks]*

Fabián stands on top of a building, T, which is on a horizontal street.

He observes a car, C, on the street, at an angle of depression of 30°. The base of the building is at B. The height of the building is 80 metres.

The following diagram indicates the positions of T, B and C.



Show, in the appropriate place on the diagram, **the values** of

(i)     the height of the building;

(ii)     the angle of depression.



**11b.** *[2 marks]*

Find the distance, BC, from the base of the building to the car.



**11c.** *[2 marks]*

Fabián estimates that the distance from the base of the building to the car is 150 metres. Calculate the percentage error of Fabián’s estimate.



**12a.** *[4 marks]*

Mandzur, a farmer, takes out a loan to buy a buffalo. He borrows 900 000 Cambodian riels (KHR) for 2 years. The nominal annual interest rate is 15%, compounded **monthly**.

Find the amount of the **interest** that Mandzur must pay. Give your answer correct to the nearest 100 KHR.

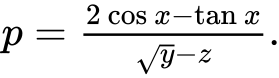


**12b.** *[2 marks]*

Write down your answer to part (a) in the form .



**13a.** *[2 marks]*

Let 

Calculate the value of  when ,  and . Write down your full calculator display.

**13b.** *[4 marks]*

Write down your answer to part (a)

(i)     correct to two decimal places;

(ii)     correct to four significant figures;

(iii)     in the form , where .

**14a.** *[1 mark]*

Ludmila takes a loan of 320 000 Brazilian Real (BRL) from a bank for two years at a nominal annual interest rate of 10%, **compounded half yearly**.

Write down the number of times interest is added to the loan in the two years.

**14b.** *[3 marks]*

Calculate the **exact** amount of money that Ludmila must repay at the end of the two years.

**14c.** *[2 marks]*

Ludmila estimates that she will have to repay  BRL at the end of the two years.

Calculate the percentage error in her estimate.

Printed for SANSKAR SCHOOL

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