

RADLEY

Scholarship Examination

MATHEMATICS II

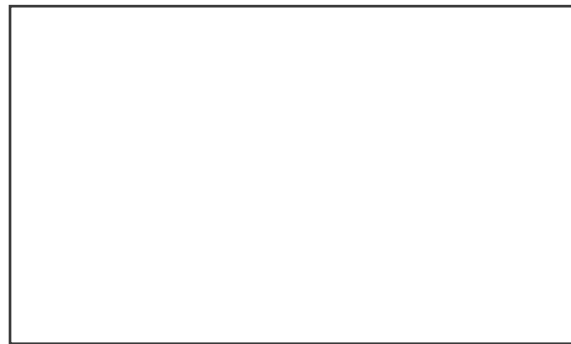
2025

Time allowed – 1 hour

Show all working

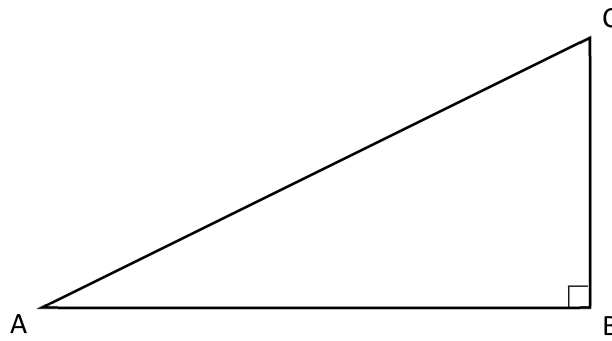
Calculators may be used

1. a. At a wine shop a customer buys five bottles of white wine and three bottles of red wine for a total cost of £98. Another customer buys seven bottles of white wine and four bottles of red wine for a total cost of £136. I wish to buy four bottles of white wine and four bottles of red wine. How much will I pay? You should assume that all the bottles of white wine are the same price, as are all the bottles of red wine.
- b. The diagram below shows a rectangle. If we increase both its length and its breadth by 2 cm, then the area of the original rectangle is increased by 54cm^2 . Find the perimeter of the original rectangle.

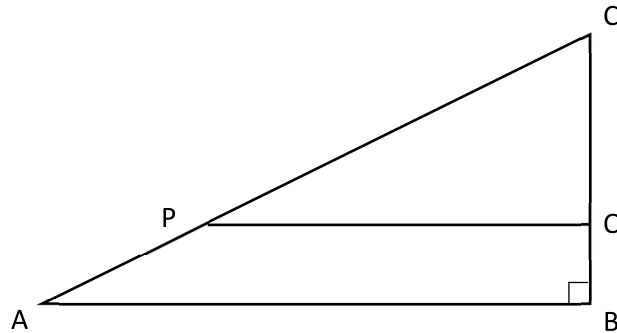


2. a. The price of a coat is reduced by 25% in a sale. Given the original price is £242, calculate the sale price.
- b. The height of a tree increases by 20% over a period of 5 years. In 2025 it is 39 meters high. How high was it in 2020?
- c. The value of a car depreciates by 12% each year. It is now worth £30 000. After how many years will it first be worth less than £10 000?

3. A right-angled triangle, ABC has length AC = 20cm and AB = 16cm.



- By first calculating the length BC, work out the area of the triangle
- The triangle is split in two by drawing a line PQ parallel to the base, AB. The area of the triangle CPQ is equal to the area of the trapezium ABQP. Calculate the length PQ.



4. A car drives a journey of 200km at an average speed of $v \text{ kmh}^{-1}$.
- Find an expression, in terms of v , for the time taken, in hours, for the car to complete the journey.

A moped completes the same journey at an average speed that is 12 kmh^{-1} slower than the car.

- Find an expression, in terms of v , for the time taken, in hours, for the moped to complete the journey.

It takes the moped 50 minutes longer than the car to complete the journey.

- Use this information to write down an equation for v .
- Solve this equation to find the value of v .

5. The sum of the integers between 1 and n inclusive is given by the formula

$$\frac{n(n+1)}{2}$$

So, for example, $1 + 2 + 3 + 4 + 5 = \frac{5(5+1)}{2} = 15$.

- a. Show that the sum of the integers between 1 and 20 inclusive, ie: $1 + 2 + 3 + \dots + 20 = 210$
- b. Find $1 + 2 + 3 + \dots + 200$
- c. Find $2 + 4 + 6 + \dots + 200$
- d. Find $1 + 3 + 5 + \dots + 199$

The sum of the integers squared between 1 and n inclusive is given by the formula

$$\frac{n(n+1)(2n+1)}{6}$$

So, for example, $1^2 + 2^2 + 3^2 + 4^2 + 5^2 = \frac{5(5+1)(10+1)}{6} = 55$

- e. Find $1^2 + 2^2 + 3^2 + \dots + 100^2$
- f. Find $51^2 + 52^2 + 53^2 + \dots + 100^2$
- g. Find $2^2 + 4^2 + 6^2 + \dots + 100^2$

6. For a positive integer n , $n!$ is defined as the product of all of the integers between 1 and n inclusive.

So, for example, $4! = 1 \times 2 \times 3 \times 4 = 24$.

a. Work out each of the following:

i $6!$

ii $\frac{20!}{19!}$

iii $\frac{100!}{98!}$

iv $\frac{100! + 101!}{102!}$

- b. Given that $\frac{n! + (n+1)! + (n+2)!}{n!} = 10\,000$, find the value of n .