



Challenge paper

Calculators allowed

Total Marks: 100

These questions are tough!

Rough working is strongly suggested before writing neat solutions in the spaces provided.

Section 1: Tough level 5 - 9 questions

- Constitutes 75 marks
- GCSE and IGCSE style level 8/9/9+ questions

Section 2: The challenge zone

- Constitutes 25 marks
- Not to be underestimated!
- All questions solvable with KS3/4 methodology

Section 1: Level 8/9 (and a little beyond)

- 1) Showing your working, express $A + B$ as a product of its prime factors:

$$A = 2^2 \times 3 \times 13 \times 17^2$$

$$B = 2^3 \times 5 \times 13 \times 17$$

(3 marks)

- 2) Evaluate $\frac{3^{111} - 3^{110}}{3^{109} + 3^{107}}$

(3 marks)

[illegible]

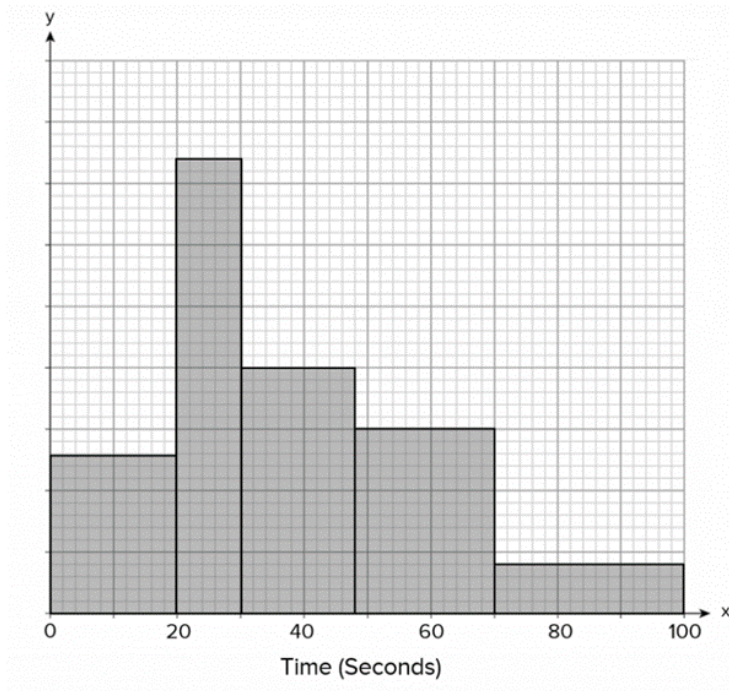
Over 1400 similar questions, and answers to all found at www.mathsadvance.co.uk

- If you are taking into account the order of the dice rolls, in how many ways could he have rolled the dice?

[illegible]

Over 1400 similar questions, and answers to all found at www.mathsadvance.co.uk

- 5) The histogram below shows the time taken for customers to be seated after entering a restaurant.



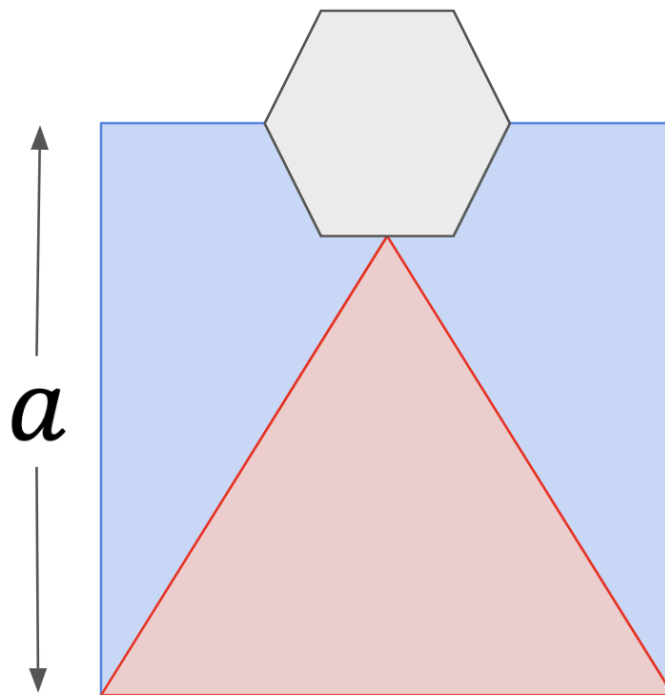
Two consecutive bars represent frequencies of 144 and 132 respectively. What are the frequencies of the other three bars?

[illegible]

(5 marks)

6) The diagram below shows:

- A purple square of side length a
- A red equilateral triangle sharing two vertices with the square
- A grey regular hexagon which has the top side of the square as a line of symmetry.



Show that the area of the grey hexagon, A is such that:

$$A = (m\sqrt{3} + n)a^2 \text{ where } m \text{ and } n \text{ are constants to be determined.}$$

(8 marks)

9) Find the value of x such that:

$$6^x = (6^{50} + 9)^2 - (6^{50} - 9)^2$$

[illegible]

(5 marks)

10) A dice is rolled 3 times and it is given that the first roll was a 6.



*AI generated image

What is the probability that each proceeding roll is less than the previous roll?

This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and extend across the width of the page. There are no margins, text, or other markings on the paper.

(4 marks)

11) Consider two plates of chocolate truffles.

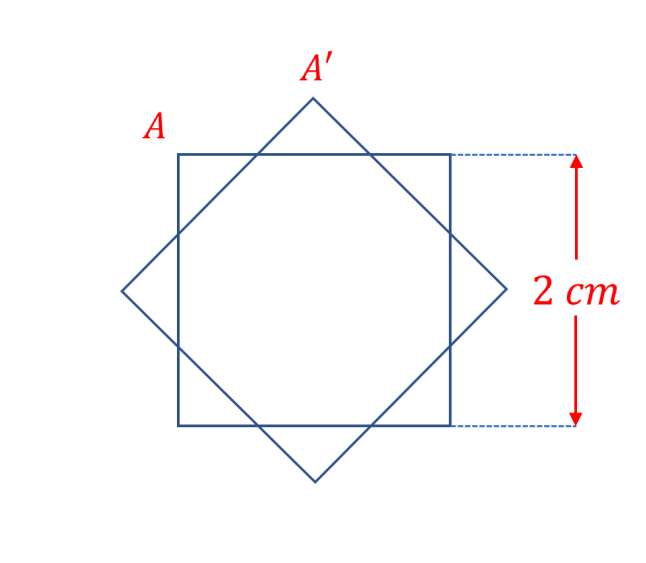
One has m chocolates on it, the other has n chocolates, where $n > m$, and both numbers are odd.

What is the minimum number of chocolates that need to be moved from the plate with n chocolates to the plate with m chocolates for there to be now more on the second plate?

This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

(4 marks)

- 13) The diagram below shows a square of side length 2 cm.



The square is rotated 45° about its centre, moving the corner at A to A' .

Calculate the distance between A and A' correct to three significant figures.

(5 marks)

-

Combined surface area = $160\pi \text{ cm}^2$

[illegible]

Over 1400 similar questions, and answers to all found at www.mathsadvance.co.uk

- At what time was the second recording taken?

[illegible]

Over 1400 similar questions, and answers to all found at www.mathsadvance.co.uk

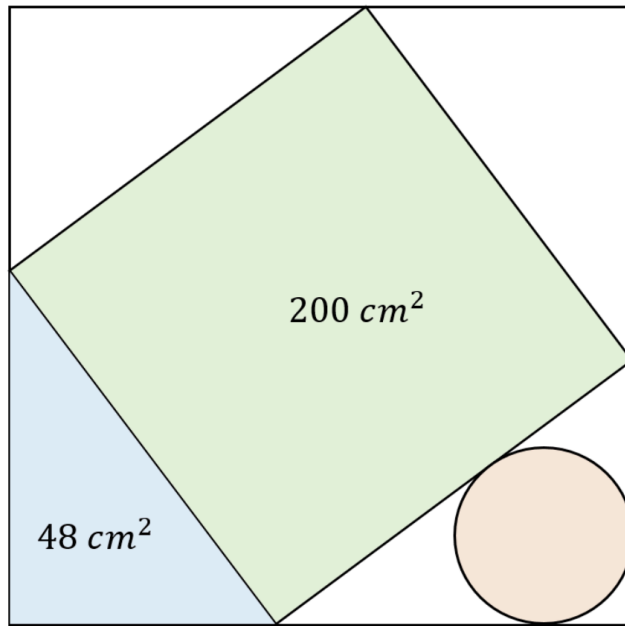
Section 2: The challenge zone

- 16) A triangle is made by randomly selecting three integers between 1 and 5 inclusive, and making these the side lengths of the triangle. If a trio is selected that doesn't obey the [triangle inequality](#) then another trio is selected.

What is the probability that the largest angle in the triangle is greater than 90 degrees?

(8 marks)

- 17) The diagram below shows a square, circle and right-angled triangle inside a larger square.



Show that the area of the circle is $8\pi \text{ cm}^2$.

This image shows a blank sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

(8 marks)

18) Given that $2581 = 29 \times 89$ solve for positive integers a and b :

$$a^4 = \frac{2581 - b^4}{4}$$

This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

(9 marks)