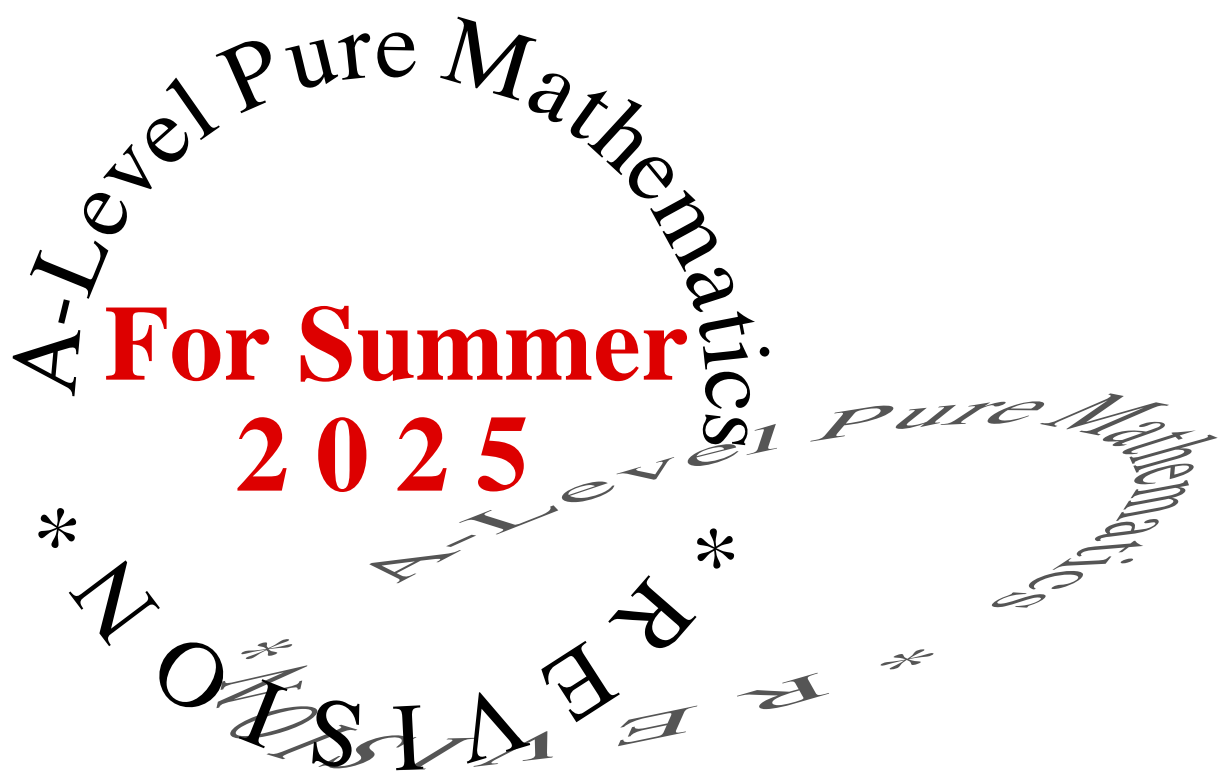


# GRADE GRABBER

Numbers 1 to 5

(With answers)



# Grade Grabber 1

*Any solution based entirely on graphical  
or numerical methods is not acceptable*

Marks Available : 34

## Question 1

Given that

$$\sum_{m=1}^k (7m + 3) = 777$$

determine the value of the integer constant  $k$

[ 4 marks ]

## Question 2

Sid claims that it's always true that

$$x^2 < (x + 1)^2$$

Exhibit a counter-example that shows Sid's claim is not true

[ 2 marks ]

**Question 3**

The equation

$$5x^2 + k = 3x + 7$$

has two distinct real roots.

Find the range of possible values for  $k$ .

[ 4 marks ]

**Question 4**

A circle of radius  $r$  cm is divided by two radii into two sectors.

The smaller sector has perimeter  $(2r + 4)$  cm and the larger sector has area  $12 \text{ cm}^2$ .

Calculate the value of  $r$  correct to 3 decimal places.

[ 6 marks ]

**Question 5**

- ( i )      Use the binomial theorem to write  $\frac{1}{(1-x)^3}$  as a polynomial, in ascending powers of  $x$ , up to and including the term in  $x^3$

[ 4 marks ]

- ( ii )      By spotting a connection with the triangular numbers, state the coefficient in the expansion of  $x^8$

[ 2 marks ]

**Question 6**

Given that

$$f(x) = e^{5x} - 1, \quad x \in \mathbb{R}$$

find  $f^{-1}(x)$  and state its domain.

[ 4 marks ]

**Question 7**

With respect to a fixed origin  $O$ , the points  $A$  and  $B$  have coordinates  $(-4, 0)$  and  $(12, 12)$  respectively.

The mid-point of  $AB$  is  $M$ .

Find an equation of the line in the plane of the coordinate axes  $Ox$  and  $Oy$  which passes through  $M$  and is perpendicular to  $AB$ .

Hence, or otherwise, find, in cartesian form, an equation of the circle which passes through  $O$ ,  $A$  and  $B$ .

[ 8 marks ]

This document is a part of a **Mathematics Community Outreach Project** initiated by Shrewsbury School

It may be freely duplicated and distributed, unaltered, for non-profit educational use

In October 2020, Shrewsbury School was voted "**Independent School of the Year 2020**"

© 2025 Number Wonder

Teachers may obtain detailed worked solutions to the exercises by email from [MHHShrewsbury@Gmail.com](mailto:MHHShrewsbury@Gmail.com)