

Mathematics pre-arrival task - 2021

DESCRIPTION:

During the next few exciting years at university we aim to help you develop the skills and knowledge you need to embark on your chosen career. To help you start out on the right foot we would like you to attempt a few tasks before you arrive. You will be given the opportunity to discuss these during the initial meetings with your tutor at the beginning of term. **Please note that this is not a test.**

Task A:

In mathematics it is often helpful to find a simple approximation to a complicated function. Now, x^n gets smaller as n gets larger if $|x| < 1$. If x is small enough then you can sometimes ignore large powers of x to approximate a function or estimate its value.

- Find the first 4 terms of the binomial expansion, in ascending powers of x of

$$\left(1 - \frac{x}{10}\right)^{10}.$$

- Use your approximation to estimate 0.98^{10} .

Task B:

Circle geometry is used in many applications e.g. meteorologists use geostationary satellites to look at the Earth. Geostationary orbits are circular orbits.

The points $A(0, 2)$, $B(6, 2)$ and $C(4, 2 - \sqrt{8})$ lie on the circumference of a circle.

- Show that AB is the diameter of the circle.
- Find the equation of the circle

Task C:

Log functions and exponential functions are used to model all kinds of physical phenomenon like population growth, interest rates and radioactive decay, to name but a few.

A radioactive isotope decay is modelled by the following formula

$$R = 180e^{kt}, \quad t \geq 0,$$

where R is the measure of radioactive decay (counts per minute) at t days, and k is a constant.

- Explain why k is negative.
- Sketch the graph of R against t .
- After 50 days the radioactive count is 100 counts per min. Find the value of k .
- The rate of decay can be modelled by a simple differential equation, can you write it down?
- Find the half-life of the radioactive isotope.

Contact and Support:

During induction week you will meet your personal tutor. Please email olga.kaplunov@brunel.ac.uk regarding support for these tasks over the summer period.

Deadline:

Please have these tasks attempted by Monday the 27st September 2021.