SIT190 - MAGI - WEEKS 9-10 - ONTRACK ASSESSMENT

TRIMESTER 1, 2024

Task 1: Integration

Another application of integration is in probability. This task applies your algebra and calculus skills to this domain.
If X is a continuous random variable with range $[a, b]$ then the probability density function satisfies the following two properties:

Property 1: $f(x) \geq 0$ for all $x \in [a, b]$.

Property 2: $\int_a^b f(x)dx = 1$.

Question 1

(1) Explain why the following functions are, or are not, probability density functions:

(a) $f(x) = \frac{7}{x}$ for $x \in [1, e^{0.5}]$

(b) $f(x) = \frac{1}{8}\left(16 - x^4\right)$ for $x \in [0, 4]$

(c) $f(x) = \frac{7}{3}\sin(x)$ for $x \in [0, 5\pi]$

1. Task 2:

Sketch the graphs $y = \sin(x)$ and $y = \cos(x)$ for the domain $x \in [0, 2\pi]$ shading the areas between the curves. Find the total area of the regions between the curves in this domain.

Submission

In order to complete this task, you must submit the following:

- For each function in Task 1, you must do one of the following:
  - Show that one of the properties does not hold, and so $f(x)$ is not a probability density function
  - Show that both properties hold and so $f(x)$ is a property density function.
- For the function in Task 2,
  - Sketch the graphs providing all working to find where the two graphs intersect.
  - Shade the regions between the curves.
  - Find the total area of these regions.

Useful Resources

This task can be completed by using the skills gained in this unit and the information in the grey boxes.

2. Further Thoughts

Further Thoughts

"Mathematics is a more powerful instrument of knowledge than any other that has been bequeathed to us by human agency." (Descartes)