1.21

Thursday, January 21, 2021 7:34 PM

Welcome to the TUT0115A

Hanchun Wang
Stephen
Mathematics Physics Specialist

The Tut will start at 8:10.

On the top of the screen, "View Options" / "Annotate"

I will answer your general questions at the beginning and then discuss some problems together.

Please feel free to ask any questions. You are encouraged to open your mic and camera to get to know each others!

There is a feedback form at the end that you can provide me any of your thought about this tutorial.

Indicate on the map where you're currently at (View Options → Annotate)

1

What would you really appreciate that we do in this tutorial?

2

Module A3: Partial Fractions

Calculate the integral of $f(x) = \frac{1}{x^n(x-a)}$ where n is a positive integer and $a \neq 0$.

Hint 1: Try this out for various values of n and see if you notice a pattern.

Hint 2: Find the coefficient A of $\frac{1}{x-a}$, subtract $\frac{A}{x-a}$ from $f(x)$, simplify the resulting difference, and use the fact that $x^n - a^n = (x-a)(x^{n-1} + x^{n-2}a + \cdots + xa^{n-2} + a^{n-1})$.

Q1. $f_{ind} = \int \frac{dx}{x^n(x-a)} =$

first way: Series expansion on $\frac{1}{x-a}$, be careful near $x=a$.

$$\frac{1}{x-a} = \sum_{i=0}^{\infty} x^{n} \cdot (-1) \cdot a^{-(n+1)}$$

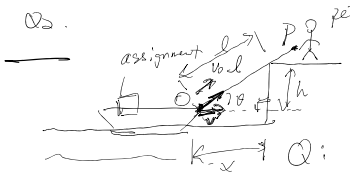
$$\int x^{-n} \cdot \frac{1}{x-a}\, dx = \int x^{-n} \left(\sum_{i=0}^{\infty} x^{i} (-1) \cdot a^{-(i+1)} \right) dx$$

$$= -\sum_{i=0}^{\infty} \int x^{i-n} \cdot a^{-(i+1)}\, dx$$

be careful around $i=n$.

$$\frac{n\left[1-\frac{a}{x}\right]}{a^n} + \sum_{i=1}^{n-1} \frac{1}{ia^{n-i}x^i} + C$$

Q2.



V_0 is const.

V is the speed that boat gets close to peter.

Q: what is v in v_0 and θ?

is the boat moves in constant speed accelerating? slower? $V = V_0 \cdot \cos\theta$?

$V = V_0 \cdot \cos\theta$? X Wrong. $\Rightarrow V = \frac{x}{t}$ &

1. First, step: Find some relationship that holds

$$\left\{ \frac{dx}{dt} = V,\ \frac{dl}{dt} = V_0 \right\}, \quad x^2 + h^2 = l^2 \quad (1)$$

take derivative on (1) both side.

$$2x\frac{dx}{dt} + 2h\frac{dh}{dt} = 2l\frac{dl}{dt}$$

to. not true!
all the

then $\frac{d\theta}{dt} = 0$

$$x \cdot \frac{dx}{dt} = l \cdot \frac{d\theta}{dt}$$

$$x \cdot v = l \cdot v_0$$

$$v = \frac{l}{x} v_0 = \boxed{\frac{v_0}{\cos\theta}}$$ doesn't

2. tell how the boat moves,

as $x \downarrow$, $\theta \uparrow$ co

accelerating.

t follow our intuition