

THE TEMPERATURE DISTRIBUTION IN THE PLATE IS MODELED BY THE HEAT EQUATION.

FOR THIS PROBLEM, WE'RE LOOKING FOR THE STEADY STATE SOLUTION, SO THE TIME DERIVATIVE IS ZERO.

WE'RE LEFT WITH THE LAPLACIAN OF TEMPERATURE, SUBJECT TO DIRICHLET BOUNDARY CONDITIONS ON EACH SIDE. THE LEFT AND BOTTOM EDGES ARE AT A CONSTANT VALUE OF ZERO, WHILE THE TOP AND RIGHT EDGES HAVE A VALUE OF ONE.

LIKE THE UNSTEADY HEAT EQUATION IN ONE DIMENSION, THIS TYPE OF PROBLEM HAS A SEPARABLE SOLUTION.

WE ASSUME THE SOLUTION T IS A PRODUCT OF TWO FUNCTIONS, X AND Y , WHICH ARE ONLY FUNCTIONS OF X AND Y , RESPECTIVELY.

SUBSTITUTION INTO THE HEAT EQUATION REDUCES THE TWO PARTIAL DERIVATIVE TERMS INTO TOTAL DERIVATIVES.

REARRANGING, WE HAVE X DOUBLE-PRIME OVER X IS EQUAL TO NEGATIVE Y DOUBLE-PRIME OVER Y .

$$\frac{\partial^2 T}{\partial x^2} + \frac{\partial^2 T}{\partial y^2} = 0$$

NOW, THE LEFT HAND SIDE IS PURELY A FUNCTION OF X , WHILE THE RIGHT HAND SIDE IS PURELY A FUNCTION OF Y . SINCE THIS MUST HOLD FOR ALL VALUES OF X AND Y , WE CAN CONCLUDE THAT EACH SIDE IS EQUAL TO THE SAME CONSTANT.

THIS ARBITRARY CONSTANT, K , IS CALLED THE SEPARATION CONSTANT.

Assume separable

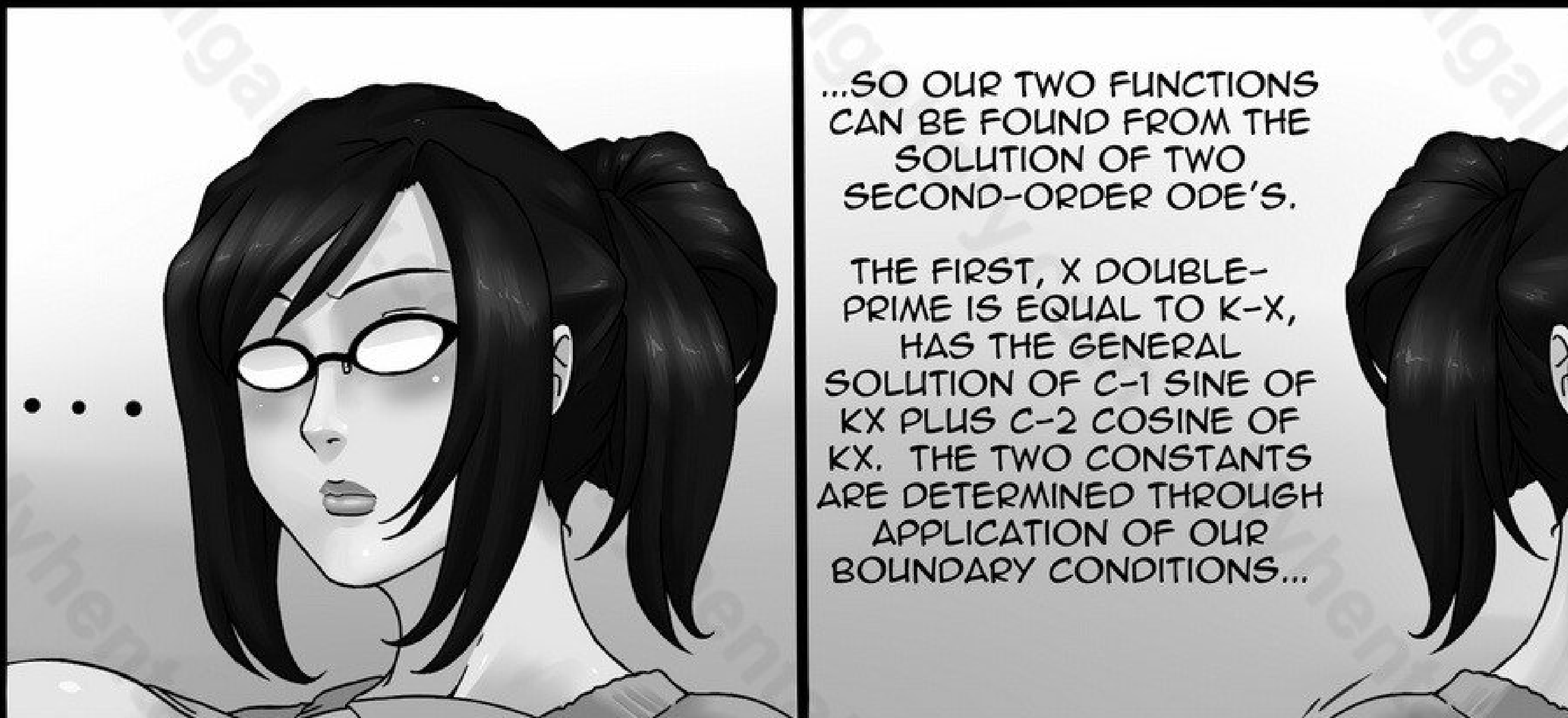
$$T(x,y) = X(x)Y(y)$$

Substitute:

$$X''(x)Y(y) + X(x)Y''(y) = 0$$

$$Y'' = -K^2 Y$$

$\sin$







LOVELY! YOU'RE AWAKE!

NO NEED TO PANIC.

REALLY... THIS IS A
WONDERFUL OPPORTUNITY
FOR YOU!

WITH THAT POMPOUS
ASS MONROE, YOU'D BE
LITTLE MORE THAN A
GUINEA PIG!

WOULDN'T WANT YOU
TO MISS THE START. I
HAVE SUCH PLANS!

WITH ME, THOUGH,
YOU'LL HELP TO USHER
IN A NEW ERA FOR
HUMANITY!

...OR SOMETHING
LIKE THAT, AT LEAST.