

# MAT215: Complex Variables And Laplace Transformations

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LECTURE-05

# Derivative formula

## Example

Show that,

$$\mathcal{L}\{y'(t)\} = sY(s) - y(0)$$

## Example

Show that,

$$\mathcal{L}\{y''(t)\} = s^2 Y(s) - sy(0) - y'(0)$$

## Example

Show that,

$$\mathcal{L}\{y'''(t)\} = s^3 Y(s) - s^2 y(0) - sy'(0) - y''(0)$$

## Example

### Example

Solve the given differential equation:

$$y'' - 4y' + 4y = t^3 e^{2t}, y(0) = 0, y'(0) = 0$$

### Example

Solve the given differential equation:

$$y'' - 3y' + 2y = 4, y(0) = 1, y'(0) = -1$$

### Hint:

$$\frac{s-2}{s(s-1)} = \frac{2}{s} + \frac{-1}{s-1}$$

## Example

### Example

Solve the given differential equation:

$$y''' - 3y'' + 3y' - y = e^t t^2, \quad y(0) = 0, y'(0) = 1, y''(0) = -2$$

### Example

Solve the given differential equation:

$$\frac{dy}{dt} + y = 13 \sin 2t, \quad y(0) = 6$$

**Hint:**

$$\frac{6s^2 + 50}{(s+3)(s^2+4)} = \frac{8}{(s+3)} + \frac{-2s+6}{(s^2+4)}$$