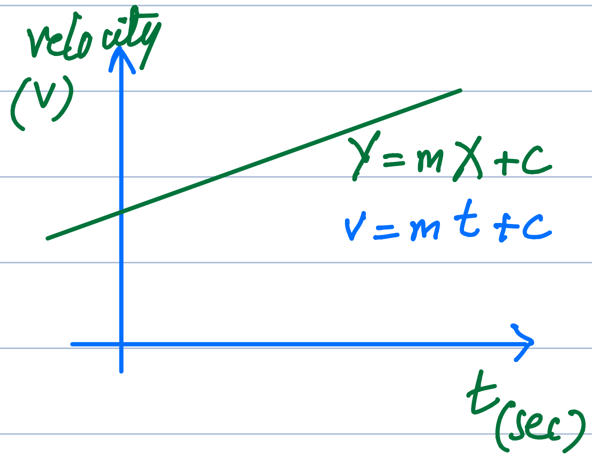
LINEAR LAW.

LINEAR → LINE

$$Y = mX + C$$

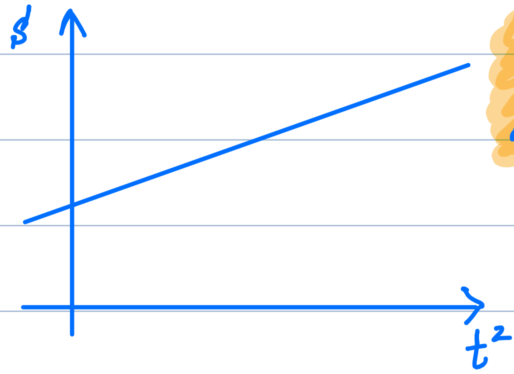
Y → Quantity plotted on y-axis

X → Quantity plotted on x-axis.



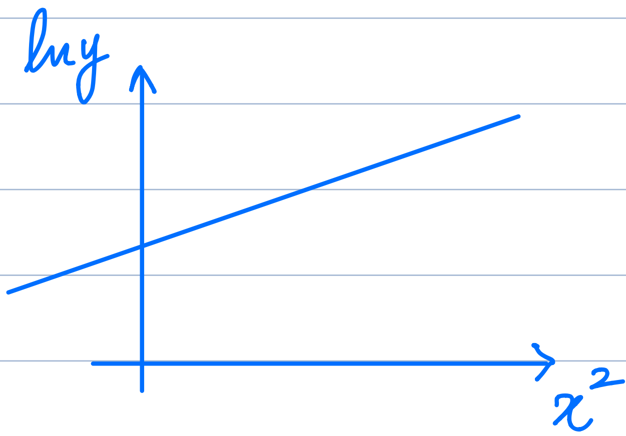
$Y = mX + C$

$v = mt + c$



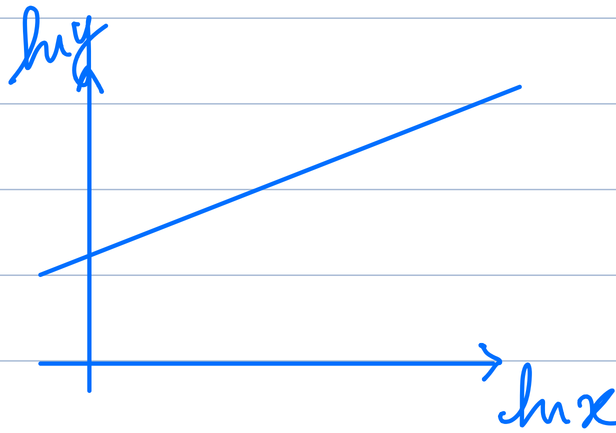
$Y = mX + c$

$s = mt^2 + c$



$\ln y = m x^2 + C$

$Y = m X + C$



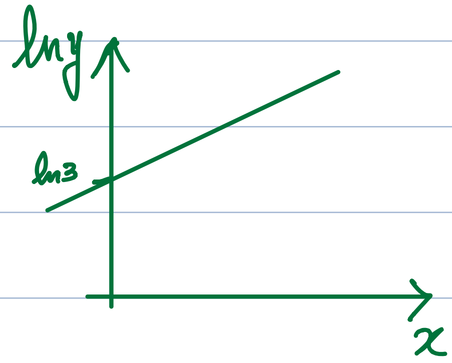
$\ln y = m \ln x + C$

$Y = m X + C$

Q

$$y = 3e^{-2x}$$

Graph of $\ln y$ against x is a straight line.
Find gradient of this line.



$$\ln y = \ln 3e^{-2x}$$

$$\ln y = \ln 3 + \ln e^{-2x}$$
$$\ln y = \ln 3 + (-2x)\ln e$$

$$\ln y = -2x + \ln 3$$
$$Y = mX + c$$
$$\boxed{\text{gradient} = -2}$$

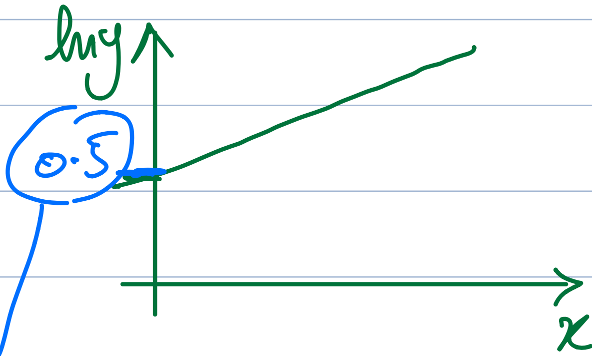
10 The variables x and y satisfy the equation $y^3 = Ae^{2x}$, where A is a constant. The graph of $\ln y$ against x is a straight line.

(i) Find the gradient of this line. [2]

(ii) Given that the line intersects the axis of $\ln y$ at the point where $\ln y = 0.5$, find the value of A correct to 2 decimal places. [2]

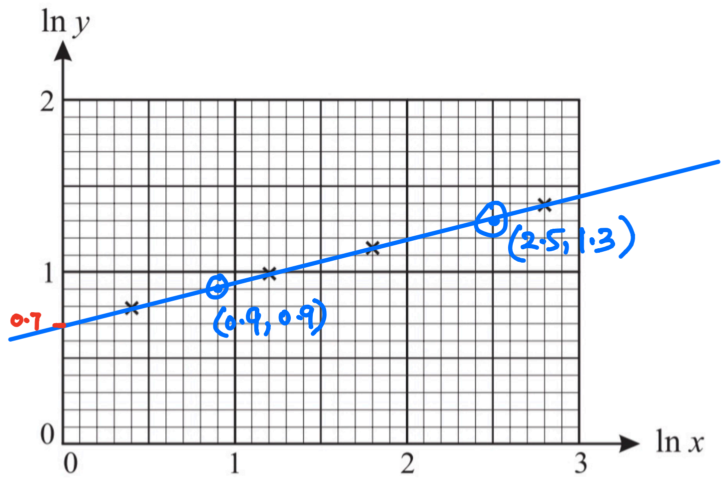
$$y^3 = Ae^{2x}$$
$$\ln y^3 = \ln Ae^{2x}$$
$$3\ln y = \ln A + \ln e^{2x}$$
$$3\ln y = \ln A + 2x\ln e$$
$$3\ln y = 2x + \ln A$$
$$\ln y = \frac{2}{3}x + \frac{\ln A}{3}$$
$$Y = mX + c$$

(i) gradient $= \frac{2}{3}$



$$\frac{\ln A}{3} = 0.5$$
$$\ln A = 3 \times 0.5$$
$$\ln A = 1.5$$
$$A = e^{1.5}$$
$$A = \boxed{4.48}$$

3



Two variable quantities x and y are related by the equation $y = Ax^n$, where A and n are constants. The diagram shows the result of plotting $\ln y$ against $\ln x$ for four pairs of values of x and y. Use the diagram to estimate the values of A and n. [5]

$$y = Ax^n$$

$$\ln y = \ln Ax^n$$
$$\ln y = \ln A + \ln x^n$$
$$\ln y = \ln A + n \ln x$$

$$\ln y = n \ln x + \ln A$$
$$Y = m X + c$$

gradient $= n$

y-intercept $= \ln A$.

GRADIENT

$(0.9, 0.9)\ (2.5, 1.3)$

$$\text{gradient} = n = \frac{1.3 - 0.9}{2.5 - 0.9}$$

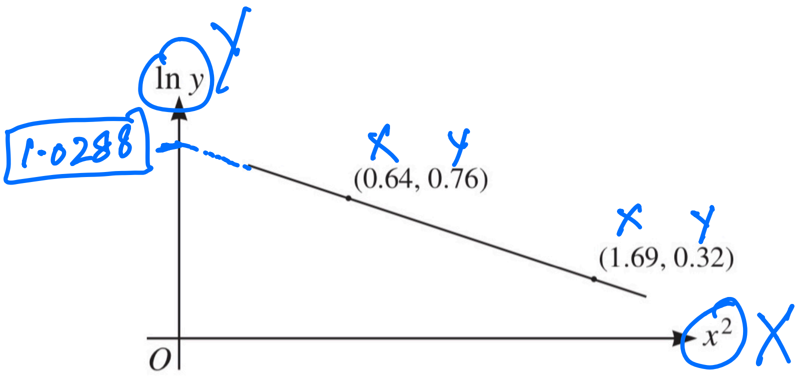
$$\boxed{n = 0.25}$$

y-intercept

$$\text{y-int} = \ln A$$
$$0.7 = \ln A$$
$$e^{0.7} = A$$

$$\boxed{A = 2.013}$$

23



The variables x and y satisfy the equation $y = Ae^{-kx^2}$, where A and k are constants. The graph of $\ln y$ against x^2 is a straight line passing through the points (0.64, 0.76) and (1.69, 0.32), as shown in the diagram. Find the values of A and k correct to 2 decimal places. [5]

$$\ln y = \ln A e^{-Kx^2}$$
$$\ln y = \ln A + \ln e^{-Kx^2}$$
$$\ln y = \ln A - Kx^2 \ln e$$
$$\ln y = \ln A - Kx^2(1)$$
$$\ln y = -Kx^2 + \ln A$$
$$Y = mX + C$$

$$Y = mX + C$$
$$Y = -0.419X + C$$
$$0.76 = (-0.419)(0.64) + C$$
$$\boxed{C = 1.0288}$$

$$\text{gradient} = -K$$
$$\frac{0.32 - 0.76}{1.69 - 0.64} = -K$$
$$-0.419 = -K$$
$$\boxed{K = 0.419}$$

$$\text{y-int} = \ln A$$
$$1.0288 = \ln A$$
e
$$A = e^{1.0288}$$
$$\boxed{A = 2.791}$$