

Interpolation and Extrapolation

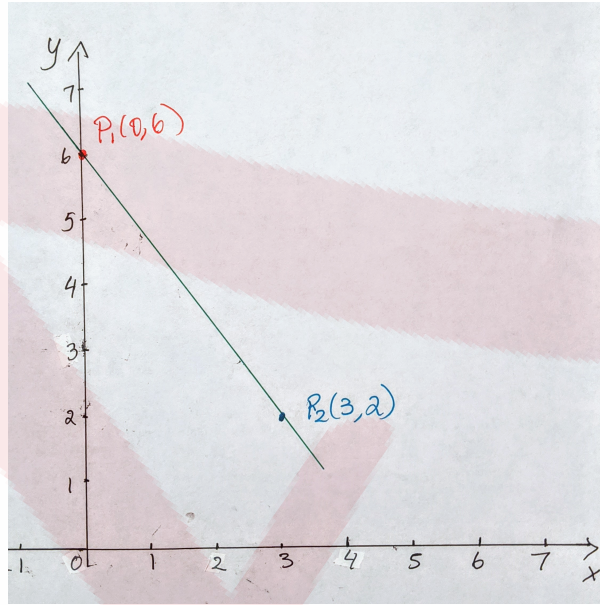
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## Interpolation and Extrapolation

Once we have a line we can estimate values on the line. **Interpolation** is the estimation of values between 2 given points on a line. **Extrapolation** is the estimation of information beyond the given line or graph.



Calculations for the equation of the line that passes through the points  $P_1(0, 6)$  and  $P_2(3, 2)$  graphed above. Slope Calculations:

$$m = \frac{y_1 - y_2}{x_1 - x_2} = \frac{6 - 2}{0 - 3} = \frac{4}{-3} = -\frac{4}{3}$$

Y-intercept Calculations:

$$y = -\frac{4}{3}x + b$$

$$2 = \frac{4}{3}(3) + b$$

$$2 = -4 + b$$

$$6 = b$$

Final equation of the line through the points  $P_1(0, 6)$  and  $P_2(3, 2)$ :

$$y = -\frac{4}{3}x + 6$$

In the graph above, if we want to interpolate the value at  $x = 1$  between  $P_1(0, 6)$  and  $P_2(3, 2)$  we see that the point  $P_0(1, \frac{14}{3})$  lies on the lines.

Calculation to find the point  $P_0(1, \frac{14}{3})$ :

$$\begin{aligned} y &= -\frac{4}{3}x + 6 \\ y &= -\frac{4}{3}(1) + 6 \\ &= -\frac{4}{3} + 6 \\ &= \frac{14}{3} \end{aligned}$$

Using extrapolation we see the point  $(-3, 10)$  lies on the line outside the given two points  $P_1$  and  $P_2$ .

## Exercises

1. Determine if the following points are collinear,  $P_1(2, -3)$ ,  $P_2(-1, 0)$ ,  $P_3(5, -6)$ .
2. Find the equation of the line that goes through the points  $P_2$  and  $P_3$ .
3. Interpolate the point on the line at  $x = 3$ .
4. Extrapolate the point on the line at  $x = -4$ .