📍 Location and Scale Parameters

- Normal PDF

    - A probability distribution is characterised by location and scale parameters

    - Location and scale parameters are typically used in modelling applications

    - For a Standard Normal Distribution, $\text{location} = 0$ and $\text{scale} = 1$

- Location Parameter

    - The effect of the location parameter is to translate the graph relative to the standard normal distribution

    - A location parameter of $-\text{x}$ would have shifted the graph x units to the left on the horizontal axis

    - A location parameter of x would have shifted the graph x units to the right on the horizontal axis

    - A location parameter simply shifts the graph left or right on the horizontal axis

- Scale Parameter

    - The effect of a scale parameter greater than one is to stretch the Probability Distribution Function

    - The effect of a scale parameter lesser than one is to squeeze the Probability Distribution Function

    - The peak of the Probability Distribution Function is multiplied by the scale parameter

    - A non-positive scale parameter is not allowed

- Location and Scale Together

- When both location and scale parameter are applied then the position and the height of the peak will change

- Standard Form

    - The standard form of any distribution is the form that has location parameter zero and scale parameter one

- Formulas for Location and Scale Based on the Standard Form

    - Cumulative Distribution Function

        - $F(x; a, b) = F(\frac{x - a}{b}; 0, 1)$

    - Probability Density Function

        - $f(x; a, b) = \frac{1}{b} f(\frac{x - a}{b}; 0, 1)$

    - Percent Point Function

        - $G(\alpha; a, b) = a + bG(\alpha; 0, 1)$

    - Hazard Function

        - $h(x; a, b) = \frac{1}{b} h(\frac{x - a}{b}; 0, 1)$

    - Cumulative Hazard Function

        - $H(x; a, b) = H(\frac{x - a}{b}; 0, 1)$

    - Survival Function

        - $S(x; a, b) = S(\frac{x - a}{b}; 0, 1)$

    - Inverse Survival Function

        - $Z(\alpha; a, b) = a + bZ(\alpha; 0, 1)$

    - Random Numbers

        - $Y(a, b) = a + bY(0, 1)$

- Relationship to Mean and Standard Deviation

    - For the normal distribution, the location and scale parameters correspond to the mean and standard deviation, respectively