1. For each function below, find x- and y- intercepts , create a table for at least 7 x- values including two negative values, zero (if allowed), two fractional values, two positive values. Plot the points on graph paper and sketch the curve. Mark clearly: intercepts, asymptotes (if any)

   a. $f(x) = 2x^3 - 3x^2 - 12x + 1$
   b. $f(x) = (x^3 - 3)e^3$
   c. $f(x) = \frac{4x+3}{x^2}$
   d. $f(x) = \frac{\ln(x)}{x^2}$

2. A student placed a large sample of ice in a beaker and heated it using a hotplate while recording the temperature every minute. The data is listed on the left. Graph the data with time on the x-axis and temperature on the y-axis. Use the graph to answer the questions below.
   (0,-10), (1,-5), (2,0), (3,0), (4,0), (5,0), (6,0), (7,0), (8,0), (9,0), (10,0), (11,8.3), (12,18), (13,28.5), (14,37), (15,48.7), (16,57), (17,68.8), (18,80), (19,89), (20,100), (21,100), (22,100), (23,100), (24,100), (25,100), (26,100), (27,100), (28,100), (29,100), (30,100), (31,100), (32,100), (33,100), (34,100), (35,100), (36,100), (37,110), (38,120), (39,130), (40,140)

   a. Label the section of the graph that represents the water as a solid, liquid, and as a gas directly on the graph.
   b. What is the melting temperature of the water? Label it on the graph.
   c. What is the boiling temperature of the water? Label it on the graph.

3. Draw an ellipse with major axis 18 cm and minor axis 6 cm. Calculate the focal distance and show the calculations. Mark the foci on the graph. Construct the ellipse by calculating at least 6 points along the semi major axis . Join the points smoothly to obtain the ellipse.

4. Measure the dimensions of the Young's modulus bar given to you in the lab and draw a 1: 4 scaled model of it on a graph paper. Measure the dimensions of the holes and also draw them in proper proportion.

5. Plot the following data points on graph paper using a suitable scale. Draw the best fit straight line . Using your drawn line, determine the slope and intercept and show the calculation. Then perform the manual least square fit by calculating $\sum x$, $\sum x^2$, $\sum y$, and $\sum xy$ and obtain the slope and intercept using the standard formula. Comment on the difference observed.
   (1,3.4), (2,4.9), (3,11.1), (4,11.4), (5,9.9), (6,15.4), (7,10.2), (8,14.2), (9,14.9), (10,18.7), (11,20.1), (12,16.9), (13,20.2), (14,21.0), (15,23.6)

6. Plot the following data points on a graph paper using an appropriate scale. Join the points smoothly to obtain a waveform. Identify and mark all maxima, minima and zero crossings. Measure the amplitude and determine the time period. (0.0,0.1), (0.5,0.7), (1.0,1.3), (1.5,1.9), (2.0,2.1), (2.5,1.7), (3.0,1.2), (3.5,0.6), (4.0,0.1),(4.5,-0.7), (5.0,-1.3), (5.5,-1.9), (6.0,-2.0), (6.5,-1.7), (7.0,-1.2), (7.5,-0.6), (8.0,0.0), (8.5,0.8), (9.0,1.4), (9.5,1.9), (10.0,2.0), (10.5,1.6),

(11.0,1.2), (11.5,0.5), (12.0,-0.1), (12.5,-0.8), (13.0,-1.5), (13.5,-1.9), (14.0,-2.1), (14.5,-1.6), (15.0,-1.3), (15.5,-0.6), (16.0,0.0), (16.5,0.7), (17.0,1.3), (17.5,1.8), (18.0,2.0)

7. Plot the given intensity (I) versus displacement (Δ) data on graph paper using a suitable scale. Join the points smoothly. Measure the fringe spacing by finding the horizontal distance between two successive maxima on either side of the centre and calculate the average fringe width. (-10.0,0.0), (-9.5,-0.3), (-9.0,-0.5), (-8.5,-0.6), (-8.0,-0.4), (-7.5,0.0), (-7.0,0.4), (-6.5,0.7), (-6.0,0.8), (-5.5,0.5), (-5.0,0.0), (-4.5,-0.7), (-4.0,-1.2), (-3.5,-1.4), (-3.0,-1.0), (-2.5,0.0),(-2.0,1.5), (-1.5,3.2), (-1.0,4.8), (-0.5,5.9), (0.0,6.5),(0.5,5.9), (1.0,4.8), (1.5,3.2), (2.0,1.5), (2.5,0.0), (3.0,-1.0), (3.5,-1.4), (4.0,-1.2),(4.5,-0.7), (5.0,0.0), (5.5,0.5), (6.0,0.8), (6.5,0.7), (7.0,0.4), (7.5,0.0), (8.0,-0.4),(8.5,-0.6), (9.0,-0.5), (9.5,-0.3), (10.0,0.0).

8. Plot the following data points on graph paper using a suitable scale and draw a smooth curve through them. Identify the nature of the curve. From your graph, locate the coordinates of the minimum point (vertex) and hence determine the shifted centre x_0. (-5,138.2), (-4,110.6), (-3,88.3), (-2,70.9), (-1,58.5), (0,51.4),(1,49.8), (2,53.6), (3,62.7), (4,77.1), (5,96.8).

9. Plot the following Gain versus Frequency data on graph paper using a suitable scale. You may use only ordinary linear graph paper. Join the points smoothly and comment on the difficulty (if any) encountered in representing the full frequency range. Based on your observation, re-plot the same data after appropriately transforming the frequency axis, clearly stating the transformation used. From the final plot, estimate the −3 dB cutoff frequency and comment on the nature of the filter. (10,1), (100,0.995), (1k,0.707), (10k,0.099), (100k,0.01),(1M,1e-3), (10M,1e-4), (100M,1e-5), (1G,1e-6), (10G,1e-7)

General Instructions:

1. All graphs must be plotted by hand on graph paper. Use pencil and ruler only.
2. Software, graphing calculators, and AI tools are not permitted.
3. Each graph must include proper scale, labelled axes with units, and a title.
4. Construction lines and intermediate calculations must be shown clearly.
5. For every plotted curve, mark important features such as intercepts, maxima/minima, asymptotes, or special points as applicable.
6. Answers without supporting graphs or calculations will not be awarded.