Homework 2

Problem 1

Suppose x takes on the values $x = 1, 1.2, 1.4, \ldots, 5$. Use MATLAB to compute the array `y` that results from the function $y = 7\sin(4x)$. Use MATLAB to determine how many elements are in the array `y` and the value of the third element in the array `y`.

Problem 2

Use MATLAB to determine how many elements are in the array `sin(-pi/2):0.05:cos(0)`. Use MATLAB to determine the 10th element.

Problem 3

Use MATLAB to find the roots of $13x^3 + 182x^2 - 184x + 2503 = 0$.

Problem 4

Use MATLAB to calculate

a. $6\pi \tan^{-1}(12.5) + 4$ *b.* $5 \tan[3 \sin^{-1}(13/5)]$

Problem 5

A *cycloid* is the curve described by a point P on the circumference of a circular wheel of radius r rolling along the x axis. The curve is described in parametric form by the equations

$$x = r(\phi - \sin\phi)$$
$$y = r(1 - \cos\phi)$$

Use these equations to plot the cycloid for $r = 10$ in. and $0 \leq \phi \leq 4\pi$.

Problem 6

Use MATLAB to plot the function $T = 6\ln t - 7e^{0.2t}$ over the interval $1 \leq t \leq 3$. Put a title on the plot and properly label the axes. The variable T represents temperature in degrees Celsius; the variable t represents time in minutes.

Problem 7

The perfect gas law relates the pressure p, absolute temperature T, mass m, and volume V of a gas. It states that

$$pV = mRT$$

The constant R is the *gas constant*. The value of R for air is 286.7 $(\text{N} \cdot \text{m})/(\text{kg} \cdot \text{K})$. Suppose air is contained in a chamber at room temperature ($20°\text{C} = 293$ K). Create a plot having three curves of the gas pressure in N/m^2 versus the container volume V in m^3 for $20 \leq V \leq 100$. The three curves correspond to the following masses of air in the container: $m = 1$ kg, $m = 3$ kg, and $m = 7$ kg.

Problem 8

The function $y(t) = 1 - e^{-bt}$, where t is time and $b > 0$, describes many processes, such as the height of liquid in a tank as it is being lled and the temperature of an object being heated. Investigate the effect of the parameter b on $y(t)$. To do this, plot y versus t for several values of b on the same plot. How long will it take for $y(t)$ to reach 98 percent of its steady-state value?

Problem 9

The volume V and surface area A of a sphere of radius r are given by

$$V = \frac{4}{3}\pi r^3 \qquad A = 4\pi r^2$$

a. Plot V and A versus r in two subplots, for $0.1 \leq r \leq 100$ m. Choose axes that will result in straight-line graphs for both V and A.

Hint: Use "." sign before any array multiplication and division.

Example: `V = (4*pi*r.^3)/3;`