MAP 5485

Maple Exercise, Euclidean motions

Use Maple to to do the following computations. When you are finished, clean up and save your worksheet. Email it to me or print it out and hand it in. Pages below refer to *The Maple Book*.

(1) A fixed point of a transformation $T(x,y)$ is a vector (x,y) such that $T(x,y) = (x,y)$. Use the `solve` command in Maple to solve two simultaneous equations to find the fixed point of the transformation

$$T: \quad (x,y) \to (2x+y+1, 3x-4y-1).$$

Look in the help menu or on p. 60 to read about the solve command. (This transformation is not a euclidean motion.)

(2) Use the Maple solve command to find the x and y coordinates of the fixed point $z = x + iy$ of the transformation

$$z \to e^{i\pi/6} z + (2-i).$$

(Solve for one complex number and find the real and imaginary parts.)

(3) Open the Maple worksheet on space curves from the class website. Execute the commands in the paragraph *Moving the letter F*. (You can first copy it to your own worksheet.)

Maple moves graphics objects using the commands `translate`, `reflect` and `rotate` in the `plottools` package. Read about these in the help menu or in Chapter 14.

Let A be reflection in the y axis. Use the Maple `reflect` and `translate` functions to write a function `T` giving the glide reflection

$$TX = AX + B$$

where B is the vector $(1,1)$.

Let `f` be the graphic object constructed in the worksheet representing the letter f. Display a graphic showing `f, T(f)` and `T(T(f))` together.

What appears to be the axis of the glide reflection?

(4) Sometimes the transformation $T(T(X)) =$ is written TTX or T^2X. Similarly $TTTX = T^3X$ etc. In Maple if `T` is a function, `T@@n(X)` gives you $T^n(X)$. (Read about the `@@` command in the Maple help menu.)

Use the transformation `T` in the previous problem and the graphics object `f` to display a graphic showing `f,T,...,T`^{12}`f`. (Use the `seq` command. Read about it in the Maple help menu, or see figures 14.16 and 114.17.)

(5)
- Read about the `spacecurve` command (in the `plots` package), or see page 89. Use the `spacecurve` command to define the helix

  $$\texttt{hel}: \qquad x = \cos t \qquad y = \sin t \qquad z = t$$

  for $0 \le t \le 10\,\pi$. Plot it using the `display` command and both options `scaling = constrained` and `scaling = unconstrained`. What is the difference?
- Use the `reflect` command to plot `hel` together with its reflection in the plane $x = y$. (You will need to find three points in this plane. This should be easy.)