

## Figure 8 Knot, Granny Knot, Square Knot\*

The Trefoil knot, Figure 8 Knot, Granny Knot, Square Knot, displayed by 3D-XplorMath are all harmonic or Fourier knots. That is they are parametrized using finite Fourier series for all three coordinates. The particular parametrizations are taken from the 1995 PhD thesis of Aaron Trautwein at The University of Iowa.

Satellite Knots can be added in the Action Menu to these four knots.

The Figure 8 Knot is an alternating prime knot with minimal crossing number 4. It is the next simplest knot after the Trefoil Knot.

Parametric formulas for the Figure 8 Knot:

$$x = (32 \cos(t) - 51 \sin(t) - 104 \cos(2t) - 34 \sin(2t) + 104 \cos(3t) - 91 \sin(3t)) / 100$$

$$y = (94 \cos(t) + 41 \sin(t) + 113 \cos(2t) - 68 \cos(3t) - 124 \sin(3t)) / 140$$

$$z = (16 \sin(t) + 138 \cos(2t) - 39 \sin(2t) - 99 \cos(3t) - 21 \sin(3t)) / 70$$

The Granny Knot and the Square Knot are not prime, both are sums of two Trefoil Knots. The Square Knot has a mirror symmetry so that one Trefoil is left handed the

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\* This file is from the 3D-XplorMath project. Please see:

<http://3D-XplorMath.org/>

other right handed. The Granny Knot is the sum of two same-handed Trefoil Knots.

Parametric formulas for the Granny Knot:

$$\begin{aligned}x &= (-22 \cos(t) - 128 \sin(t) - 44 \cos(3t) - 78 \sin(3t))/80 \\y &= (-10 \cos(2t) - 27 \sin(2t) + 38 \cos(4t) + 46 \sin(4t))/80 \\z &= (70 \cos(3t) - 40 \sin(3t))/100\end{aligned}$$

Parametric formulas for the Square Knot:

$$\begin{aligned}x &= (-22 \cos(t) - 128 \sin(t) - 44 \cos(3t) - 78 \sin(3t))/100 \\y &= (11 \cos(t) - 43 \sin(3t) + 34 \cos(5t) - 39 \sin(5t))/100 \\z &= (70 \cos(3t) - 40 \sin(3t) + 18 \cos(5t) - 9 \sin(5t))/100\end{aligned}$$

R.S.P.