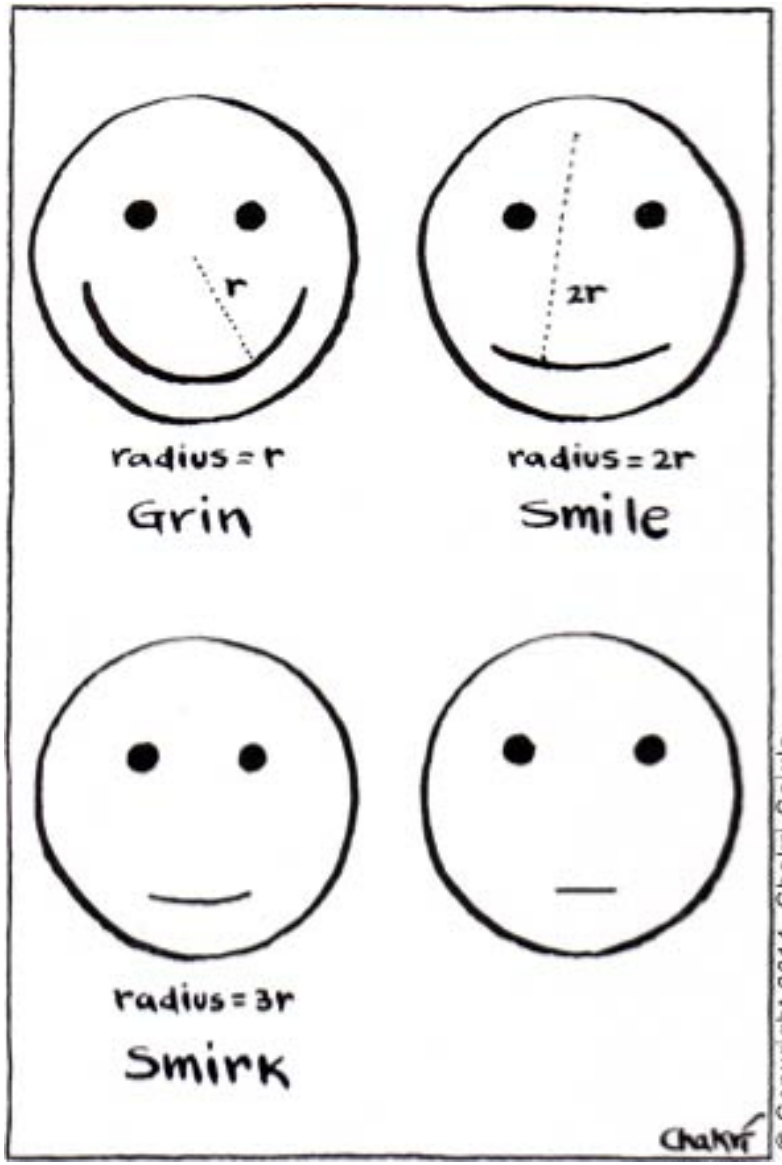
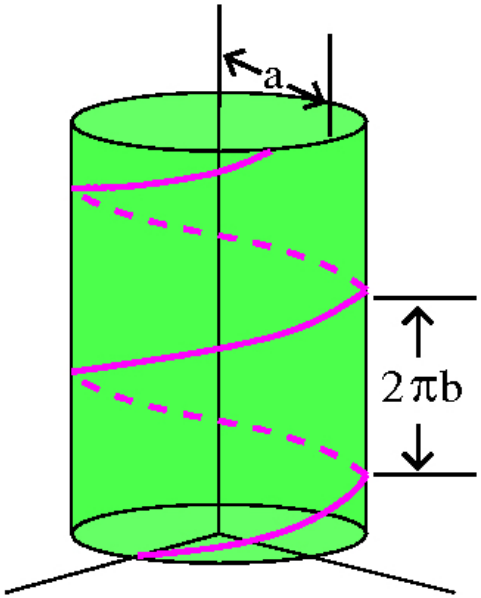
If $\kappa \neq 0$ but is constant for a plane curve $\alpha(s)$ then $\alpha(s)$ is part of a circle.



http://chakrigajula.com/wp-content/uploads/2014/11/misc_cartoon375.jpg

1. For each s, what is the angle between $T(s)$ on this cylindrical helix and the vector $< 0, 0, 1 >$ translated to $\alpha(s)$?

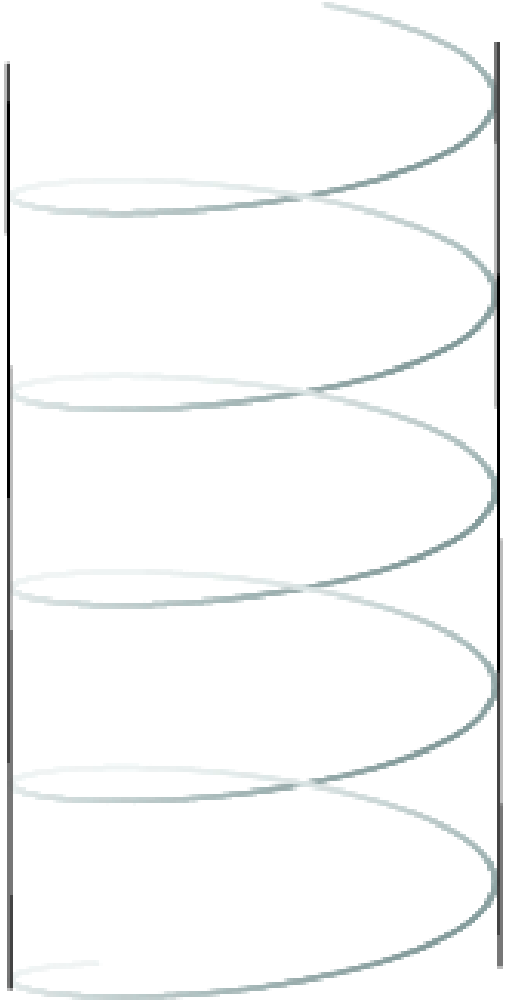


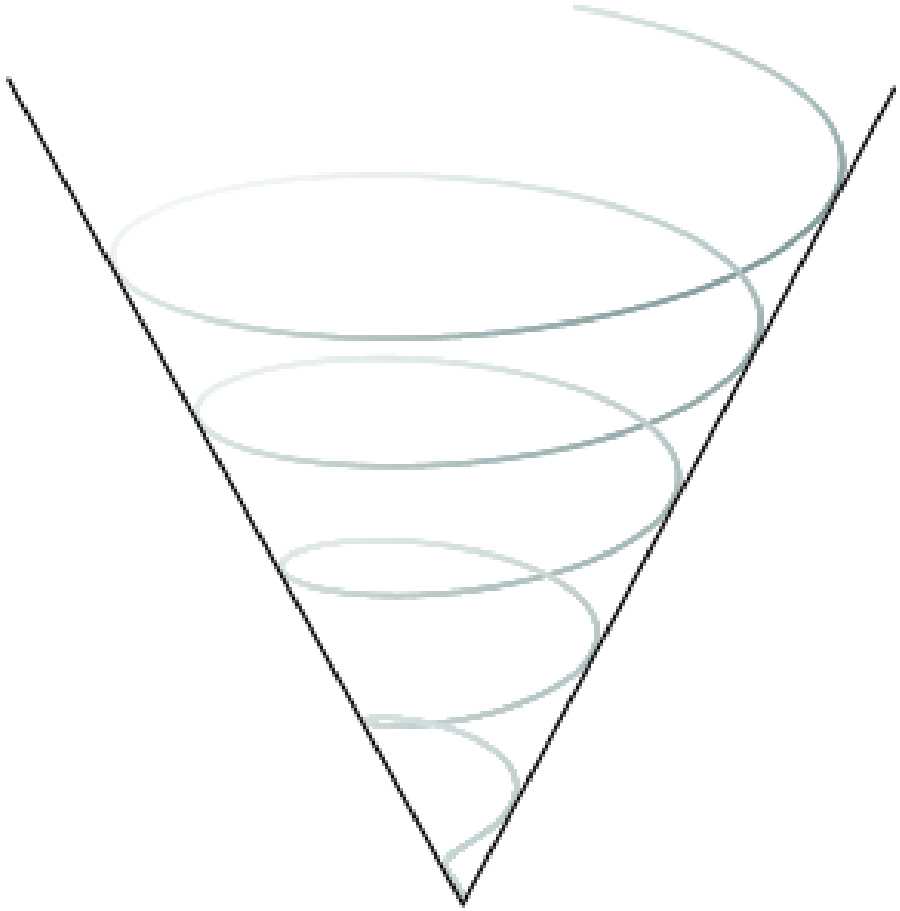
http://www.math.rutgers.edu/~greenfie/mill_courses/math251a/gifstuff/helix.gif

http://previews.123rf.com/images/limbi007/limbi0071302/limbi007130200034/17726502-Orange-cartoon-characters-runs-on-the-green-helix--Stock-Photo-orange-spiral.jpg

a) the angle changes
b) the angle is constant
c) no way to tell

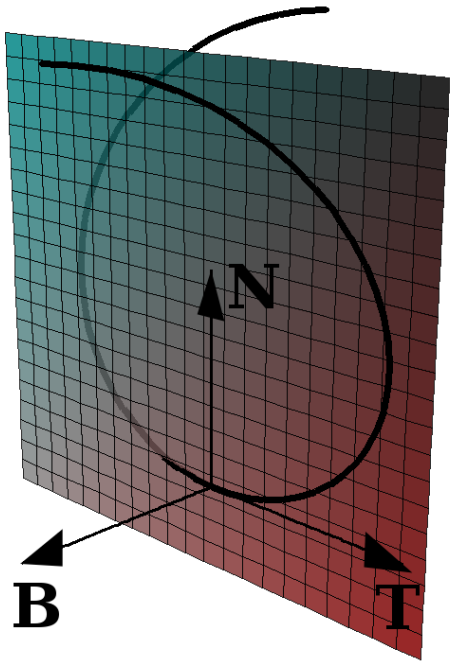
A curve $\alpha(s)$ with $\kappa \neq 0$ is a cylindrical helix $\Leftrightarrow \frac{\tau}{\kappa}$ is constant.



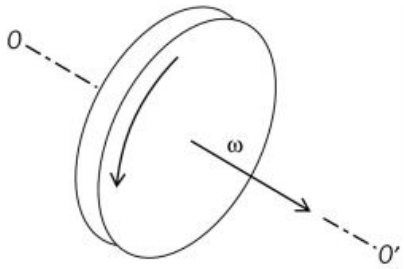


http://www.tankonyvtar.hu/en/tartalom/tamop425/0038_matematika_Miklos_Hoffmann-Topology_and_differential_geometry/images/csavar_hengeres_kupos_cdr.png

2. To prove that a planar space curve has 0 torsion, we
   a) We used two derivatives of $(\alpha(s) - \alpha(0)) \cdot \vec{n}$ to show that the (constant) normal to the plane $\vec{n}$ that the curve always lies in is always parallel to the binormal $B(s)$ (from the Frenet Frame of the curve) for all s.
   b) Then we used a derivative of the (now shown to be) constant B to show $0 = B'$ so $\tau = 0$.
   c) both of the above
   d) none of the above



3.



angular velocity shown as an axial B vector when $\tau = 0$
http://img.tfd.com/mgh/cep/thumb/Angular-velocity-shown-as-an-axial-vector.jpg

Combining the T' Frenet equation with the expression for T' in the Darboux vector ω (angular velocity vector), and writing it in terms of the basis given by T, N and B, we can obtain:

$$\kappa N = T' = \omega \times T = (c_1 T + c_2 N + c_3 B) \times T$$

Continue computing using the right-hand side.
Then compare to the left side:

a) $c_1 = 0$
b) $c_2 = 0$
c) $c_3 = 0$
d) more than one of the above
e) none of the above

4. The parametrization of the outer helix on the strake from the homework is

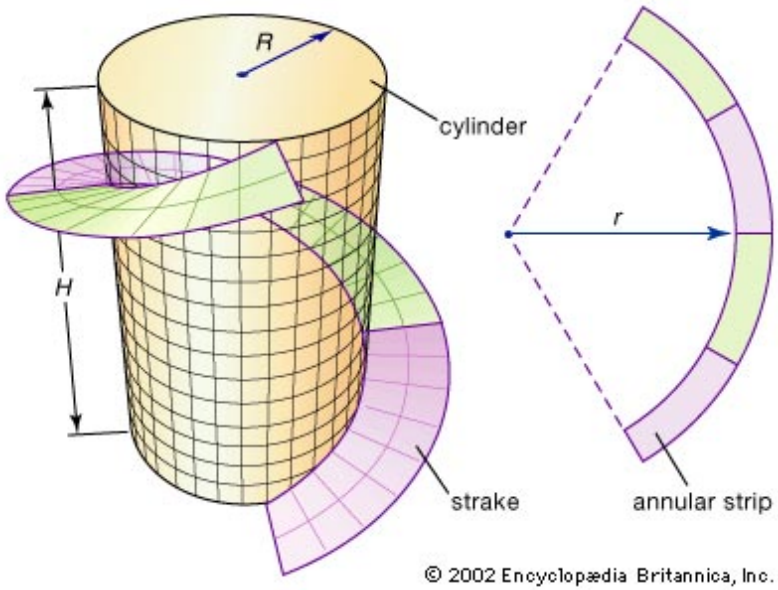
a) $(\cos t, \sin t, \frac{10t}{2\pi})$

b) $(1.2\cos t, 1.2\sin t, \frac{10t}{2\pi})$

c) $(\frac{\pi^2+25}{\pi^2}\cos t, \frac{\pi^2+25}{\pi^2}\sin t, 0)$

d) $((\frac{\pi^2+25}{\pi^2}+.2)\cos t, (\frac{\pi^2+25}{\pi^2}+.2)\sin t, 0)$

e) $(\cos t, \sin t, 0)$



https://cdn.britannica.com/22/70822-004-B85BF4BD/

strake-strip-dimensions-cylinder-contour-Techniques-differential.jpg

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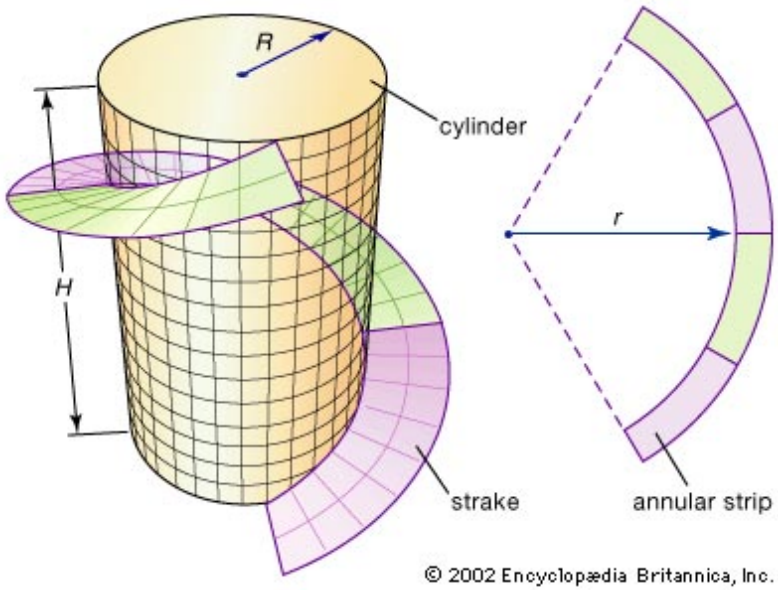
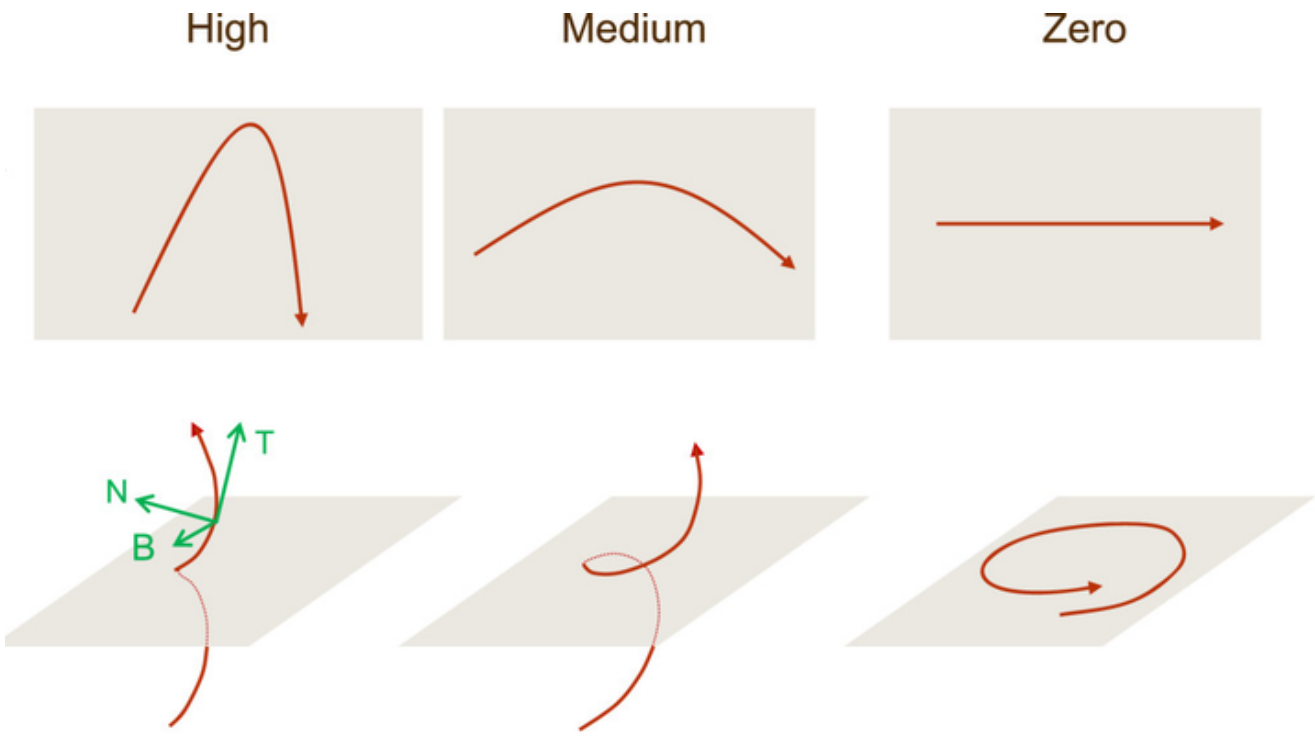


https://cdn.britannica.com/22/70822-004-B85BF4BD/strake-strip-dimensions-cylinder-contour-Techniques-differential.jpg

parameterize the strake to motivate surfaces

Fundamental Theorem of Curves for the Plane and $\mathbb{R}^3$

$$\begin{bmatrix} T'(s) \\ N'(s) \\ B'(s) \end{bmatrix} = \begin{bmatrix} 0 & \kappa & 0 \\ -\kappa & 0 & \tau \\ 0 & -\tau & 0 \end{bmatrix} \begin{bmatrix} T \\ N \\ B \end{bmatrix}$$



Pitt et al.: "Polyphony: superposition independent methods for ensemble-based drug discovery." *BMC Bioinformatics* 2014 15:324.

Curves $\rightarrow$ Surfaces

- Given a fixed piece of string, what figure bounds the largest area?

Curves $\rightarrow$ Surfaces

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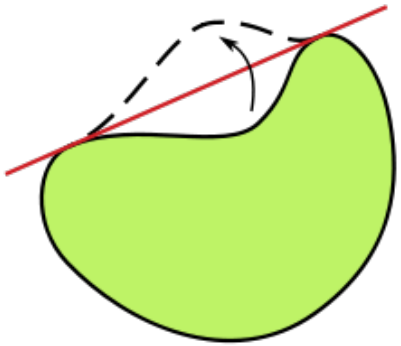


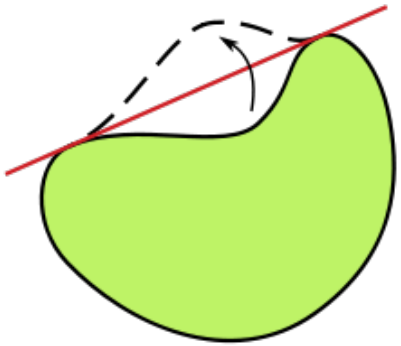
https://upload.wikimedia.org/wikipedia/commons/thumb/0/03/Isoperimetric_inequality_illustr1.svg/440px-Isoperimetric_inequality_illustr1.svg.png

Green's Theorem $\int_\alpha L dx + M dy = \int\int \frac{\partial M}{\partial x} - \frac{\partial L}{\partial y} dA$

Think Green!

Curves $\rightarrow$ Surfaces

- Given a fixed piece of string, what figure bounds the largest area?



https://upload.wikimedia.org/wikipedia/commons/thumb/0/03/Isoperimetric_inequality_illustr1.svg/440px-Isoperimetric_inequality_illustr1.svg.png

Green's Theorem $\int_\alpha L dx + M dy = \int\int \frac{\partial M}{\partial x} - \frac{\partial L}{\partial y} dA$

Think Green!

- Find as many people as you can related to the creation of the Frenet formulas and the years of their contributions, including Bartels, Darboux, Frenet, Pagani, and Serret
- Study guide