

# Math2310 - Fall '22

## Syllabus - Lecture 07

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### Review

#### 1 Derivatives of paths

- defn derivative of a path: the velocity vector

#### 2 More about velocity

- defn speed - the magnitude of the velocity
- direction of velocity: the unit tangent vector

#### 3 Vector operations on paths:

- exmpl Finding projections of a path onto a planes
- exmpl Avoiding component computation

### Topics

#### 1 Calculus for curves

- Product rule for curves
  - prop with proof:  $\frac{d}{dt}(\vec{p}(t) \cdot \vec{q}(t)) = \dot{\vec{p}}(t) \cdot \vec{q}(t) + \vec{p}(t) \cdot \dot{\vec{q}}(t)$
- Chain rule for curves
- The derivative of the norm:  $t \mapsto \|\vec{p}(t)\|$

#### 2 Fundamental theorem of calculus for curves

- The integral of a vector function:
  - examples
  - motivation and physical meaning
- Fundamental theorem of calculus for curves
  - The integral as the inverse of the derivative: from the quantity to its rate of change and back again

#### 3 Velocity vector - further applications

- The rate of change of distance to a point

- The rate of change of distance to a plane

## References

### Textbook

- [Ste] Chap 13.1 Vector Functions and Space Curves (complete)
- [Ste] Chap 13.2 Derivatives and Integrals of Vector Functions (complete)
- [Ste] Chap 13.3 pp904-906 (stop at curvature)

### Additional material