IMPORTANT

• Association between position, velocity, and acceleration:
  – Velocity: rate of change of position w.r.t. time
  – Acceleration: rate of change of velocity w.r.t. time
  – *Instantaneous velocity* is reflected by the slope of the position curve at some instant in time.
  – *Instantaneous acceleration* in reflected by the slope of the velocity curve at some instant in time.

Changes in a curve

• positive change
  – up and to the right
• negative change
  – down and to the left
• quick change
  – very steep curve
• slow change
  – very flat curve
Slope of a Curve

• “Slope” = number which describes the change in a curve

–rise/run

– Note: this is the definition for the tangent of the lower angle in the triangle

Tangent of a Curve

• tangent is drawn at only one pt on the curve
• a straight line which ‘touches’ the curve only at the one point
• slope of the tangent represents the slope of the curve
• Note: when person (object) changes direction the tangent is horizontal so the slope is ZERO
Relationship of $v$ to $d$

- the instantaneous velocity ($v$) curve is the plot of how the slope of the $d$ vs. $t$ curve changes
- a similar relationship exists between $a$ and $v$
Steps to determining \( v \) vs. \( t \) curve from \( d \) vs. \( t \) curve

1. Draw a set of axes (\( v \) & \( t \)) directly under the \( d \) vs. \( t \) curve.
2. Locate all points where there is a change in direction.
3. Plot zero velocity points for each corresponding change in direction.
4. Between zero points, identify if the slope of the curve is positive or negative.
5. Determine how ‘quickly’ the slope changes.
6. Estimate the shape of the \( v \) vs. \( t \) curve based on the direction and the steepness of the slope.
SUMMARY: Displacement and Velocity

- Velocity = slope of displacement vs. time curve (slope = “rise”/”run”; \( v = \frac{\Delta d}{\Delta t} \))
  - positive slope = positive velocity
  - negative slope = negative velocity
  - steeper slope = larger velocity
  - flatter slope = smaller velocity
  - no slope (horizontal) = 0 velocity
    - max or min position = 0 velocity
  - steepest slope = peak velocity

SUMMARY: Velocity and Acceleration

- Acceleration = slope of velocity vs. time curve (slope = “rise”/”run”; \( a = \frac{\Delta v}{\Delta t} \))
  - positive slope = positive acceleration
  - negative slope = negative acceleration
  - steeper slope = larger acceleration
  - flatter slope = smaller acceleration
  - no slope (horizontal) = 0 acceleration
    - max or min velocity = 0 acceleration
  - steepest slope = peak acceleration