Review: The Big 5, Sig Digs, Vector Analysis

UNIT #1 DYNAMICS
Given: \( v_1 = 110 \text{ m/s} \)

\( a = -6.2 \text{ m/s}^2 \)

\( v_2 = 0 \text{ m/s} \)

Required: \( \Delta t, \Delta d \)

Analysis: \( v_2 = v_1 + a \Delta t \)

\[ \Delta d = \left( \frac{v_2 + v_1}{2} \right) \Delta t \]

Steps:

\( v_2 = v_1 + a \Delta t \)

\[ \Delta t = \frac{v_2 - v_1}{a} \]

\[ \Delta t = \frac{0 - 110}{-6.2} \text{ s} = 17.7 \text{ s} \]

\[ \Delta t = 18 \text{ s} \]
b) \[ \Delta d = \left( \frac{v_2 + v_1}{2} \right) \Delta t \]

\[ = \left( 0 + \frac{110 \, \text{m/s}}{2} \right) \times 17.7 \, \text{s} \]

\[ \Delta d = 973.5 \, \text{m} \]

\[ \Delta d = 970 \, \text{m} \]
TODAY’S LEARNING GOALS

DYN 2

I can use vector approaches to analyse projectile motion.
<table>
<thead>
<tr>
<th>Equation</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1) ( \Delta \vec{d} = \left( \frac{\vec{v}_2 + \vec{v}_1}{2} \right) \Delta t )</td>
</tr>
<tr>
<td>(2) ( \vec{v}_2 = \vec{v}_1 + \vec{a} \Delta t )</td>
</tr>
<tr>
<td>(3) ( \Delta \vec{d} = \vec{v}_1 \Delta t + \frac{1}{2} \vec{a} \Delta t^2 )</td>
</tr>
<tr>
<td>(4) ( \vec{v}_2^2 = \vec{v}_1^2 + 2\vec{a} \Delta \vec{d} )</td>
</tr>
<tr>
<td>(5) ( \Delta \vec{d} = \vec{v}_2 \Delta t - \frac{1}{2} \vec{a} \Delta t^2 )</td>
</tr>
</tbody>
</table>
As the projectile is going up...

1. It starts at the bottom at the MAXIMUM SPEED.
2. As it rises, it SLOWS DOWN because gravity is a negative acceleration.
3. It reaches its maximum height, where for a moment its INSTANTANEOUS VELOCITY is ZERO. This is exactly half way through the flight time (if the projectile starts and stops at the same height).
As the projectile is coming down...

1. The projectile begins to speed up, downwards (gravity and velocity are in the same direction)
2. When it reaches the same height that it started from (like the ground, or the person's hand), it will be going at the same speed down as it was originally moving up, but negative.
3. It takes just as much time to come down as it did to go up.
FREE FALL

- an object that falls with no air resistance
- in reality, there is always air resistance
- when air resistance equals the force due to gravity, the object stops accelerating and stays at a constant velocity
- “TERMINAL VELOCITY”
Follow these rules to decide if a digit is significant:

1. All non-zero digits are significant.
2. If a decimal point is present, zeros to the left of other digits (leading zeros) are not significant.
3. If a decimal point is not present, zeros to the right of the last non-zero digit (trailing zeros) are not significant.
4. Zeros placed between other digits are always significant.
5. Zeros placed after other digits to the right of a decimal point are significant.
6. When a measurement is written in scientific notation, all digits in the coefficient are significant.
7. Counted and defined values have infinite significant digits.
<table>
<thead>
<tr>
<th>Measurement</th>
<th>Number of significant digits</th>
</tr>
</thead>
<tbody>
<tr>
<td>32.07 m</td>
<td>4</td>
</tr>
<tr>
<td>0.0041 g</td>
<td>2</td>
</tr>
<tr>
<td>$5 \times 10^5$ kg</td>
<td>1</td>
</tr>
<tr>
<td>7002 N·m</td>
<td>4</td>
</tr>
<tr>
<td>6400 s</td>
<td>2</td>
</tr>
<tr>
<td>6.0000 A</td>
<td>5</td>
</tr>
<tr>
<td>204.0 cm</td>
<td>4</td>
</tr>
<tr>
<td>10.0 kJ</td>
<td>3</td>
</tr>
<tr>
<td>100 people (counted)</td>
<td>infinite</td>
</tr>
</tbody>
</table>
An airplane flies 250 km [E 25° N], and then flies 280 km [S 13° W]. Using components, calculate the airplane’s total displacement.
Finding Resultant

\[ d_{Rx} = d_{1x} + d_{2x} \]
\[ = 227 \text{ km [E]} + (-63 \text{ km [E]}) \]
\[ = 164 \text{ km [E]} \]

\[ d_{Ry} = d_{1y} + d_{2y} \]
\[ = -106 \text{ km [S]} + 273 \text{ km [S]} \]
\[ = 167 \text{ km [S]} \]

\[ r = \sqrt{164^2 + 167^2} \]
\[ r = 234 \text{ km} \]

\[ \tan \theta = \frac{167}{164} \]
\[ \theta = \tan^{-1}(\frac{167}{164}) \]
\[ \theta = 45.5^\circ \]
HOMEWORK

- Pg. 21 #1-3,5
- Pg. 29 #8

→ Big 5

→ Vectors.