Chapter 3 Example

Problem Solving
3.25 Standing at the edge of the roof of a tall building you throw a ball upward with a velocity of 15 m/s (meters per second). The ball goes straight up and begins its downward descent just missing the edge of the building. The building is 40 m tall.

(a) What is the velocity of the ball at its uppermost position?

(b) How high above the building will the ball go before beginning its descent?

(c) What will be the velocity of the ball as it passes the roof of the building?

(d) What will be the speed of the ball just before it hits the ground?

(e) How long will it take for the ball to hit the ground after leaving your hand?
Systematic Approach to Problem Solving

\[ g := 9.81 \frac{m}{s^2} \]

**Example of problem 3.25**

**Given:** Initial velocity of the Ball: \[ v_0 := 15 \frac{m}{s} \]

Building Height \[ h := 40 \cdot m \]

**Answers:**

(a) \( V_{\text{ball at uppermost position}} = ? \)

(b) max. height. Remember \( v(t) = v_0 - g \cdot t \)
Systematic Approach to Problem Solving

At the max. height, $v=0$. Thus

$$0 = v_0 - g \cdot t_{\text{max}}$$

$$t := \frac{v_0}{g} \quad t = 1.529 \text{ s}$$

$$h_{\text{max}} := \frac{1}{2} \cdot g \cdot t^2 \quad h_{\text{max}} = 11.468 \text{ m}$$
(c) Velocity while passing the roof

\[ v_{\text{passing}} = v_0 \]

(d) Velocity when approaching Ground:

**Height (from max. elev.)**

\[ = \frac{1}{2} g t^2 \]

\[ v_{\text{Ground}} = v_0 + g t_{\text{drop}} \]
(d) Numerical Solution

Height (from max. elev.)
\[51.5 \text{ m} = \frac{1}{2} \cdot g \cdot t^2\]

Symbolic Solve for \(t\) gives:

\[t := \frac{1}{g} \cdot \sqrt{2 \cdot (g \cdot h)^2}\]

\[v_{\text{max}} := g \cdot t\]

\[v_{\text{max}} = 31.777 \text{ m/s}\]

\[t = 3.239 \text{ s}\]
(e) Total time elapsed
(from release to arrival on ground)

\[ t_{\text{total}} := t_{\text{up}} + t_{\text{down}} \]

\[ t_{\text{total}} = 4.768 \text{ s} \]
Note re. Ch. 3

Required formulas will be given in the exam paper.
Chapter 4 Examples

GRAPHING

See posted slides and textbook. Both Linear graphing and Logarithmic graphing will be required
Chapter 5 Examples

Estimation
Significant Figures

Definitions:
Accuracy
Precision
Random and Systematic Errors
Chapter 5 Examples

Analog and digital methods

Definitions:

Analog
Digital
Chapter 6 Examples

Dimensions and Units

Definitions:

\( m, \ kg, \ s, \ K \ ... \)

Derived Units:

Force, Pressure, ...
Chapter 6 Examples

Dimensions and Units

Multipliers:

kilo, mega, milli, micro, ...

Writing Conventions:

1.2 km, 5 MPa, 2 μA...