UNSW AUSTRALIA

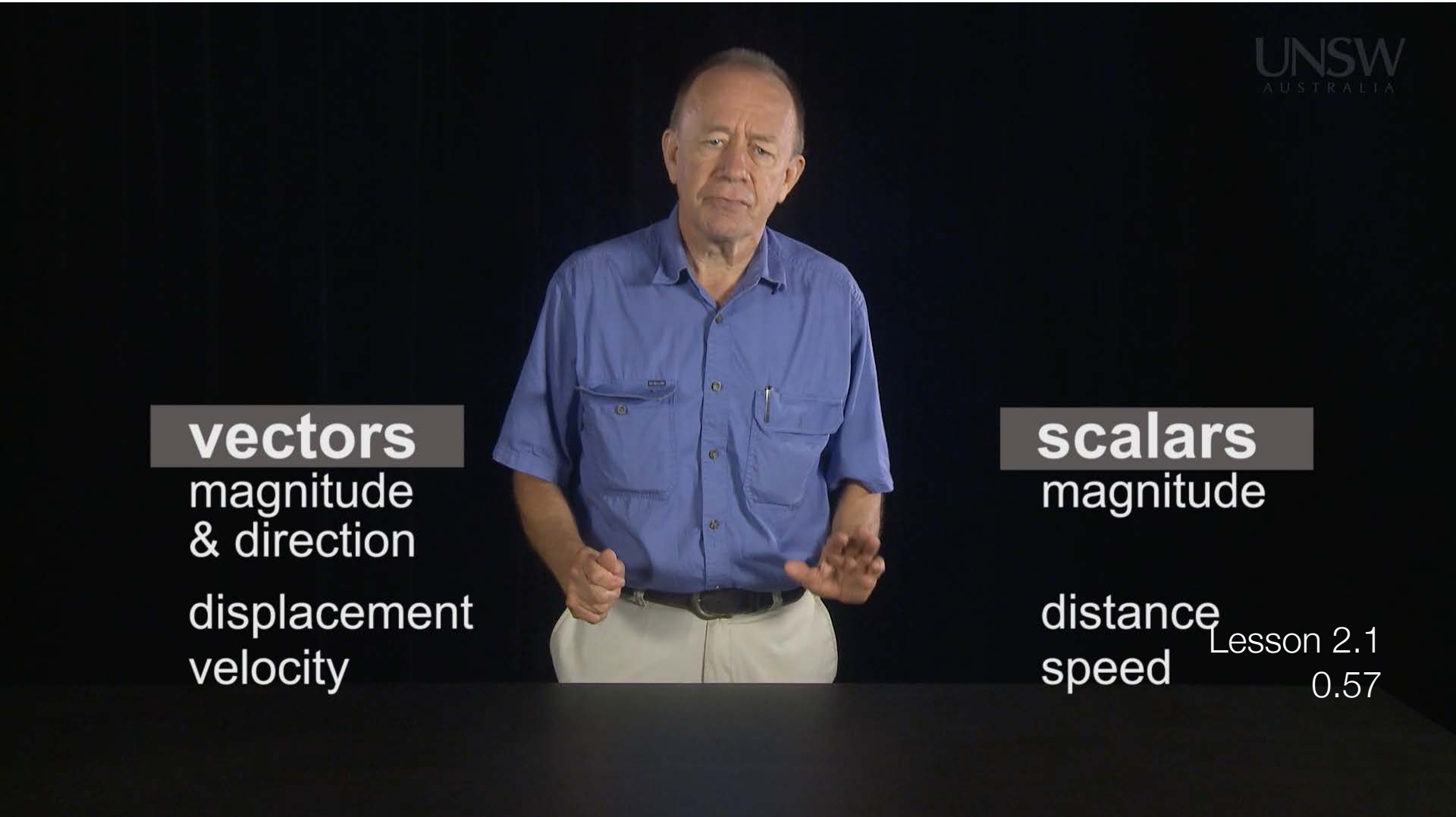
Never Stand Still

Week 2 notes

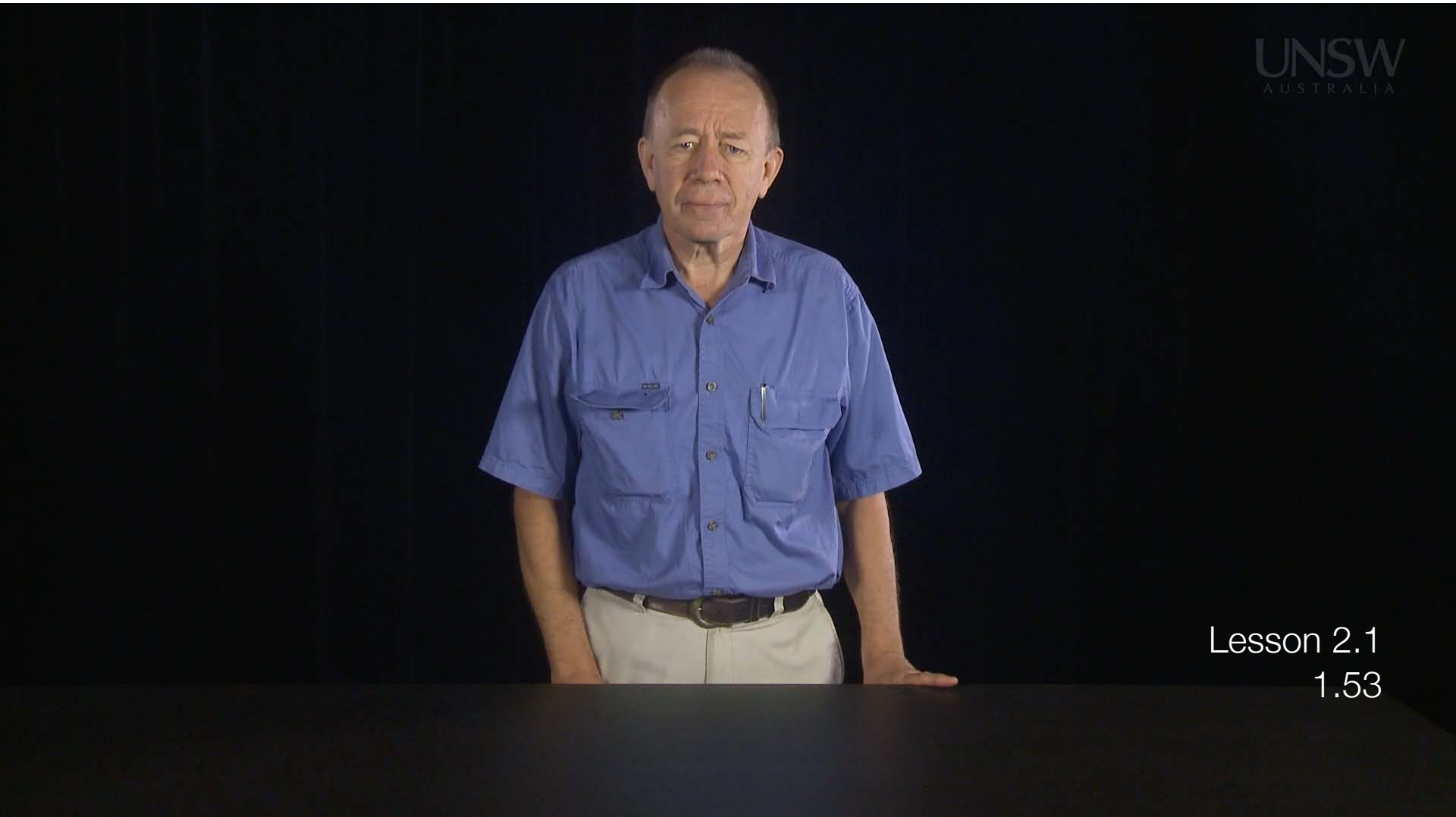
Week 2 Velocity, acceleration and relative motion

- Graphing displacement and velocity
- Acceleration – changing velocity but not necessarily changing speed
- Kinematics equations relating acceleration, velocity and displacement
- Relative motion and frames of reference

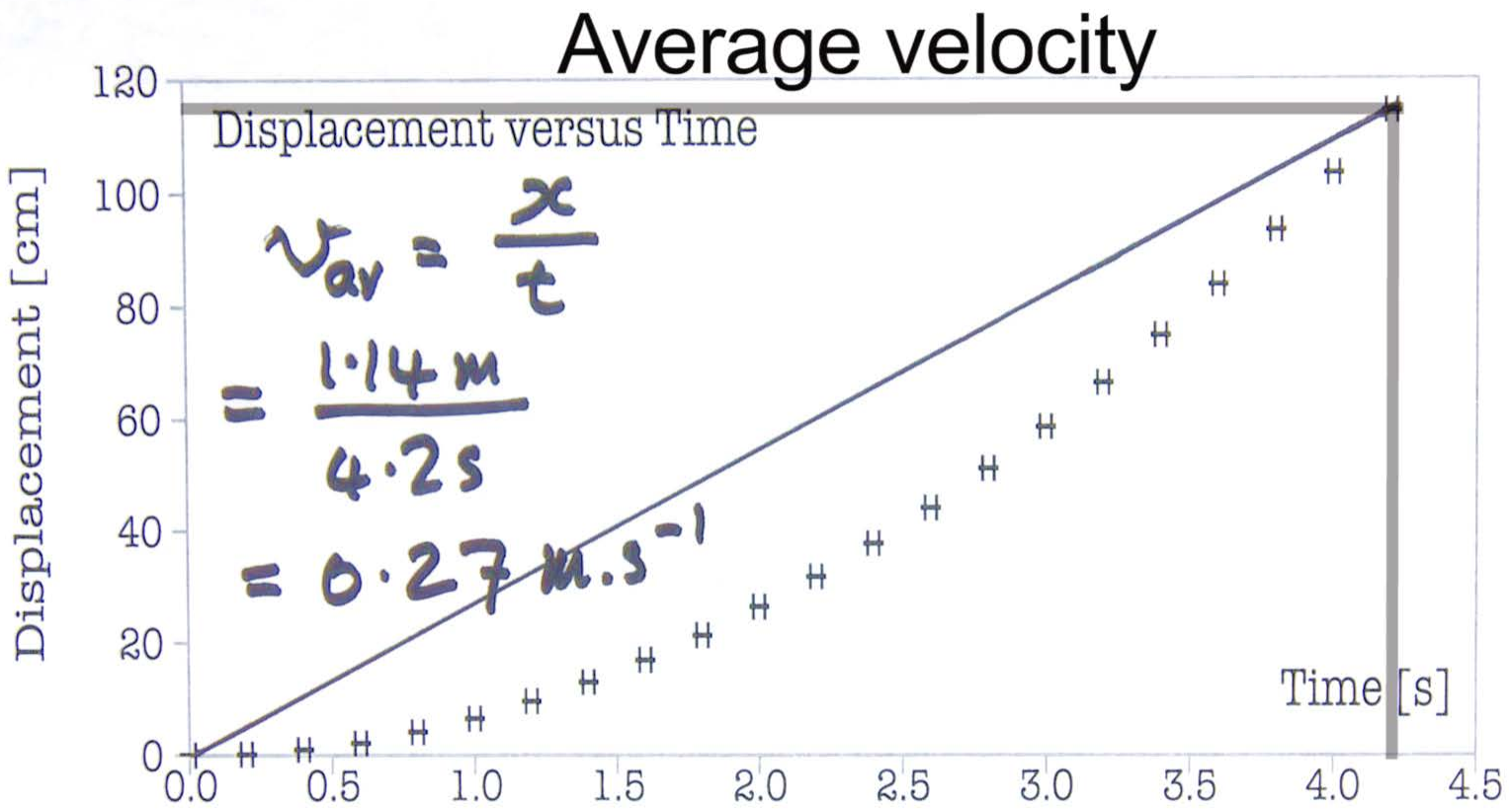
Vectors and scalars



Any change in velocity is an acceleration

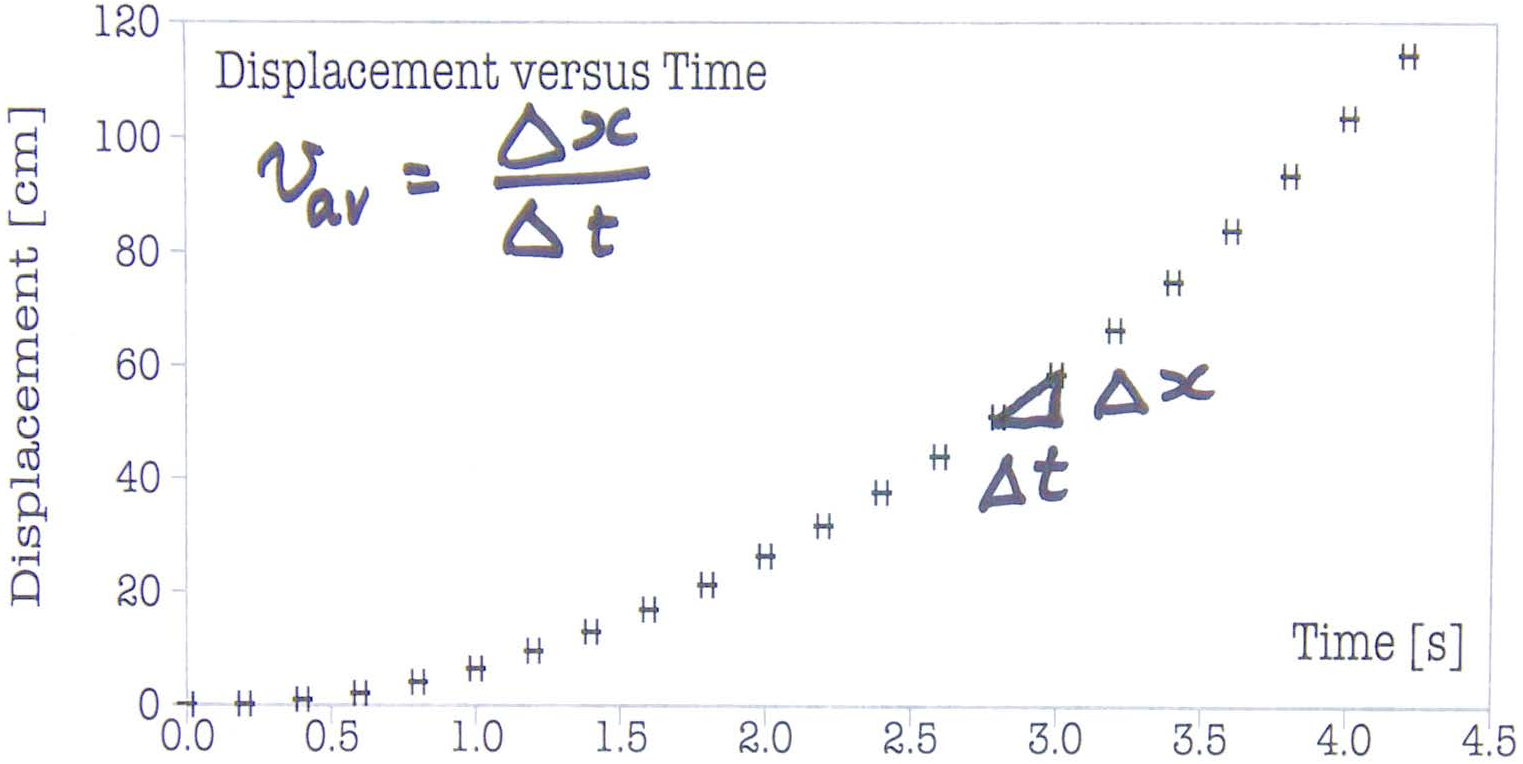


Average velocity



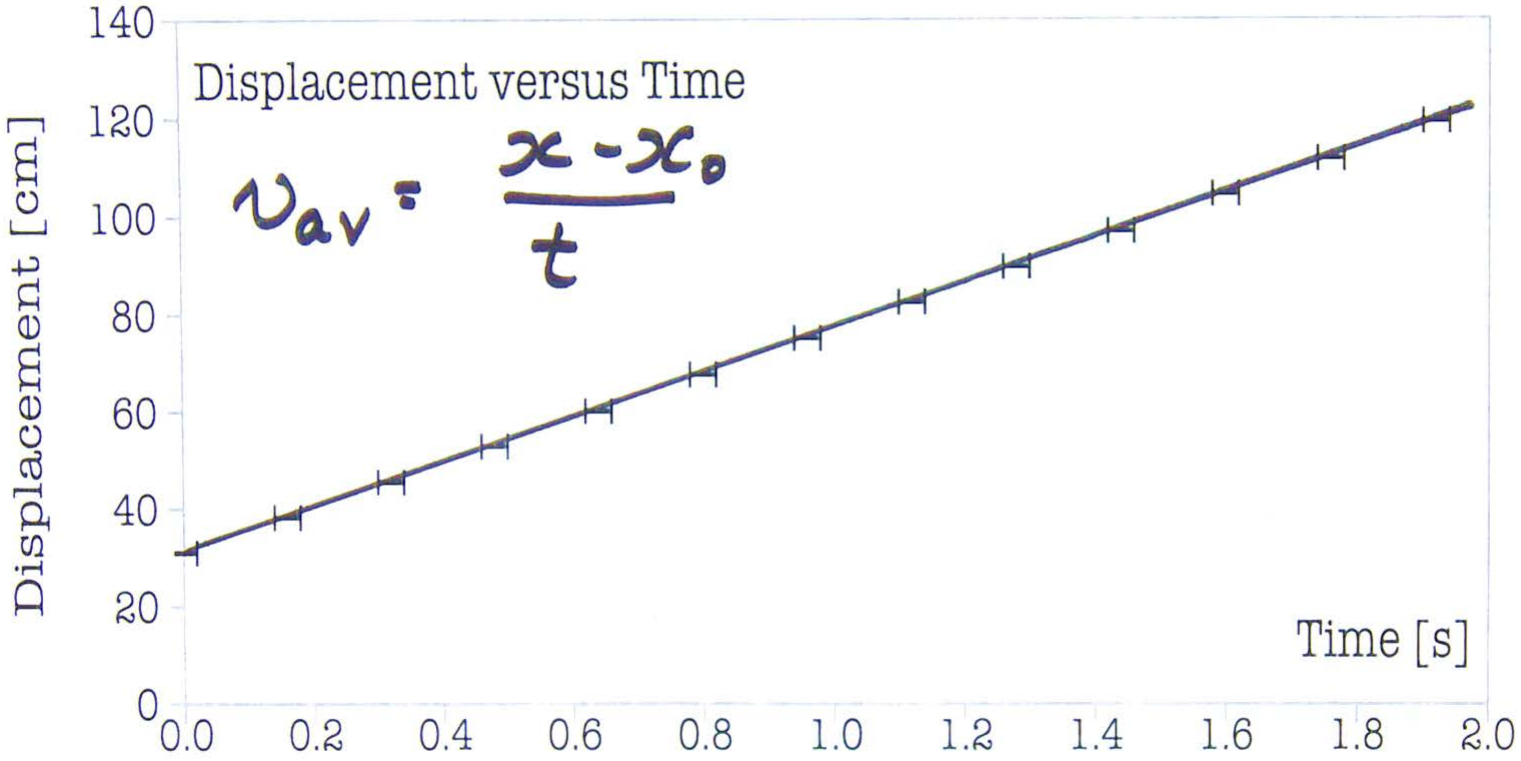
Lesson 2.1
3.29

Change in velocity over change in time



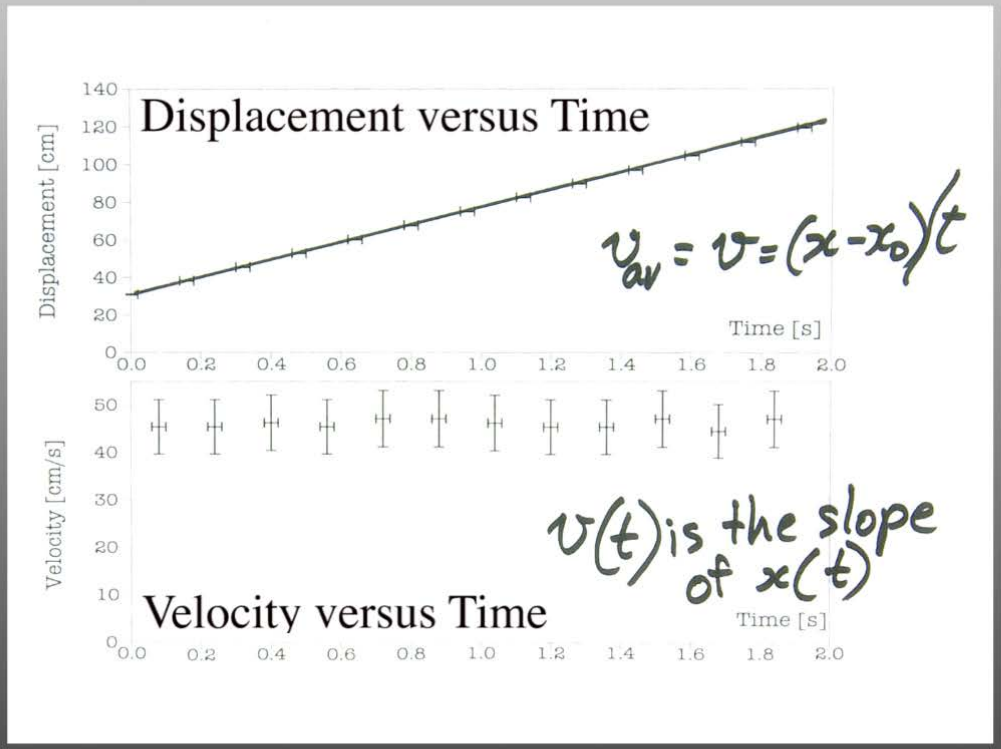
Lesson 2.1
4.09

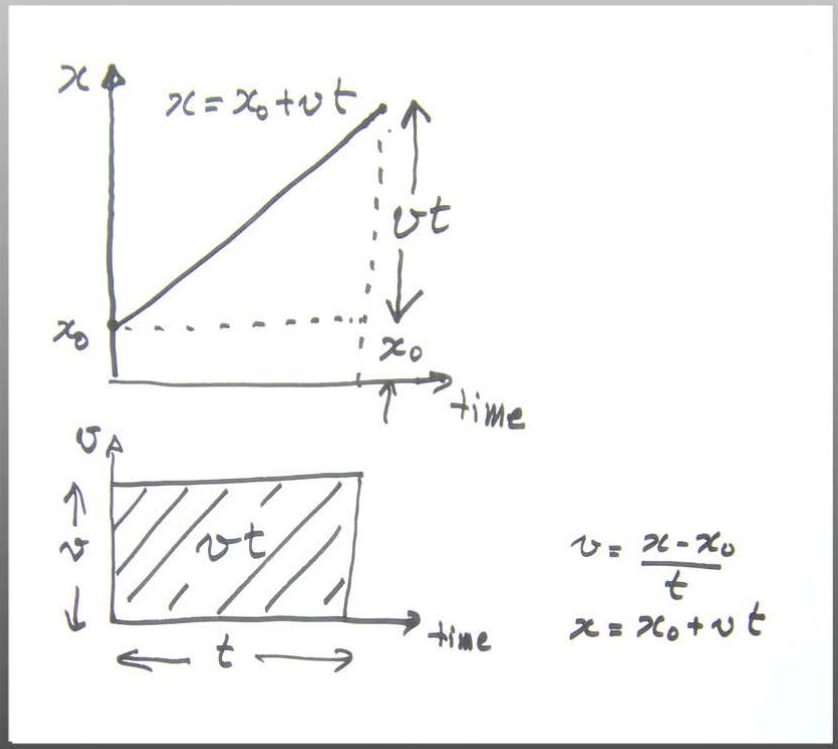
Average velocity



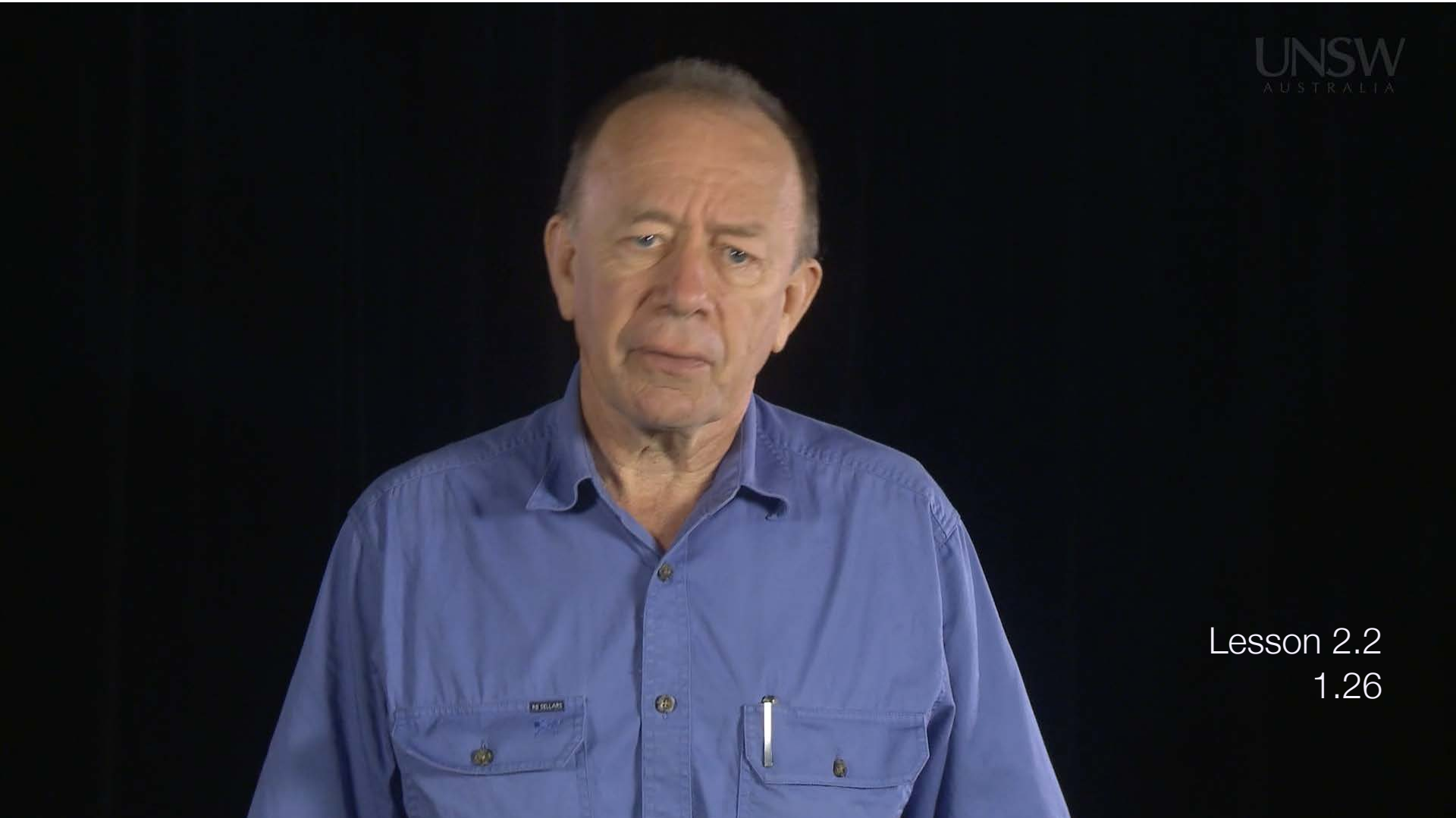
Lesson 2.1
5.39

From displacement to velocity and back

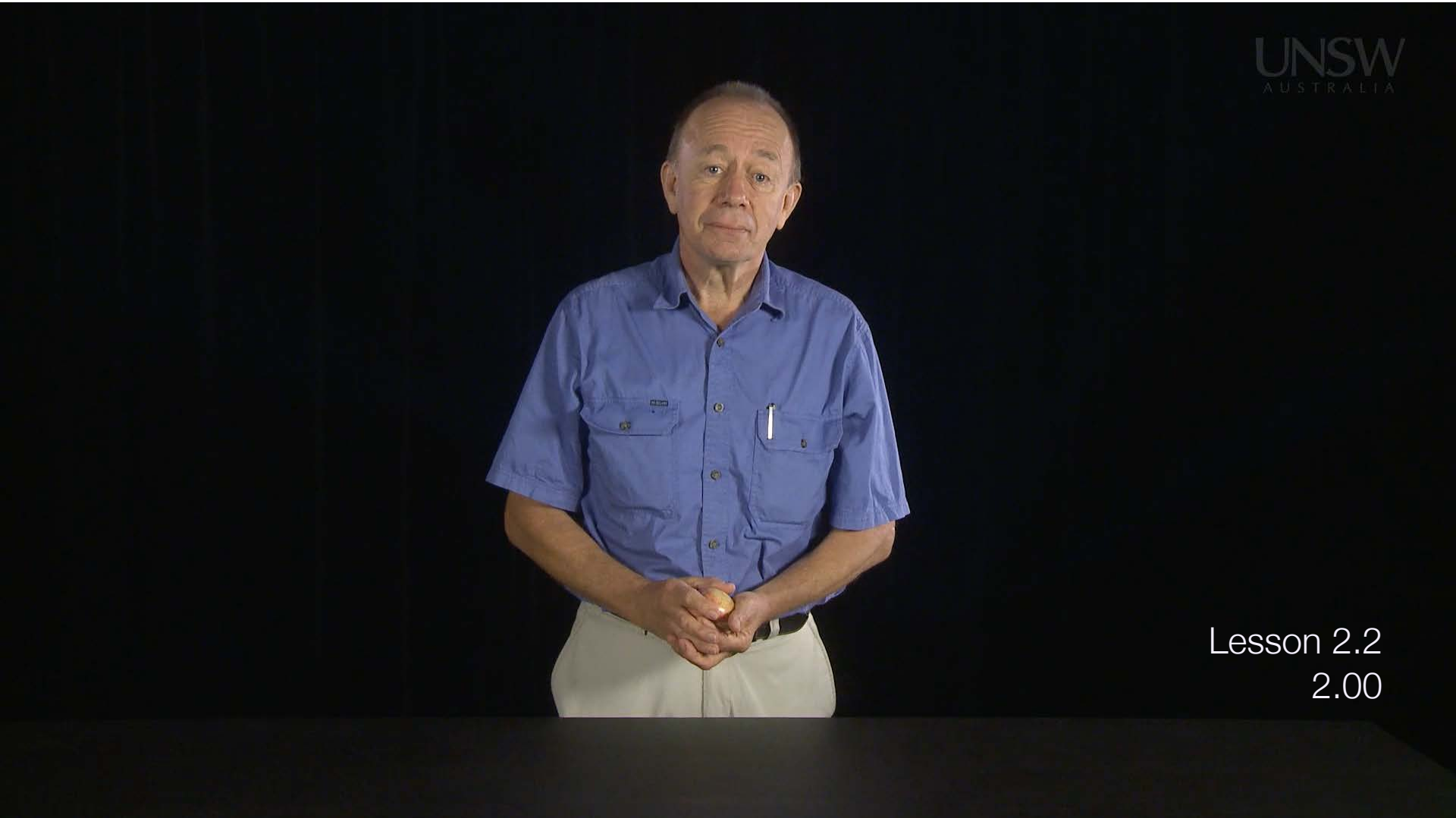




Defining acceleration



Constant acceleration



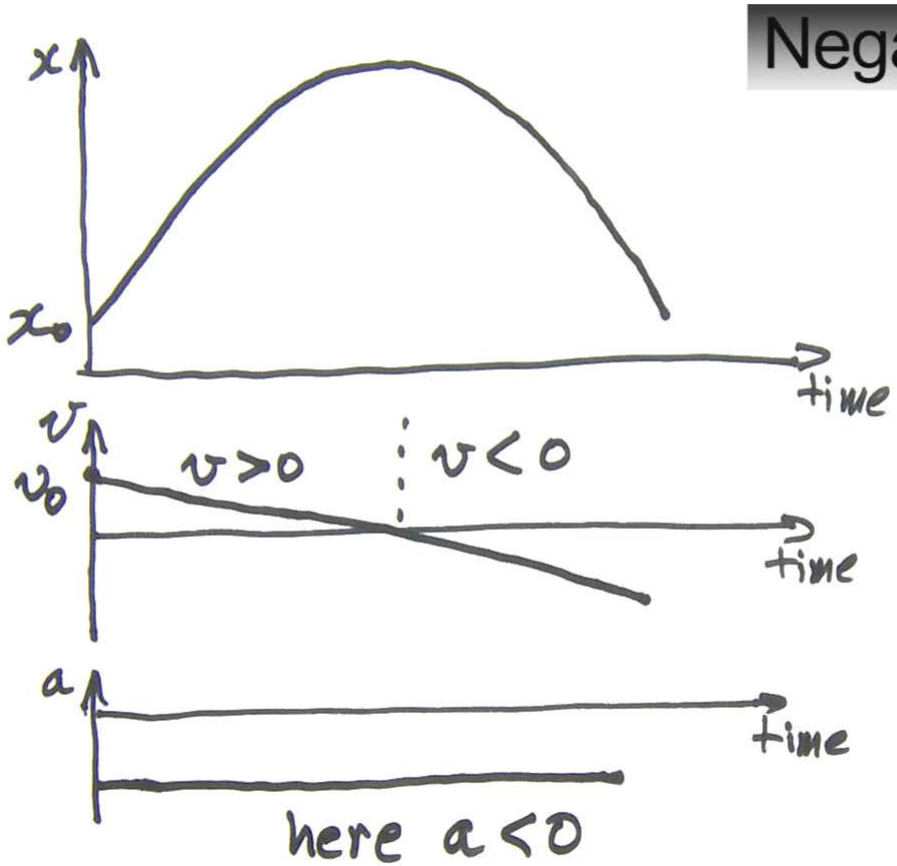
Collected terms

If a = constant (with calculus)

$v = v_0 + at$ $= \int a\,dt$

$x = x_0 + v_0 t + \frac{1}{2} a t^2$ $= \int v\,dt$

Negative acceleration



Negative acceleration

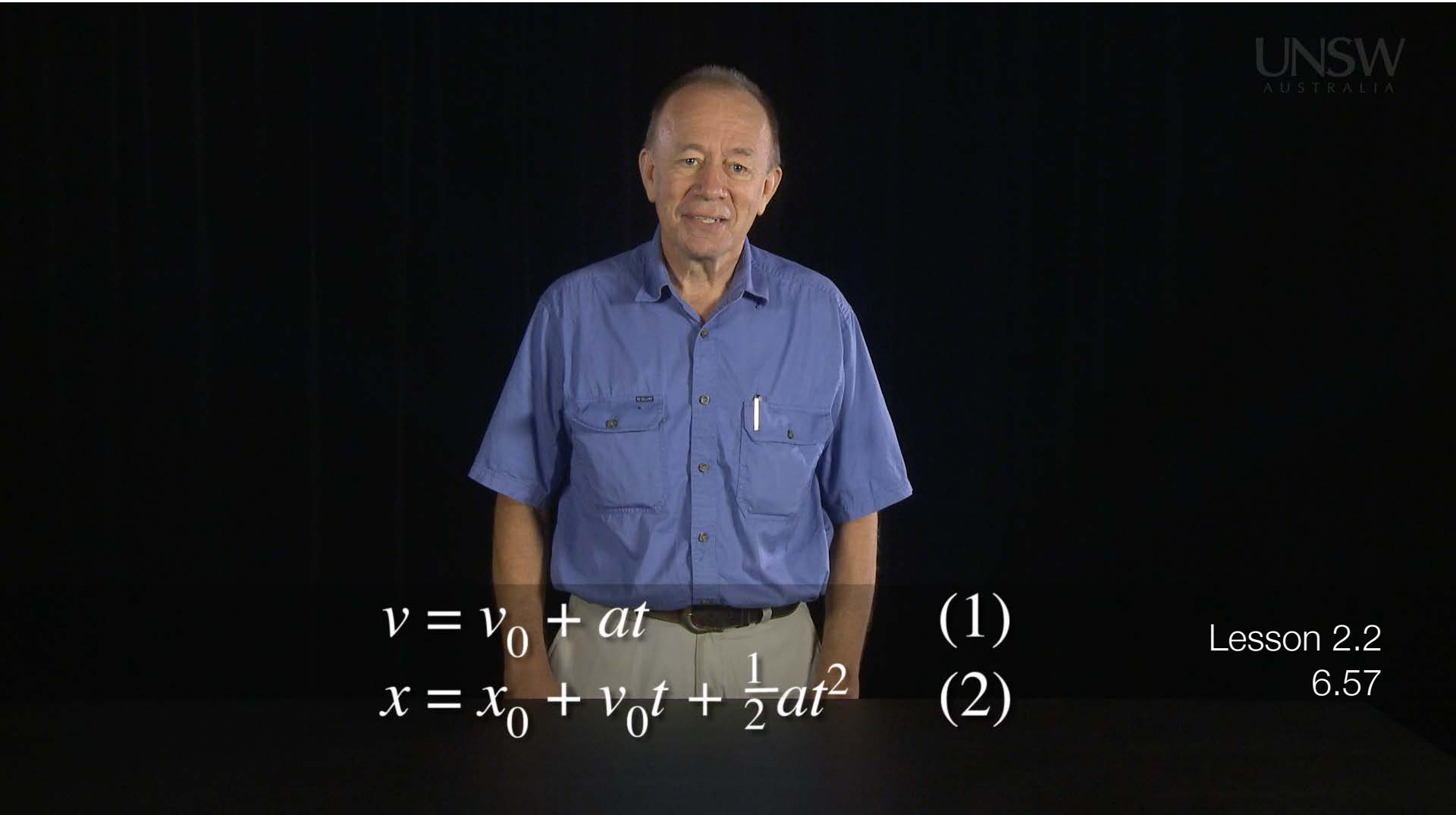
$$x = x_0 + v_0 t + \frac{1}{2} a t^2$$

$$v = v_0 + at$$

a = constant

$a < 0$

Useful equations



Relating acceleration, displacement and final velocity

(1) $v = v_0 + at \longrightarrow t = \dfrac{v - v_0}{a}$

Substitute in (2): $x = x_0 + v_0 t + \frac{1}{2} a t^2$

$$x - x_0 = v_0 \frac{v - v_0}{a} + \frac{a}{2}\left(\frac{v - v_0}{a}\right)^2$$

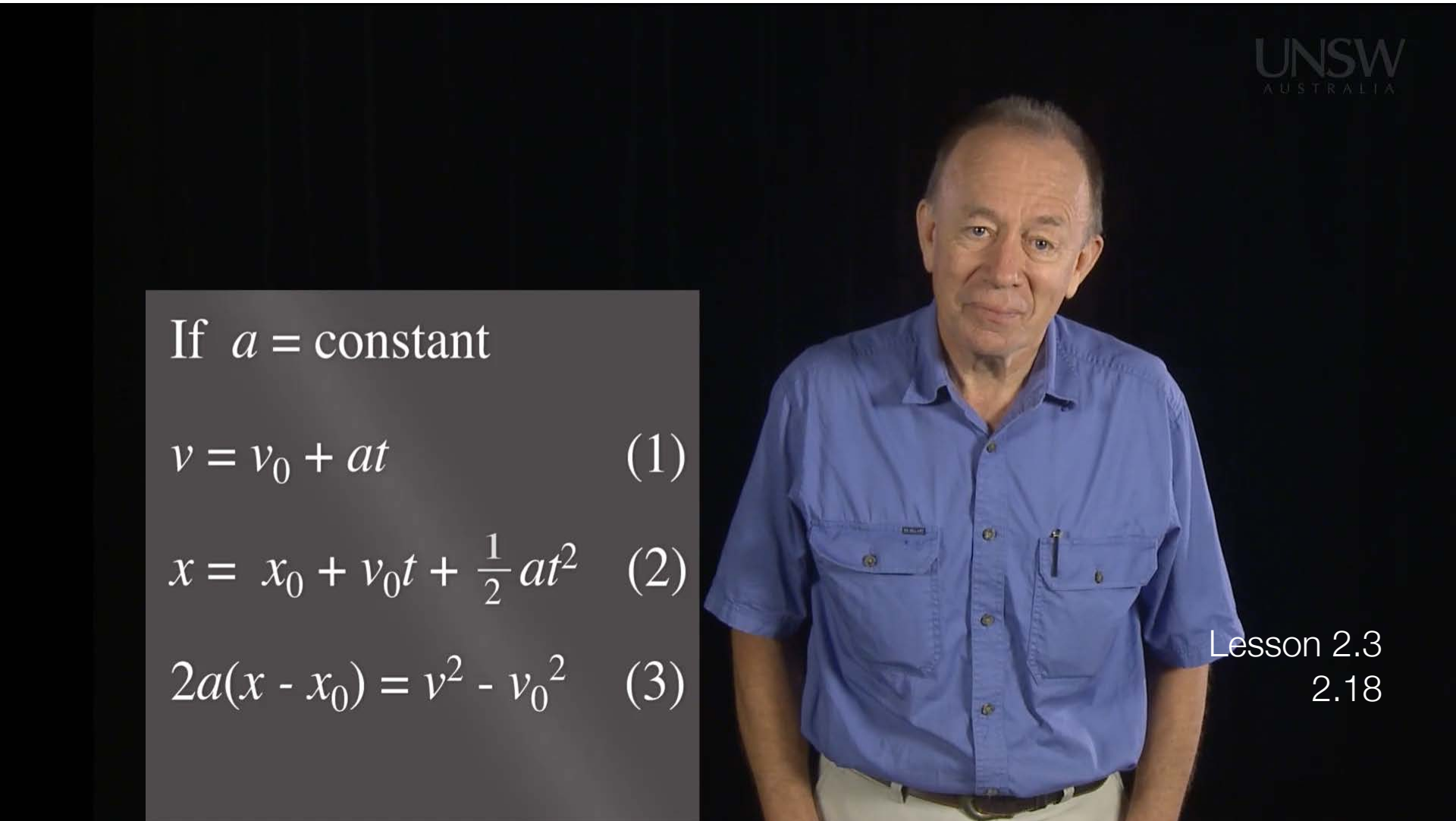
$$2a(x - x_0) = 2v_0(v - v_0) + (v - v_0)^2$$

$$= 2vv_0 - 2v_0^2 + v^2 - 2vv_0 + v_0^2$$

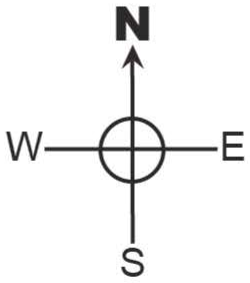
$$2a(x - x_0) = v^2 - v_0^2$$

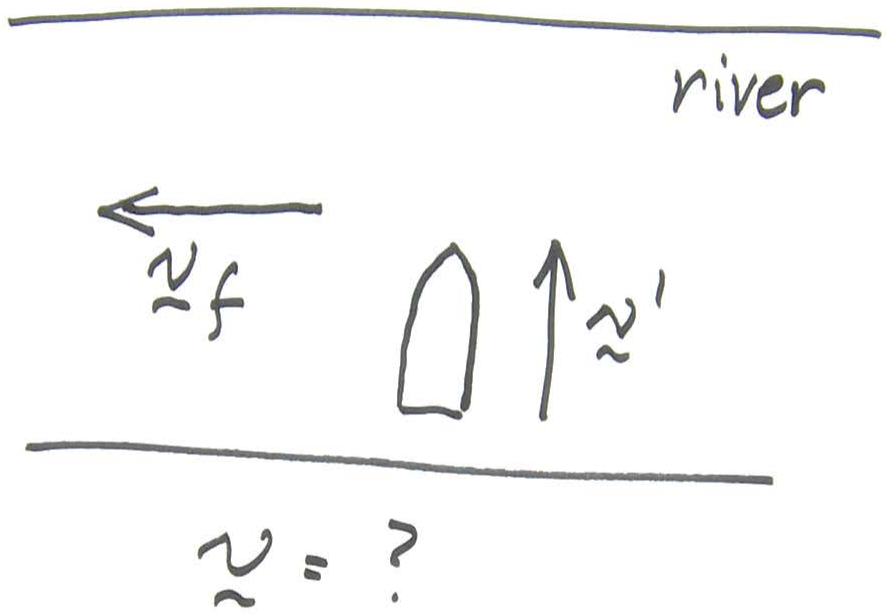
Lesson 2.3
2.07

Equations to memorise



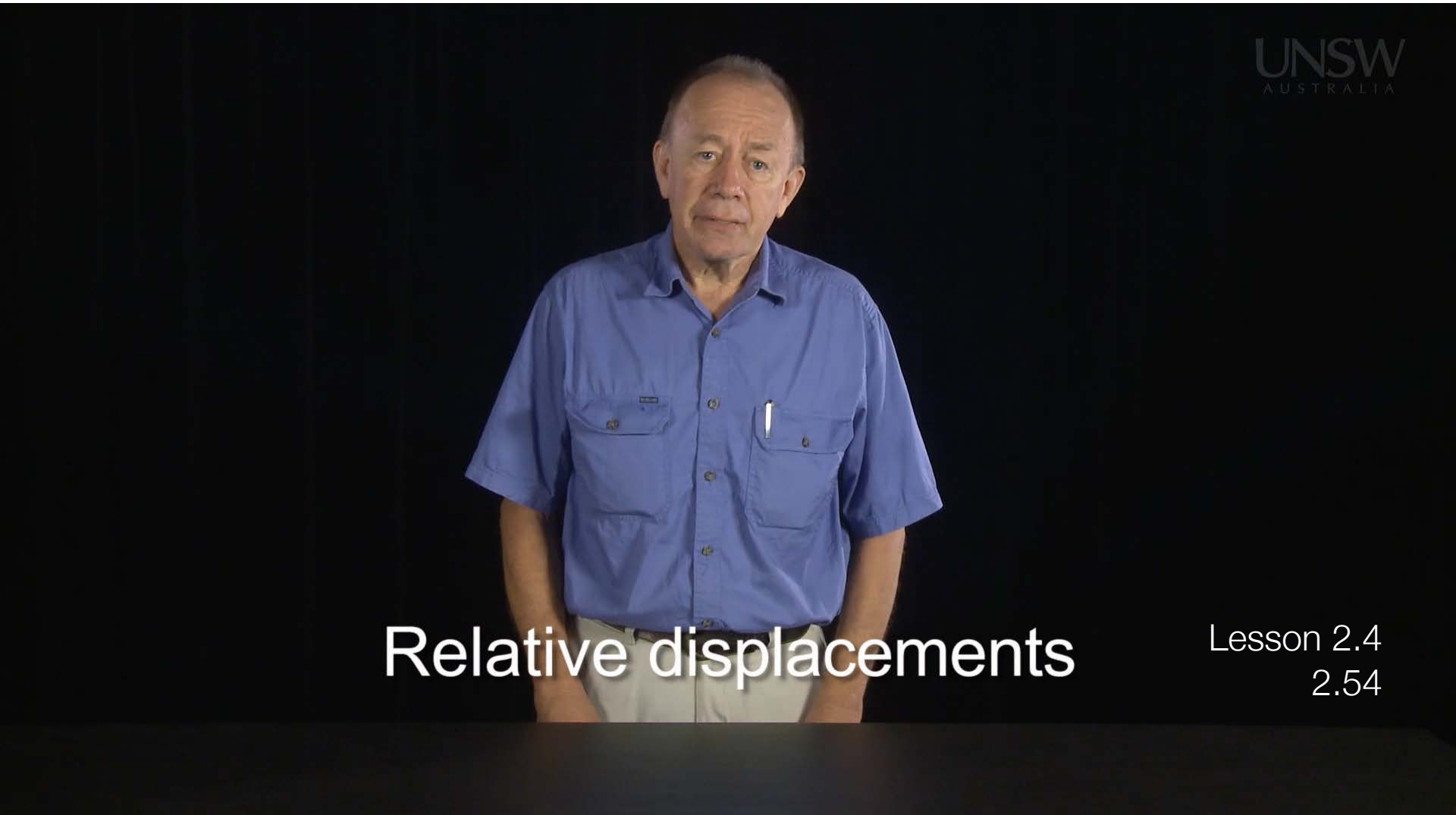
Relative velocity





Lesson 2.4
1.39

Relative displacement



Notes

Notes