KEY

p. 66 # 15-18, 26, 27, 28

(15) $v_i = 0$ $\quad\downarrow +$ down is positive

$a = 9.8 \, m/s^2$ down

$t = 4s$

(a) $x_f = x_i + v_i t + \frac{1}{2}at^2$

$\underbrace{x_f - x_i}_{\Delta x} = v_i t + \frac{1}{2}at^2$

$\Delta x = 0(4) + \frac{1}{2}(9.8)(4)^2$

$\boxed{\Delta x = 78.4 \, m}$

(b) $v_f = v_0 + at$

$v_f = 0 + 9.8(4)$

$\boxed{v_f = 39.2 \, m/s}$

(16) $\downarrow a = -9.8 \, m/s^2$ $\quad\uparrow +$ up is positive

$x_i = 0$ $\quad v_i = 19.6 \, m/s$

$v_f = v_0 + at$

(a) $v_{1s} = v_i + at$

$= 19.6 - 9.8(1)$

$\boxed{v_{1s} = 9.8 \, m/s}$

$x_f = x_i + v_i t + \frac{1}{2}at^2$

$\Delta x = v_i t + \frac{1}{2}at^2$

$\Delta x_{1s} = 19.6(1) + \frac{1}{2}(-9.8)(1)^2$

$\boxed{\Delta x_{1s} = 14.7 \, m}$

at 2 seconds

$v_{2s} = v_i + at$

$= 19.6 - 9.8(2)$

$\boxed{v_{2s} = 0 \, m/s}$

$x_{2s} = x_i + v_i t + \frac{1}{2}at^2$

$= 0 + 19.6(2) + \frac{1}{2}(-9.8)(2)^2$

$\boxed{x_{2s} = 19.6 \, m}$

at 3s

$v_{3s} = v_i + at$

$= 19.6 - 9.8(3)$

$\boxed{= -9.8 \, m/s}$

ball is on it's way down

$x_{3s} = \cancel{x_i} + v_i t + \frac{1}{2}at^2$

$= 0 + 19.6(3) + \frac{1}{2}(-4.9)(3)^2$

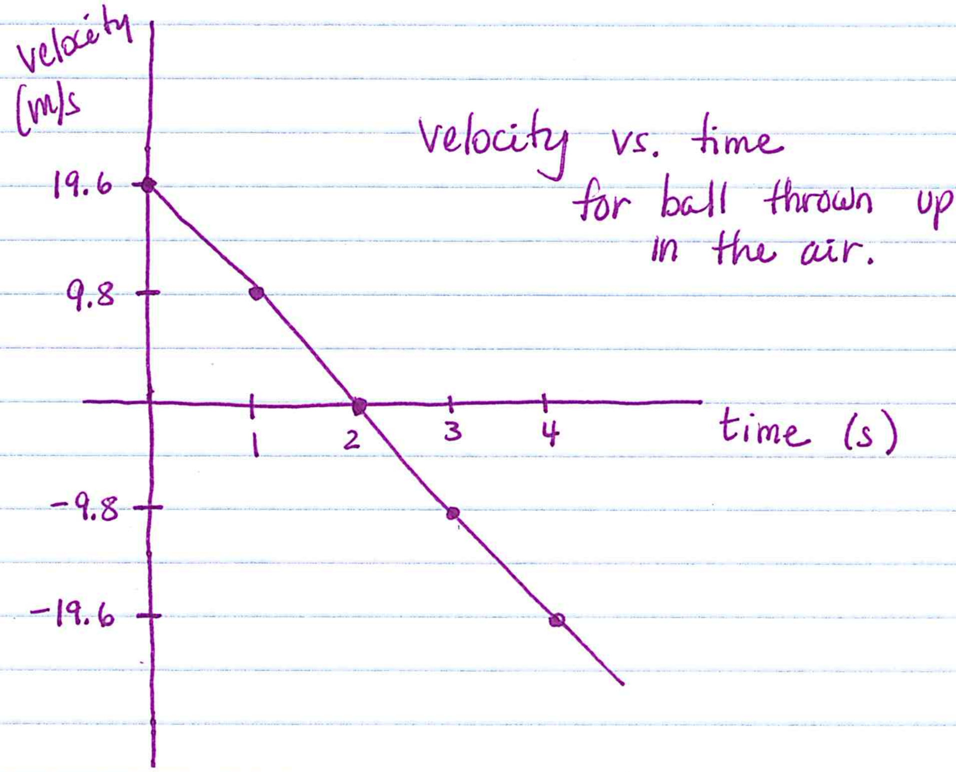
$\boxed{= 14.7 \, m}$

at 4s

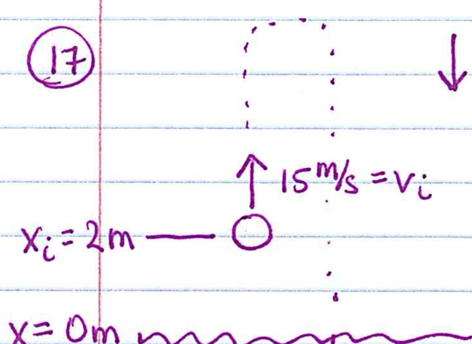
$V_{4s} = v_i + at$
$= 19.6 + (-9.8)(4)$
$\boxed{V_{4s} = -19.6 \text{ m/s}}$

$X_{4s} = X_i + V_i t + \frac{1}{2}at^2$
$= 0 + 19.6(4) + \frac{1}{2}(-9.8)(4)^2$
$\boxed{X_{4s} = 0\text{m}}$

II (b)



(17)



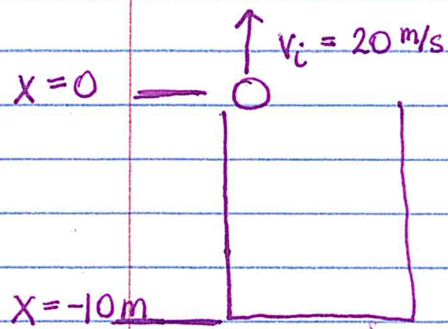
$V_i = 15 \text{ m/s}$
$a = -9.8 \text{ m/s}^2$
$X_i = 2\text{m}$
$X_f = 0\text{m}$
find t

$X_f = X_i + V_i t + \frac{1}{2}at^2$
$0 = 2 + 15t + \frac{1}{2}(-9.8)t^2$
$4.9t^2 - 15t - 2 = 0$
$t = \dfrac{15 \pm \sqrt{(-15)^2 - 4(4.9)(-2)}}{2(4.9)}$

$\boxed{t = 3.19 \text{ sec}}$ or $\cancel{t = -0.128\text{s}}$

(18)

$\downarrow a \qquad \uparrow +$



ⓐ $v_f^2 = v_i^2 + 2a\Delta x$

be very careful with signs

$\Delta x = x_f - x_i$

$= -10m - 0m$

$= -10m$

$v_f^2 = (20)^2 + 2(-9.8)(-10)$

$v_f^2 = 596 \qquad v_f = \pm\sqrt{596}$

$\boxed{v_f = -24.41 \text{ m/s}}$

take the negative velocity b/c ball is moving downwards.

ⓑ $v_f = v_i + at$

$-24.41 = 20 + (-9.8)t$

$\dfrac{-24.41 - 20}{-9.8} = t$

$\boxed{t = 4.53 \text{ sec}}$

could also use $x_f = x_i + v_i t + \frac{1}{2}at^2$

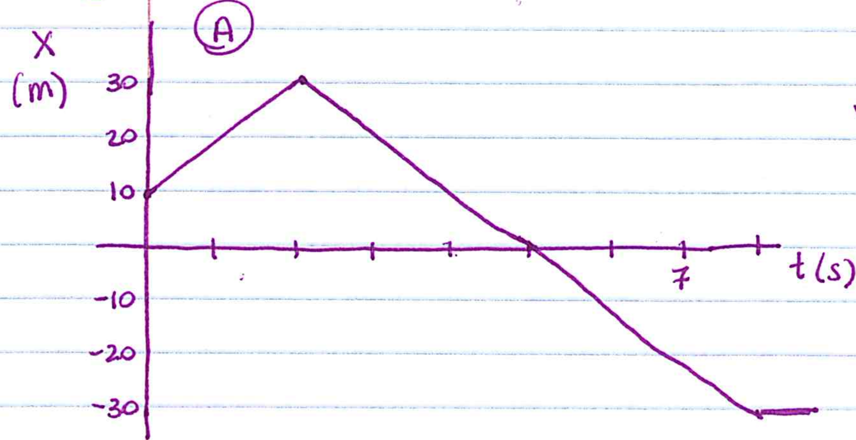
$-10 = 0 + 20t + \frac{1}{2}(-9.8)t^2$

$4.9t^2 - 20t - 10 = 0$

$t = \dfrac{20 \pm \sqrt{(-20)^2 - 4(4.9)(-10)}}{2(4.9)}$

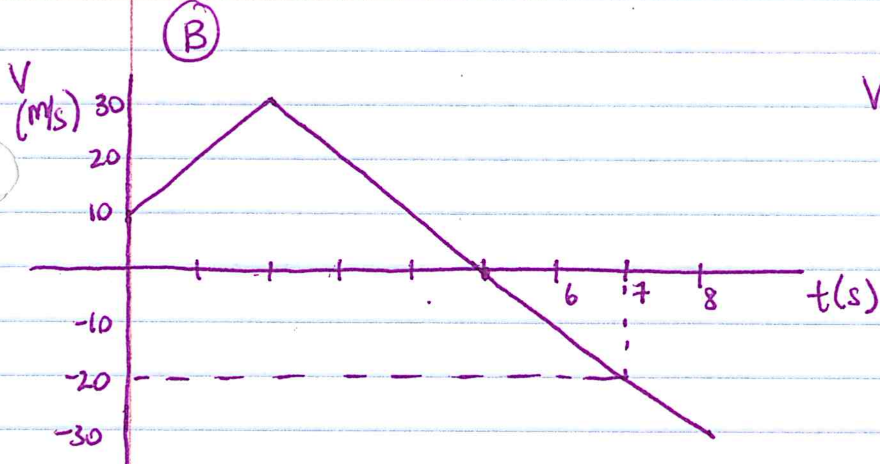
$\boxed{t = 4.53 \text{ sec}}$ or $t = \cancel{-0.45}$ sec

(26) $V_{0x} = V_i = 10\ m/s \quad @\ t_0 = 0\,s$



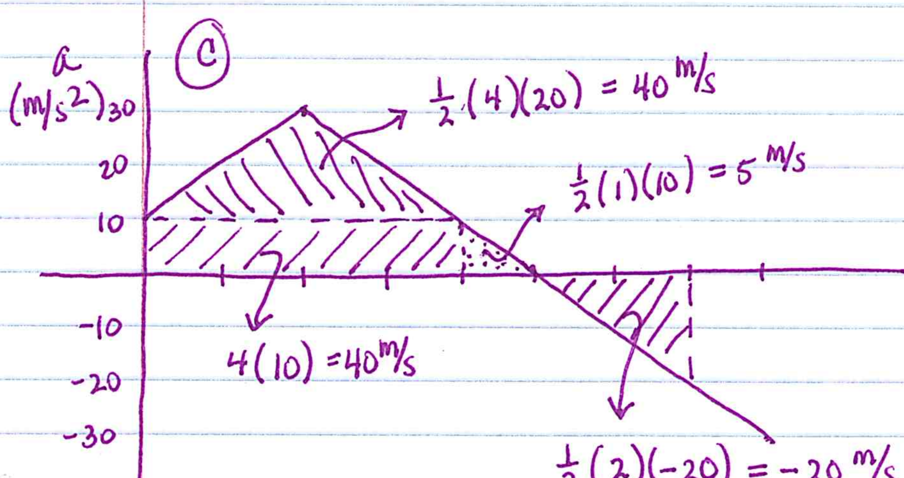
V at 7s = slope of line at 7s

$\boxed{V = -10\ m/s}$



V @ 7s is read directly from the graph

$\boxed{V = -20\ m/s}$



$V\ @\ 7s = \overset{\text{given}}{V_i} + \underbrace{\Delta V}_{\text{area under acceleration curve}}$

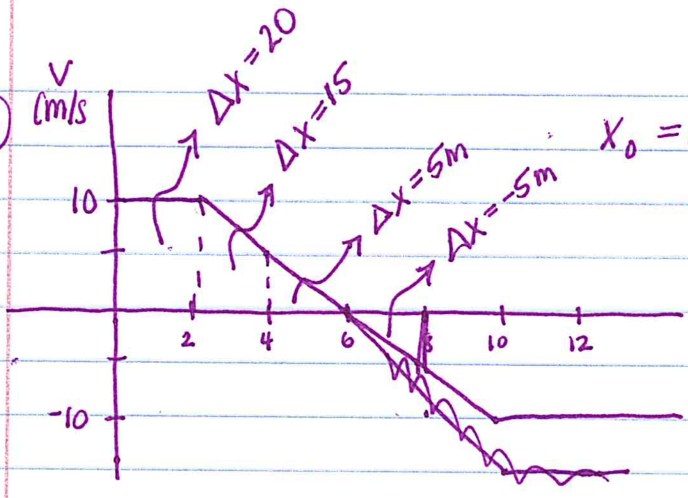
$V = 10\ m/s + 65\ m/s$

$\boxed{V = 75\ m/s}$

$\Delta V = 40\ m/s + 40\ m/s + 5\ m/s - 20\ m/s$

$\Delta V = 65\ m/s$

27



$X_0 = 0$ at $t_0 = 0$

find time when $X = 35m$

$X = X_0 + \Delta X$

$35 = 0 + \Delta X$

$\Delta X = 35m$

ΔX is the area under the curve

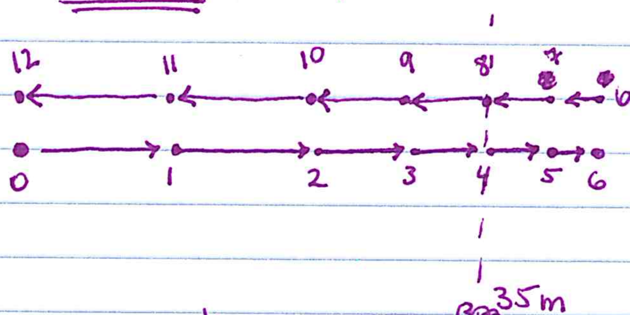
at 4s $\Delta X_4 = 20 + 15 = 35m$

at 4second the particle is at $X = 35m$

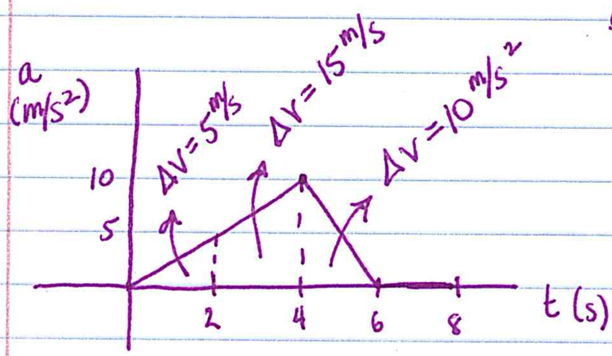
at 8s $\Delta X_8 = 20 + 15 + 5 - 5 = 35m$

at 8s the particle is at $X = 35m$

(b)



28



$V_i = 0$ at $t = 0$ (starts from rest)

find v @ 0s, 2s, 4s, 6s, 8s

Δv is the area under the acceleration curve

$V = V_i + \Delta V$

at $t=0$ $v_i = 0\ m/s$

at $t = 2s$ $V = V_i + \Delta V$

$= 0 + \frac{1}{2}(2)(5)$

$= 5\ m/s$

at $t = 4s$ $V = V@2s + \Delta V$

$= 5\ m/s + 15\ m/s = 20\ m/s$

at $t = 6s$

$V = V@4s + \Delta V$

$= 20\ m/s + 10\ m/s$

$= 30\ m/s$

at $t = 8s$

$V = V@6s + \Delta V$

$= 30\ m/s + 0\ m/s$

$= 30\ m/s$