# Kinematics 2

① $v_i = 0$
$a = 2.3\ m/s^2$
$t = 34\ s$
$d = ?$

$d = v_i t + \frac{1}{2} a t^2$

$= (0)(34) + \frac{1}{2}(2.3)(34)^2$

$= 0 + 1329.4$

$d = 1329.4\ m$

② $v_i = 90\ km/h = 25\ m/s$
$a = -7.5\ m/s^2$
$v_f = 0$
$d = ?$

$v_f^2 = v_i^2 + 2ad$

$0 = 25^2 + 2(-7.5)d$

$0 = 625 - 15d$

$d = \frac{625}{15} = 41.6\ m$

You avoid hitting the dog (since you stop in less than 50 m).

③ a) Trip up

$v_i = 15\ m/s$
$a = -9.8\ m/s^2$
$v_f = 0$
$d = ?$

$v_f^2 = v_i^2 + 2ad$

$0 = 15^2 + 2(-9.8)d$

$0 = 225 - 19.6d$

$d = \frac{225}{19.6} = 11.5\ m$

b) Trip up

$t = ?$

$v_f = v_i + at$

$0 = 15 - 9.8t$

$t = \frac{15}{9.8} = 1.53\ s$

Total

$t = 2(1.53) = 3.06\ s$

③ c) $t = 1.53$ s (see part B)

d) Whole trip

$v_i = 15$ m/s
$a = -9.8$ m/s$^2$
$d = 0$ (start and end at same position)
$v_f = ?$

$v_f^2 = v_i^2 + 2ad$

$= 15^2 + 2(-9.8)(0)$

$v_f^2 = 225$

$v_f = \pm 15$ m/s $= -15$ m/s

e) Whole Trip

$v_i = 15$ m/s
$a = -9.8$ m/s$^2$
$d = 8$ m
$t = ?$

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

$8 = 15t + \frac{1}{2}(-9.8)t^2$

$8 = 15t - 4.9t^2$

$4.9t^2 - 15t + 8 = 0$

(This is a quadratic)

$t = \frac{15 \pm \sqrt{15^2 - 4(4.9)(8)}}{2(4.9)}$

$= \frac{15 \pm 8.258}{9.8}$

$t = 2.37$ s or $0.69$ s

↑ on the way down

↑ on the way up

④ $v_i = 0$

$v_f = 120 \text{ km/h} = 33.\overline{3} \text{ m/s}$

$d = 3.5 \text{ m}$

$a = ?$

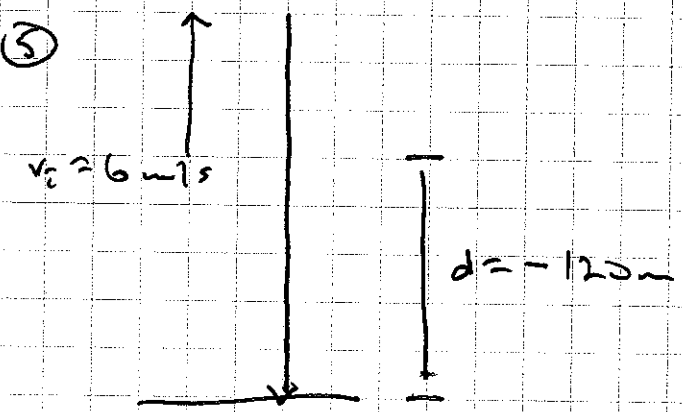
$v_f^2 = v_i^2 + 2ad$

$(33.\overline{3})^2 = 0^2 + 2a(3.5)$

$1111.\overline{1} = 7a$

$a = \frac{1111.\overline{1}}{7} = 158.7 \text{ m/s}^2$

⑤




$v_i = 6 \text{ m/s}$

$a = -9.8 \text{ m/s}^2$

$d = -120 \text{ m}$

$t = ?$

$v_f^2 = v_i^2 + 2ad$

$= 6^2 + 2(-9.8)(-120)$

$v_f^2 = 2388$

$v_f = -48.867 \text{ m/s}$

$v_f = v_i + at$

$-48.867 = 6 - 9.8t$

$-54.867 = -9.8t$

$t = \frac{-54.867}{-9.8}$

$t = 5.60 \text{ s}$

⑥ $a = -30g = -30(9.8) = -294 \text{ m/s}^2$

$v_i = 100 \text{ km/h} = 27.\overline{7} \text{ m/s}$

$v_f = 0$

$d = ?$

$v_f^2 = v_i^2 + 2ad$

$0 = (27.\overline{7})^2 + 2(-294)d$

$0 = 771.605 - 588d$

$d = \frac{771.605}{588} = 1.31 \text{ m}$

⑦ Time for pelican to dive 20 m:

$v_i = 0$

$a = -9.8 \text{ m/s}^2$

$d = -20 \text{ m}$

$t = ?$

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

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

$-20 = 0 - 4.9t^2$

$t^2 = \frac{20}{4.9}$

$t = 2.02 \text{ s}$

Subtract 0.1 s for the fish to evade:

$t = 2.02 - 0.1 = 1.92 \text{ s}$

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(7) Distance the pelican dives in 1.92 s:

$v_i = 0$
$a = -9.8\ m/s^2$
$t = 1.92\ s$
$d = ?$

$$d = v_i t + \frac{1}{2}at^2$$
$$= (0)(1.92) + \frac{1}{2}(-9.8)(1.92)^2$$
$$= 0 - 18.07$$
$$d = -18.07\ m$$

Height above water at 1.92 s:

$$h = 20\ m - 18.07\ m = 1.93\ m$$

(8) $v_i = -5\ m/s$
$t = 2\ s$
$a = -9.8\ m/s^2$

a) $v_f = v_i + at$
$= -5 - 9.8(2)$
$v_f = -24.6\ m/s$

b) $d = v_i t + \frac{1}{2}at^2$
$= (-5)(2) + \frac{1}{2}(-9.8)(2)^2$
$d = -29.6\ m$