Author: Mr Fan

This step-by-step solution guide has been created by **Mr Fan** for educational purposes. While we have made every effort to ensure the accuracy of the information presented, it is possible that there may be errors or omissions. We encourage users to critically evaluate and verify the content. BF Maths and the author cannot be held responsible for any errors or inaccuracies in this guide.

If you find any mistakes or have any suggestions for improvements, please contact us at bfmathshello@gmail.com. Your feedback is invaluable in helping us maintain the quality and accuracy of our resources. Please specify *which exercise* and *which question* in the email.

Thank you for using BF Maths for your maths revision!

11.5 - Constant acceleration formulae

Q1a $v = \frac{ds}{dt}$

$v = u + \frac{1}{2}(2)at = \underline{\underline{u + at}}$

Q1b $a = \frac{dv}{dt}$

$a = \frac{d}{dt}(u + at) = \underline{\underline{a\ ms^{-2}}}$

Q2a $v = \int a\,dt$

$v = at + c$

When $t = 0$, $v = u$

$u = 0 + c \Rightarrow c = u$

$v = \underline{\underline{at + u}}$

Q2b $s = \int v\,dt$

$s = \int (at + u)\,dt$

$s = \frac{at^2}{2} + ut + d$

When $t = 0$, $s = 0$

$0 = 0 + 0 + d \Rightarrow d = 0$

$s = \underline{\underline{\frac{at^2}{2} + ut}}$

Q3 Constant accel $\Rightarrow$ a is "an expression" without other variable.

a) $s = 3t - 2t^3$

$v = \frac{ds}{dt} = 3 - 6t^2$

$a = \frac{dv}{dt} = -12t \Rightarrow a$ is not constant.

b) $s = t^2 - 7t$

$v = \frac{ds}{dt} = 2t - 7$

$a = \frac{dv}{dt} = 2 \Rightarrow a$ is a constant

c) $s = 5t^{-1} + 8$

$v = \frac{ds}{dt} = -5t^{-2}$

$a = \frac{dv}{dt} = +10t^{-3} \Rightarrow a$ is not a constant

d) $s = 16 - \frac{t^2}{2}$

$v = \frac{ds}{dt} = -t$

$a = \frac{dv}{dt} = -1 \Rightarrow a$ is a constant.

e) $s = 10$

$v = \frac{ds}{dt} = 0$

$a = \frac{dv}{dt} = 0 \Rightarrow a$ is a constant.

11.5 - Constant acceleration formulae

(Q4a) When $t=0$, $s=0$

When $t=50$, $s=32(50)-0.3(50)^2$

$=850\text{m}$

$\therefore AB = \underline{\underline{850\text{m}}}$

Note: Here we made an assumption that the car travels in the same direction throughout the journey A to B. Hence the displacement = distance. We assumed it because it's only a 1-marker. If the question is worth more marks, be mindful the car comes to an "instantaneous rest". See Problem Solving questions in Chapter 11.

(Q4b) $v = \frac{ds}{dt} = 32 - 0.6t$

$a = \frac{dv}{dt} = -0.6\,\text{ms}^{-2}$

$\therefore$ The car travels with constant acceleration. (deceleration rather)

(Q5a) $a = 3$

$v = \int a\,dt = 3t + c$

When $t=0$, $v=10$

$10 = 3(0) + c \Rightarrow c = 10$

$\Rightarrow v = \underline{\underline{3t+10}}$

(Q5b) $s = \int v\,dt$

$s = \frac{3t^2}{2} + 10t + d$

When $t=0$, $s=5$

$5 = 0 + 0 + d \Rightarrow d = 5$

$\Rightarrow s = \frac{3t^2}{2} + 10t + 5$

$s = \underline{\underline{10t + 1.5t^2 + 5}}$

(Q6) $s = pt^2 + qt + r$

When $t=2$, $s=8$

$8 = 4p + 2q + r$ — (1)

$v = \frac{ds}{dt} = 2pt + q$

When $t=2$, $v=7$

$7 = 2p(2) + q$

$7 = 4p + q$ — (2)

$a = \frac{dv}{dt} = 2p$

When $t=2$, $a=6$

$6 = 2p$

$p = \underline{\underline{3}}$

Sub into (2)

$7 = 4(3) + q$

$q = \underline{\underline{-5}}$

Sub into (1)

$8 = 4(3) + 2(-5) + r$

$8 = 12 - 10 + r$

$r = \underline{\underline{6}}$

11.5 - Constant acceleration formulae

Q7a) Constant acceleration ⇒ Let accel be $a\ ms^{-2}$

$v = \int a\,dt$

$v = at + c$

When $t=0$, $v=5$

$5 = 0 + c \Rightarrow c = 5$

$v = at + 5$

When $t=2$, $v=13$

$13 = a(2) + 5$

$a = \underline{\underline{4\ ms^{-2}}}$

Q7b) $s = \int v\,dt$

$s = \int 4t + 5\,dt$

$s = 2t^2 + 5t + d$

When $t=0$, $s=3$

$3 = 0 + 0 + d \Rightarrow d = 3$

$s = \underline{\underline{2t^2 + 5t + 3}}$ (Totally not worth 5 marks imo)