Multi-Stage Constant Acceleration Problems

(a) A particle travels in a straight line from A to B with a constant acceleration of $2\ \text{ms}^{-2}$. After 3 seconds the particle reaches B, where it has a velocity of $18\ \text{ms}^{-1}$. Its acceleration then changes to $1.5\ \text{ms}^{-2}$ and it continues to travel in a straight line from B to C, a distance of 39 m. Find the initial velocity of the particle, the total distance travelled and the total time taken.

A to B	B to C	Working and Answers
$s = 45$	$s = 39$	Initial velocity $= 12\ \text{ms}^{-1}$ Total distance travelled $= 84$ m Total time taken $= 5$ s
$u = 12$	$u = 18$	
$v = 18$	$v = 21$	
$a = 2$	$a = 1.5$	
$t = 3$	$t = 2$	

(b) A particle sets off from A with an initial velocity of $10\ \text{ms}^{-1}$. It travels in a straight line for 2.5 seconds with a constant acceleration of $a\ \text{ms}^{-2}$ until it reaches B. The acceleration of the particle then changes to $4\ \text{ms}^{-2}$ and the particle travels a further 240 m over 6 seconds, until it reaches point C. Find the acceleration from A to B, and the total distance travelled by the particle.

A to B	B to C	Working and Answers
$s = 47.5$	$s = 240$	Acceleration from A to B $= 7.2\ \text{ms}^{-2}$ Total distance travelled $= 287.5$ m
$u = 10$	$u = 28$	
$v = 28$	$v =$	
$a = 7.2$	$a = 4$	
$t = 2.5$	$t = 6$	

(c) A particle travels in a straight from A to C through B, where AB=BC. The particle starts from rest at A and moves with a constant acceleration of $2.5\ \text{ms}^{-2}$ until it reaches B. The particle then continues in the same direction, decelerating at a constant rate until it reaches C. The time taken from B to C is 5 seconds and the velocity at C is $12\ \text{ms}^{-1}$. Find the velocity at B, the total distance travelled and the deceleration from B to C.

A to B	B to C	Working and Answers
$s = 80$	$s = 80$	Velocity at B $= 20\ \text{ms}^{-1}$ Total distance travelled $= 160$ m Deceleration from B to C $= 1.6\ \text{ms}^{-2}$
$u = 0$	$u = 20$	
$v = 20$	$v = 12$	
$a = 2.5$	$a = -1.6$	
$t = t$	$t = 5$	