Question 2 **(10 marks)**

An advertising graphic moves across the bottom of a television screen during a sporting game, changing direction to attract viewer attention. The position of the graphic is modelled by

$$x(t) = \frac{1}{3}t^3 - 7t^2 + 40t$$

where x, in centimetres, is the position of the graphic relative to the left side of the screen, and t, in seconds, is the time from when the graphic first appears on the screen.

The position of the graphic at integer time increments is given in the table below.

t	0	1	2	3	4	5	6	7
$x(t)$	0	$33\frac{1}{3}$	$54\frac{2}{3}$	66	$69\frac{1}{3}$	$66\frac{2}{3}$	60	$51\frac{1}{3}$

t	8	9	10	11	12	13	14	15
$x(t)$	$42\frac{2}{3}$	36	$33\frac{1}{3}$	$36\frac{2}{3}$	48	$69\frac{1}{3}$	$102\frac{2}{3}$	150

(a) Determine the velocity of the graphic when it first appears on the screen. (2 marks)

(b) Is the graphic initially speeding up or slowing down? Justify your answer. (2 marks)

(c) Evaluate $\int_3^9 v(t)\,dt$ and explain what this integral represents. (3 marks)

(d) Calculate the total distance travelled by the graphic from the time it enters the screen to the time it leaves the screen 15 seconds later. (3 marks)