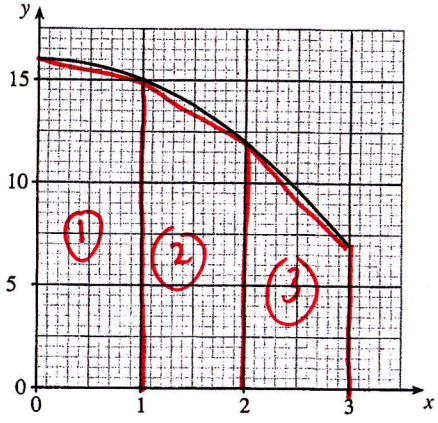
Trapezium Rule & Velocity Time Graphs

(1)

The graph of $y = 16 - x^2$ is shown below for values of x from 0 to 3.



Use the trapezium rule, with the four ordinates $x = 0$, $x = 1$, $x = 2$ and $x = 3$, to estimate the area of the region bounded by the curve, the x-axis, the y-axis and the line $x = 3$.

Area of trap(1) $= \frac{1}{2}(16+15) \times 1 = 15.5$

Area of trap(2) $= \frac{1}{2}(15+12) \times 1 = 13.5$

Area of trap(3) $= \frac{1}{2}(12+7) \times 1 = 9.5$

Total area = 38.5

[4]

Examin only Arholw yn unig

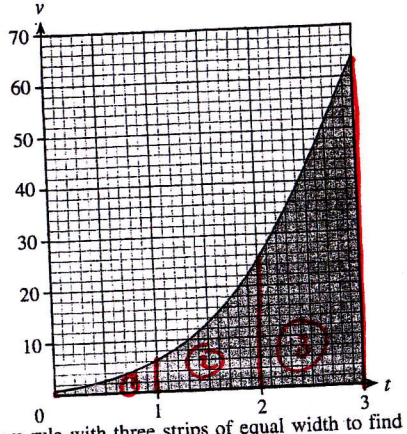
(2)

The velocity, v metres per second, of a particle at time t seconds is given by the equation $v = t^3 + 4t^2 + 1$.

A table of values of v for values of t between $t = 0$ and $t = 3$ is given below.

t	0	1	2	3
v	1	6	25	64

The graph of the equation is drawn below.



(a) Use the trapezium rule with three strips of equal width to find the approximate area of the shaded region between the curve and the t-axis from $t = 0$ to $t = 3$.

Area of trap(1) $= \frac{1}{2}(1+6) \times 1 = 3.5$

Area of trap(2) $= \frac{1}{2}(6+25) \times 1 = 15.5$

Area of trap(3) $= \frac{1}{2}(25+64) \times 1 = 44.5$

Total Area = 63.5

[4]

(b) The area found in part (a) represents **one** of the following.

Average Speed or **Velocity** or **Acceleration** or **Distance** or **Time**

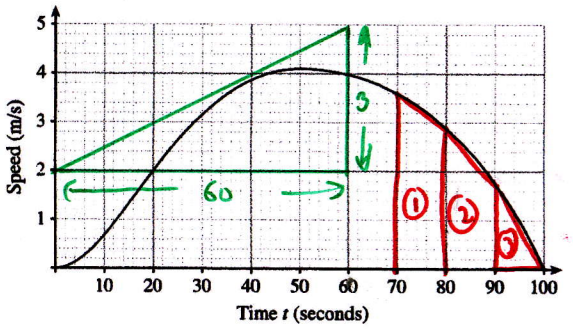
Circle the correct answer.

[1]

Turn over.

Examiner only Arholwr yn unig

(3) The graph below shows the speed of a train, in m/s, over a period of 100 seconds starting at time $t = 0$ seconds.



(a) Estimate the acceleration of the train at time $t = 40$ seconds.

accel = gradient of tangent @ $t=40$

gradient = $\frac{3}{60}$ = 0·05 m/s²

[3]

Examiner only *Arholwr yn unig*

(184/10)

(b) The table below gives the speed of the train between $t = 70$ and $t = 100$.

Time t (seconds)	70	80	90	100
Speed (m/s)	3·6	2·9	1·8	0

Use the trapezium rule with the values taken from the table to estimate the distance, in metres, travelled by the train between $t = 70$ and $t = 100$ seconds.

Area of trap ① = $\frac{1}{2}(3.6+2.9)\times 10 = 32.5$

Area of trap ② = $\frac{1}{2}(2.9+1.8)\times 10 = 23.5$

Area of trap ③ = $\frac{1}{2}(1.8+0)\times 10 = 9$

∴ Total area between $t=70$ + $t=100$

= 32·5 + 23·5 + 9 = 65 metres

[3]

AREA underneath a Vel/time graph = distance travelled

Examiner only *Arholwr yn unig*

(184/10)

Turn over.