QUESTION 3 (25 MARKS)
Question 3 (a) (i)

x	3	4	5	6	7	8	9
$f(x)$	0	5	8	9	8	5	0

$f(x) = -x^2 + 12x - 27$

$f(5) = -(5)^2 + 12(5) - 27 = -25 + 60 - 27 = 8$

$f(6) = -(6)^2 + 12(6) - 27 = -36 + 72 - 27 = 9$
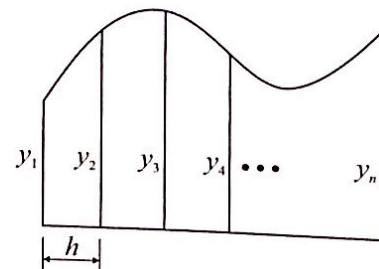
$f(8) = -(8)^2 + 12(8) - 27 = -64 + 96 - 27 = 5$

$f(9) = -(9)^2 + 12(9) - 27 = -81 + 108 - 27 = 0$

Question 3 (a) (ii)

$h = 1$

$A = \frac{1}{2}\{0 + 0 + 2(5 + 8 + 9 + 8 + 5)\} = 35$

FORMULAE AND TABLES BOOK
Area approximations [page 12]

Trapezoidal Rule:

$$A \approx \frac{h}{2}[y_1 + y_n + 2(y_2 + y_3 + y_4 + \ldots + y_{n-1})]$$

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MARKING SCHEME NOTES
Question 3 (a) (i) (ii) [Scale 15D (0, 4, 7, 11, 15)]
4: • Any one correct value
  • Writes formula
7: • Correct table
11: • Correct formula for trapezoidal rule, and some correct substitution with $h = 1$
  • Completely incorrect table but applied correctly in a (ii)
  • Correct table and 35 without work

Note 1: Answers in terms of h merit Mid Partial at most
Note 2: Correct formula and some substitution gets High Partial
Note 3: No formula and $\frac{1}{2}[5 + 5 + 2(8 + 9 + 8)] = 30$ gets High Partial

Question 3 (b) (i)

$$\int_3^9 (-x^2 + 12x - 27)dx$$

$$= \left[-\frac{x^3}{3} + 6x^2 - 27x \right]_3^9$$

$$= \left(-\frac{(9)^3}{3} + 6(9)^2 - 27(9) \right) - \left(-\frac{(3)^3}{3} + 6(3)^2 - 27(3) \right)$$

$$= 36$$

FORMULAE AND TABLES BOOK
Calculus: Integrals [page 26]

$$\int x^n \, dx = \frac{x^{n+1}}{n+1} + c, \ n \neq -1$$

Question 3 (b) (ii)

FORMULA: % ERRORS
Absolute error in a quantity = |Measured value of quantity – Accepted value of quantity|

Percentage error in a quantity $= \dfrac{\text{Absolute error in quantity}}{\text{Accepted value of quantity}} \times 100\%$

$$\% \text{ error} = \frac{(36 - 35)}{36} \times 100\% = 2 \cdot 8\%$$

MARKING SCHEME NOTES
Question 3 (b) (i) (ii) [Scale 10C (0, 4, 8, 10)]
4: • Any correct integration
  • Correct substitution of $f(x)$
  • Correct % error formula
  • Correct substitution of $f(x)$ i.e. $-x^2 + 12x - 27$
8: • Correct integration with some correct substitution
  • $97 \cdot 2\%$
10: • Accept $2 \cdot 8\%$ without work for full credit