9. I · Numerical methods

Starter Quiz ·

AQA · A-Level · Mathematics Name: _____ Score: _____

1. $f(x) = x^3 - 3x + 1$ has a root between 0 and 1.

   ☐ True ☐ False

2. Use $x_{n+1} = \sqrt{x_n + 3}$ with $x_0 = 2$. Find x_1 to 4 d.p.

   _____

3. Use one step of Newton–Raphson on $f(x) = x^2 - 5$ from $x_0 = 2$.

   _____

4. Use the trapezium rule with 2 strips to estimate $\displaystyle\int_0^2 x^2\,dx$.

   _____

5. Why does the trapezium rule overestimate $\displaystyle\int_0^2 x^2\,dx$?

   ☐ The function is negative

   ☐ The curve is decreasing

   ☐ The curve is convex, so each straight top lies above it

   ☐ There are too many strips

6. Newton–Raphson fails at x_0 when

   ☐ $f(x_0) = 0$

   ☐ $x_0 < 0$

   ☐ $f(x_0) > 0$

   ☐ $f'(x_0) = 0$

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Answers ·

AQA · A-Level · Mathematics

1. **True**

   $f(0) = 1$ and $f(1) = -1$; f is continuous.

2. **2.2361**

   $\sqrt{5} = 2.23607$.

3. **2.25**

   $2 - \dfrac{-1}{4} = 2.25$.

4. **3**

   $h = 1$: $\frac{1}{2}[0 + 4 + 2(1)] = 3$; the exact value is $\frac{8}{3}$.

5. **The curve is convex, so each straight top lies above it**

   Chords lie above a convex curve.

6. $f'(x_0) = 0$

   The formula divides by $f'(x_0)$; the tangent is horizontal.