

TK Maths Tuition UK

A-Level Differentiation Worksheet

Applications Only

Section A – Basics

1. $y = 5x^3 - 7x + 12$
2. $y = 4x^{-2} + 9x^{1/2}$
3. $y = 3/x^4 - 2\sqrt{x}$

Section B – Applications (Tangents & Normals)

4. $y = x^3 - 4x$: Find the tangent at $x = 1$.
5. $y = 2x^2 + 3x - 5$: Find the normal at $x = -2$.
6. A curve has gradient 12 at $x = 3$. If $y = 4x^3 - kx$, find k .

Section C – Applications (Stationary Points)

7. $y = x^3 - 6x^2 + 8x$: Find all stationary points.
8. $y = 5x^4 - 20x^2$: Determine the nature of each stationary point.
9. $y = x^3 + 3x^2 - 9x$: Find turning points and classify them.

Section D – Applications (Optimisation)

10. A rectangle has width x and area $A = x(20 - x)$. Find the value of x giving maximum area.
11. A box has volume $V = x^2(30 - x)$. Find the maximum volume.
12. A farmer fences three sides of a rectangular field using 100m of fencing. If the open side is length x , show that the area is $A = x(50 - x/2)$ and find the maximum area.

Section E – Applications (Related Rates)

13. A balloon rises so that height $h = 3t^2 + 2t$. Find dh/dt when $t = 4$.
14. A particle moves so that $s = t^3 - 6t$. Find its acceleration when velocity is zero.
15. The radius of a circle increases at 0.5 cm/s. Find the rate of change of area when $r = 10$ cm.

