

Pure Mathematics 1 (P1)

Edexcel IAL Maths · Knowledge organiser

KEY DEFINITIONS

Discriminant

$b^2 - 4ac$: positive gives two real roots, zero one repeated root, negative none.

Surd

An irrational root such as $\sqrt{2}$, kept exact rather than written as a decimal.

Tangent and normal

The tangent has the curve's gradient at the point; the normal is perpendicular to it.

Radian

π radians = 180° ; arc length $s = r\theta$ and sector area $\frac{1}{2}r^2\theta$ need θ in radians.

YOU SHOULD BE ABLE TO...

- Apply the laws of indices to simplify expressions such as $(3x^2)^3 \div 9x$, then expand brackets and collect like terms in longer algebraic expressions.
- Model real situations such as the path of a ball or the area of a pen with quadratic functions, and interpret roots and turning points in context.
- Sketch quartic graphs and reciprocal graphs such as $y = a/x$ and $y = a/x^2$, marking intercepts and horizontal and vertical asymptotes.
- Use the sine rule to find missing sides and angles, and recognise the ambiguous case where an angle could be acute or obtuse.
- Solve multi-step problems with arcs, sectors and segments, such as finding the perimeter or area of shapes made from circles and triangles.
- Use a point on a curve and its gradient function to find the constant of integration and the equation of the curve.

COMMON MISTAKES

- ✗ Calculator warning ignored: surds and fractions done on the calculator
- ✗ Indices: not writing terms as powers of the same base
- ✗ $(a+b)^2$ written as a^2+b^2
- ✗ $A^{(-n)}$ treated as $-a^n$

KEY FORMULAS

B = given in the exam (formula booklet or list); learn the rest.

Quadratic formula $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

Discriminant $b^2 - 4ac$: > 0 two real roots, $= 0$ equal roots, < 0 no real roots

Completing the square $x^2 + bx + c = \left(x + \frac{b}{2}\right)^2 + c - \frac{b^2}{4}$

Indices; surds $a^{-n} = \frac{1}{a^n}$, $a^{\frac{m}{n}} = \sqrt[n]{a^m}$, $\frac{1}{\sqrt{a}} = \frac{\sqrt{a}}{a}$

Lines $y - y_1 = m(x - x_1)$, $m = \frac{y_2 - y_1}{x_2 - x_1}$, $m_1 m_2 = -1$

Transformations: $f(x) + a$ up a ; $f(x + a)$ left a ; $af(x)$ vertical $\times a$; $f(ax)$ horizontal $\times \frac{1}{a}$

Mensuration **B** sphere $A = 4\pi r^2$, cone curved $A = \pi rl$

Sine rule $\frac{a}{\sin A} = \frac{b}{\sin B}$

Cosine rule **B** $a^2 = b^2 + c^2 - 2bc \cos A$

Area; arc; sector (radians) $\frac{1}{2}ab \sin C$; $s = r\theta$; $\frac{1}{2}r^2\theta$

Differentiate / integrate x^n $\frac{d}{dx} x^n = nx^{n-1}$, $\int x^n dx = \frac{x^{n+1}}{n+1} + c$ ($n \neq -1$)

Tangent; normal $y - y_1 = m(x - x_1)$, $m_n = -\frac{1}{m}$

WORKED EXAMPLE

Find the equation of the tangent to $y = x^3 - 4x$ at the point where $x = 1$.

1. $dy/dx = 3x^2 - 4 = -1$ at $x = 1$

2. $y = 1 - 4 = -3$, so the point is $(1, -3)$

3. $y + 3 = -1(x - 1)$

Answer: $y = -x - 2$