Edexcel International GCSE Mathematics A (4MA1)

Higher tier · one-page formula sheet · ★ = not given on the paper

★ not on the 4MA1 Higher formulae sheet — learn it. Everything else is printed on the exam paper.

Number

★ Indices: $a^m \times a^n = a^{m+n}$, $a^m \div a^n = a^{m-n}$, $(a^m)^n = a^{mn}$, $a^0 = 1$, $a^{-n} = \frac{1}{a^n}$, $a^{\frac{m}{n}} = (\sqrt[n]{a})^m$

★ Standard form: $A \times 10^n$, $1 \le A < 10$, $n \in \mathbb{Z}$

★ Surds: $\sqrt{ab} = \sqrt{a}\sqrt{b}$, $\frac{a}{\sqrt{b}} = \frac{a\sqrt{b}}{b}$, $\frac{1}{c+\sqrt{b}} = \frac{c-\sqrt{b}}{c^2-b}$

★ Percentage change: $\frac{\text{new}-\text{original}}{\text{original}} \times 100\%$

★ Reverse percentage: $\text{original} = \frac{\text{new}}{1 \pm \frac{r}{100}}$

★ Compound growth / decay: $A = P\left(1 \pm \frac{r}{100}\right)^n$

★ Recurring decimal: $x = 0.\dot{2}\dot{7}$, then $100x - x = 27$, so $x = \frac{27}{99} = \frac{3}{11}$

★ Bounds: a value to the nearest u lies in $[x - \frac{u}{2},\ x + \frac{u}{2})$; for $a - b$ and $a \div b$ use max with min

★ Compound measures: $\text{speed} = \frac{\text{distance}}{\text{time}}$, $\text{density} = \frac{\text{mass}}{\text{volume}}$, $\text{pressure} = \frac{\text{force}}{\text{area}}$

★ Sets: $n(A \cup B) = n(A) + n(B) - n(A \cap B)$

Algebra

★ Expanding: $(a+b)^2 = a^2 + 2ab + b^2$, $(a-b)^2 = a^2 - 2ab + b^2$, $a^2 - b^2 = (a+b)(a-b)$

Quadratic formula, $ax^2 + bx + c = 0$: $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

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

★ Turning point of $y = (x+p)^2 + q$: $(-p,\ q)$

Arithmetic series, sum of n terms: $S_n = \frac{n}{2}\left[2a + (n-1)d\right]$

★ Arithmetic nth term: $u_n = a + (n-1)d$

★ Proportion: $y \propto x^n \Rightarrow y = kx^n$; $y \propto \frac{1}{x^n} \Rightarrow y = \frac{k}{x^n}$

★ Functions: $fg(x) = f\big(g(x)\big)$; f^{-1}: swap x, y and rearrange

★ Transformations: $f(x) + a$ up a; $f(x+a)$ left a; $-f(x)$ reflect in x-axis; $f(-x)$ reflect in y-axis

★ Inequalities: multiplying or dividing by a negative number reverses the sign

Graphs & calculus

★ Straight line: $y = mx + c$, $m = \frac{y_2 - y_1}{x_2 - x_1}$

★ Parallel; perpendicular: $m_1 = m_2$; $m_1 \times m_2 = -1$

★ Midpoint; length: $\left(\frac{x_1+x_2}{2}, \frac{y_1+y_2}{2}\right)$, $\sqrt{(x_2-x_1)^2 + (y_2-y_1)^2}$

★ Differentiation: $y = ax^n \Rightarrow \frac{dy}{dx} = anx^{n-1}$

★ Turning points: $\frac{dy}{dx} = 0$; gradient of the tangent at $x = a$ is $\frac{dy}{dx}$ at a

★ Kinematics: $v = \frac{ds}{dt}$, $a = \frac{dv}{dt}$

★ Distance–time gradient = speed; velocity–time gradient = acceleration, area = distance

Shape & space

★ Pythagoras: $a^2 + b^2 = c^2$

★ SOHCAHTOA: $\sin\theta = \frac{\text{opp}}{\text{hyp}}$, $\cos\theta = \frac{\text{adj}}{\text{hyp}}$, $\tan\theta = \frac{\text{opp}}{\text{adj}}$

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

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

Area of a triangle: $\frac{1}{2}ab\sin C$

★ Exact values: $\sin 30° = \frac{1}{2}$, $\cos 60° = \frac{1}{2}$, $\tan 45° = 1$, $\sin 60° = \frac{\sqrt{3}}{2}$, $\sin 45° = \frac{\sqrt{2}}{2}$

★ Polygons (n sides): interior sum $= (n-2) \times 180°$, exterior angle (regular) $= \frac{360°}{n}$

★ Areas: triangle $\frac{1}{2}bh$, parallelogram bh

Area of a trapezium: $\frac{1}{2}(a+b)h$

★ Circle: $C = 2\pi r = \pi d$, $A = \pi r^2$

★ Arc; sector: arc $= \frac{\theta}{360} \times 2\pi r$, sector $= \frac{\theta}{360} \times \pi r^2$

Prism; cylinder: $V =$ cross-section $\times$ length; $V = \pi r^2 h$, curved $A = 2\pi rh$

Cone (slant l): $V = \frac{1}{3}\pi r^2 h$, curved $A = \pi rl$

Sphere: $V = \frac{4}{3}\pi r^3$, $A = 4\pi r^2$

★ Pyramid: $V = \frac{1}{3} \times$ base area $\times h$

★ Similar shapes, scale factor k: lengths $\times k$, areas $\times k^2$, volumes $\times k^3$

★ Circle theorems: angle at centre = 2 × angle at circumference; angle in a semicircle = 90°; angles in the same segment are equal; opposite angles of a cyclic quadrilateral sum to 180°; tangent ⊥ radius; two tangents from a point are equal; alternate segment theorem; perpendicular from the centre bisects a chord

★ Intersecting chords: $AP \times PB = CP \times PD$

★ Vectors: $\left|\binom{x}{y}\right| = \sqrt{x^2 + y^2}$, $\overrightarrow{AB} = \mathbf{b} - \mathbf{a}$

★ Bearings: measured clockwise from north, written with 3 figures

Statistics & probability

★ Mean from a table: $\bar{x} = \frac{\sum fx}{\sum f}$

★ Median position (n values): $\frac{n+1}{2}$th value

★ Interquartile range: $Q_3 - Q_1$

★ Histogram: $\text{frequency density} = \frac{\text{frequency}}{\text{class width}}$

★ Probability: $P(\text{not } A) = 1 - P(A)$; expected frequency $= n \times P(A)$

★ Mutually exclusive: $P(A \text{ or } B) = P(A) + P(B)$

★ Any two events: $P(A \cup B) = P(A) + P(B) - P(A \cap B)$

★ Independent: $P(A \text{ and } B) = P(A) \times P(B)$

★ Conditional: $P(B \mid A) = \frac{P(A \cap B)}{P(A)}$

★ Tree diagrams: multiply along branches, add the outcomes you want; without replacement, change the second branch