Mathematics: Units 3C and 3D
Formula sheet

Number and algebra

If $f(x) = y$ then $f'(x) = \frac{dy}{dx}$

If $f(x) = x^n$ then $f'(x) = n\,x^{n-1}$

If $f(x) = e^x$ then $f'(x) = e^x$

Product rule:

If $y = f(x)\ g(x)$ then $y' = f'(x)\ g(x) + f(x)\ g'(x)$

or

If $y = uv$ then $\frac{dy}{dx} = \frac{du}{dx}v + u\frac{dv}{dx}$

Quotient rule:

If $y = \frac{f(x)}{g(x)}$ then $y' = \frac{f'(x)\ g(x) - f(x)\ g'(x)}{(g(x))^2}$

or

If $y = \frac{u}{v}$ then $\frac{dy}{dx} = \frac{\frac{du}{dx}v - u\frac{dv}{dx}}{v^2}$

Chain rule:

If $y = f(g(x))$ then $y' = f'(g(x))\ g'(x)$

or

If $y = f(u)$ and $u = g(x)$ then $\frac{dy}{dx} = \frac{dy}{du} \times \frac{du}{dx}$

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

Exponentials: $\int e^x\,dx = e^x + c$

Fundamental Theorem of Calculus:

$\frac{d}{dx}\int_a^x f(t)\,dt = f(x)$ and $\int_a^b f'(x)\,dx = f(b) - f(a)$

Incremental formula: $\delta y \approx \frac{dy}{dx}\,\delta x$

Exponential growth and decay:

If $\frac{dy}{dt} = ky$, then $y = Ae^{kt}$

Space and measurement

Circle: $C = 2\pi r = \pi D$, where C is the circumference, r is the radius and D is the diameter

$A = \pi r^2$, where A is the area

Triangle: $A = \frac{1}{2} b h$, where b is the base and h is the perpendicular height

Parallelogram: $A = b h$

Trapezium: $A = \frac{1}{2}(a + b)h$ where a and b are the lengths of the parallel sides and h is the perpendicular height

Prism: $V = Ah$, where V is the volume, A is the area of the base and h is the perpendicular height

Pyramid: $V = \frac{1}{3} \mathrm{A}h$

Cylinder: $S = 2\pi r h + 2\pi r^2$, where S is the total surface area

$V = \pi r^2 h$

Cone: $S = \pi r s + \pi r^2$ where s is the slant height

$V = \frac{1}{3} \pi r^2 h$

Sphere: $S = 4\pi r^2$

$V = \frac{4}{3} \pi r^3$

Volume of solids of revolution:

$\mathrm{V} = \int \pi y^2 \, dx$ rotated about the x - axis

$\mathrm{V} = \int \pi x^2 \, dy$, rotated about the y - axis

Chance and data

Probability laws:

$P(A) + P(\bar{A}) = 1$

$P(A \cup B) = P(A) + P(B) - P(A \cap B)$

$P(A \cap B) = P(A)P(B/A) = P(B)P(A/B)$

Binomial distributions:

Mean: $\mu = np$ and standard deviation: $\sigma = \sqrt{np(1 - p)}$

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A confidence interval for the mean of a population is:

$$\bar{x} - z \frac{\sigma}{\sqrt{n}} \le \mu \le \bar{x} + z \frac{\sigma}{\sqrt{n}}$$

where μ is the population mean, σ is the population standard deviation and

where $\bar{x}$ is the sample mean, n is the sample size and

z is the cut off value on the standard normal distribution corresponding to the confidence level.

Note: Any additional formulas identified by the examination panel will be included in the body of the particular question.