

EXAM-DAY · 90-MIN REVISION CARD

Calculus

Print this · Fold it · Carry to the exam-hall gate · Revise once · Then walk in.

FORMULAS & KEY RESULTS

FUNCTION: a rule pairing each input x (the DOMAIN) with exactly one output y (the RANGE). $f(x) = 2x+1$, $f(x) = x^2$, $f(x) = e^x$, $f(x) = \ln x$ are standard types.

DOMAIN cautions: denominator $\neq 0$; argument of $\sqrt{\quad}$ must be ≥ 0 ; argument of \ln/\log must be > 0 .

LIMIT: $\lim_{x \rightarrow a} f(x) = L$ means $f(x)$ approaches L as $x \rightarrow a$. It equals $f(a)$ only when f is continuous at a .

0/0 INDETERMINATE: factorise top and bottom, cancel the common factor, THEN substitute. e.g. $\lim_{x \rightarrow a} \frac{(x^2 - a^2)}{(x - a)} = 2a$.

CONTINUITY at a : f is continuous if (i) $f(a)$ exists, (ii) $\lim_{x \rightarrow a} f(x)$ exists, (iii) $\lim = f(a)$. LHL = RHL = $f(a)$.

FIRST PRINCIPLES: $f'(x) = \lim_{h \rightarrow 0} \frac{f(x+h) - f(x)}{h}$.

POWER RULE: $\frac{d}{dx}(x^n) = n \cdot x^{n-1}$.

CONSTANT: $\frac{d}{dx}(c) = 0$.

CONSTANT MULTIPLE: $\frac{d}{dx}(c \cdot f) = c \cdot f'$.

SUM/DIFFERENCE: $(u \pm v)' = u' \pm v'$.

PRODUCT RULE: $(uv)' = u'v + uv'$.

QUOTIENT RULE: $(\frac{u}{v})' = \frac{u'v - uv'}{v^2}$.

CHAIN RULE: $\frac{d}{dx} f(g(x)) = f'(g(x)) \cdot g'(x)$ — outer derivative \times inner derivative.

STANDARD DERIVATIVES: $\frac{d}{dx}(e^x) = e^x$; $\frac{d}{dx}(\ln x) = 1/x$; $\frac{d}{dx}(\text{constant}) = 0$.

RATE OF CHANGE / MARGINAL: $MC = dC/dx$; $MR = dR/dx$; profit $P = R - C$, maximised where $dP/dx = 0$.

TOP 5 PYQ PATTERNS

1 Differentiate using power / product / quotient / chain rule

3 marks · 95% of years

Identify the structure (sum, product, quotient, composite) · pick the matching rule · for chain rule never forget the inner derivative · simplify.

2 Evaluate a limit (including 0/0 by factorisation)

3 marks · 85% of years

Substitute first; if 0/0, factorise top and bottom, cancel the common factor, then substitute again.

3 Marginal cost / marginal revenue and interpret

3 marks · 75% of years

$MC = dC/dx$, $MR = dR/dx$ · differentiate · evaluate at the given output · close with a one-line economic interpretation.

4 Maxima / minima using the derivative tests

5 marks · 70% of years

Set $f'(x) = 0$ for stationary points · use $f''(x)$: negative \Rightarrow max, positive \Rightarrow min · compute the actual extreme value · state which is which.

5 Functions (domain/range) or first-principles derivative

2 marks · 60% of years

Domain: exclude division-by-zero, negative roots, non-positive log arguments. First principles: apply the $\frac{f(x+h) - f(x)}{h}$ limit carefully.

90-MIN REVISION FLOW

0-15 min

Memorise the differentiation rules (power, constant, sum, product, quotient, chain) and the three standard derivatives (x^n , e^x , $\ln x$). These are the spine of the chapter's marks.

15-35 min

Differentiate 8 functions back-to-back — two each of power, product, quotient and chain type. Name the rule you use each time. Speed target: 2 minutes each.

35-50 min

Evaluate 5 limits, at least three of them 0/0 forms requiring factorisation. Always test substitution first, then factorise.

50-65 min

Do 3 marginal-cost / marginal-revenue problems, finishing each with the economic interpretation sentence.

65-85 min

Solve 3 maxima-minima problems using $f'(x) = 0$ then the second-derivative test. Always compute the actual extreme value, not just the x -coordinate.

85-90 min

Self-check — state from memory: the product rule, the chain rule, the 0/0 procedure, and 'f' negative \Rightarrow maximum'. If all four come instantly, you are chapter-ready.

INCREASING/DECREASING: $f'(x)$
 $> 0 \Rightarrow$ increasing; $f'(x) < 0 \Rightarrow$
decreasing.

MAXIMA-MINIMA: solve $f'(x) = 0$
for stationary points; $f''(x) < 0 \Rightarrow$
MAXIMUM, $f''(x) > 0 \Rightarrow$
MINIMUM.

Confidence, not anxiety. You've practised this all year. Trust your steps. Don't change strategy on exam morning.
Helpline: **+91 70330 05444** · **readyforboards.com**