QUICK DRILL · CBSE CLASS 12

Calculus — Differentiation, Applications & Integration

Applied Mathematics · Chapter 3 · 15 MCQs · 20 minutes · PYQ-tagged with time budgets

DATE	TOTAL MARKS	DURATION	MARKING	TARGET
_____	15	20 min	+1 / 0	⩾ 12/15

OBJECTIVES

Reinforce the four core topics of Calculus — Differentiation, Applications & Integration via 15 PYQ-derived MCQs. Identify weak sub-topics via concept-node IDs (see answer key). Build per-question time budget habit.

INSTRUCTIONS

Attempt all 15. Time budget shown per Q (use it as pacing guide). Mark answers (A/B/C/D) in the margin. Answer key + explanations on the last page. **Don't peek — score yourself honestly.**

SECTION · QUICK DRILL

Q 1–15 · 20 MIN

Q1. If $C(x) = 0.1x^2 + 20x + 500$ is the total cost, the marginal cost at $x = 50$ is:

(A) ₹25 **(B)** ₹30
(C) ₹35 **(D)** ₹70

PYQ 2022 · Delhi · 3m · ? 40s

Q2. For $f(x) = x^3 - 3x^2 + 4$, the second derivative $f''(x)$ is:

(A) $3x^2 - 6x$ **(B)** $6x - 6$
(C) $6x - 3$ **(D)** $3x - 6$

PYQ 2021 · All India · 2m · ? 30s

Q3. The function $f(x) = x^2 - 4x + 7$ is increasing for:

(A) $x < 2$ **(B)** $x > 2$
(C) $x < -2$ **(D)** all x

PYQ 2023 · Delhi · 3m · ? 35s

Q4. At a critical point where $f'(c) = 0$, the point is a local MAXIMUM if:

(A) $f''(c) > 0$ **(B)** $f''(c) < 0$
(C) $f''(c) = 0$ **(D)** $f(c) > 0$

PYQ 2024 · All India · 1m · ? 20s

Q5. $P(x) = -2x^2 + 40x - 100$ is the profit. The profit-maximising output x is:

(A) 5 **(B)** 10
(C) 20 **(D)** 40

PYQ 2022 · Outside Delhi · 3m · ? 40s

Q6. The maximum value of $P(x) = -2x^2 + 40x - 100$ is:

(A) ₹80 **(B)** ₹100
(C) ₹120 **(D)** ₹200

PYQ 2022 · Outside Delhi · 2m · ? 35s

Q7. If demand is $p = 100 - 2x$, the marginal revenue MR is:

(A) $100 - 2x$ **(B)** $100 - 4x$
(C) $100x - 2x^2$ **(D)** $200 - 4x$

PYQ 2023 · All India · 3m · ? 40s

Q8. $\int (6x^2 + 2)\,dx$ equals:

(A) $2x^3 + 2x + C$ **(B)** $12x + C$
(C) $6x^3 + 2x + C$ **(D)** $2x^3 + 2 + C$

PYQ 2021 · Delhi · 2m · ? 30s

Q9. The value of $\int$ from 0 to 2 of $3x^2\,dx$ is:

(A) 4 **(B)** 6
(C) 8 **(D)** 12

PYQ 2022 · Delhi · 2m · ? 30s

Q10. $\int$ from 0 to 1 of $2x(x^2 + 1)^3\,dx$ equals:

(A) 15/4 **(B)** 16/4
(C) 4 **(D)** 8

PYQ 2024 · Outside Delhi · 3m · ? 45s

Q11. Demand is $D(x) = 50 - 2x$ and the market price is ₹30. The equilibrium quantity x_0 is:

(A) 5 **(B)** 10
(C) 15 **(D)** 20

PYQ 2023 · Outside Delhi · 2m · 30s

Q12. For demand $D(x) = 50 - 2x$ and price ₹30 ($x_0 = 10$), the consumer surplus is:

(A) ₹50 **(B)** ₹100
(C) ₹200 **(D)** ₹300

PYQ 2023 · Outside Delhi · 4m · 60s

Q13. The average cost $A(x) = C(x)/x$ of $C(x) = x^2 + 64x + 100$ is minimised at $x =$:

(A) 8 **(B)** 10
(C) 12 **(D)** 64

PYQ 2024 · Delhi · 4m · 55s

Q14. Marginal cost MC differs from average cost because:

(A) MC = C(x)/x, average = dC/dx **(B)** MC = dC/dx (cost of one more unit); average = C(x)/x (total ÷ units)
(C) They are always equal **(D)** MC ignores variable cost

PYQ 2022 · All India · 1m · 25s

Q15. An indefinite integral $\int f(x)\,dx$ must always include:

(A) fixed limits **(B)** the constant of integration + C
(C) a substitution **(D)** a definite numeric value

PYQ 2021 · Outside Delhi · 1m · 20s

ANSWER KEY & EXPLANATIONS

Q 1–15 · MARK YOUR SCORE

Q1. Answer: B

MC = dC/dx = 0.2x + 20. At x = 50: 0.2(50) + 20 = 10 + 20 = ₹30.

Q2. Answer: B

$f'(x) = 3x^2 - 6x$; differentiating again gives $f''(x) = 6x - 6$.

Q3. Answer: B

$f'(x) = 2x - 4 > 0 \Rightarrow x > 2$. Increasing where derivative is positive.

Q4. Answer: B

Second-derivative test: $f''(c) < 0 \Rightarrow$ concave down ⇒ local maximum.

Q5. Answer: B

$P'(x) = -4x + 40 = 0 \Rightarrow x = 10$. $P''(x) = -4 < 0 \Rightarrow$ maximum.

Q6. Answer: B

Max at x = 10: $P(10) = -2(100) + 400 - 100 = -200 + 300 = ₹100$.

Q7. Answer: B

$R = p \cdot x = (100 - 2x)x = 100x - 2x^2$. $MR = dR/dx = 100 - 4x$.

Q8. Answer: A

$\int 6x^2\,dx = 6 \cdot x^3/3 = 2x^3$; $\int 2\,dx = 2x$. So $2x^3 + 2x + C$.

Q9. Answer: C

$\int 3x^2\,dx = x^3$. $[x^3]$ from 0 to 2 = 8 − 0 = 8.

Q10. Answer: A

Let $u = x^2+1$ ($du = 2x\,dx$); limits u: 1→2. $\int u^3\,du = u^4/4 = (16-1)/4 = 15/4$.

Q11. Answer: B

$30 = 50 - 2x \Rightarrow 2x = 20 \Rightarrow x_0 = 10$.

Q12. Answer: B

$CS = \int_0^{10}(50-2x-30)dx = \int_0^{10}(20-2x)dx = [20x-x^2]_0^{10} = 200-100 = ₹100$.

Q13. Answer: B

$A(x) = x + 64 + 100/x$; $A'(x) = 1 - 100/x^2 = 0 \Rightarrow x^2 = 100 \Rightarrow x = 10$. $A''>0 \Rightarrow$ min.

Q14. Answer: B

MC is the derivative (one more unit); average is total cost per unit. Different ideas.

Q15. Answer: B

Indefinite integrals carry an arbitrary constant + C; a definite integral gives a number.