

AP Calculus AB practice exam: 20 questions in the exam's format, with answers

Part A is no calculator (questions 1 to 12, 24 minutes: the real exam gives 2 minutes a question). Part B allows a graphing calculator (13 to 16, 12 minutes). Questions 17 to 20 are free-response style: show every step, and justify in words where asked (30 minutes). Score it on page 2.

Part A: no calculator (2 minutes each)

No.	Question	Choices
1	$\lim_{x \rightarrow 3} \text{ of } (x^2 - 9)/(x - 3)$	(A) 0 (B) 3 (C) 6 (D) does not exist
2	$\lim_{x \rightarrow \infty} \text{ of } (5x^2 - 3x)/(2x^2 + 7)$	(A) 0 (B) $5/2$ (C) $5/7$ (D) infinity
3	If $f(x) = x^3 - 4x$, then $f'(2) =$	(A) 0 (B) 4 (C) 8 (D) 12
4	$d/dx [\sin(3x)] =$	(A) $\cos(3x)$ (B) $3 \cos(3x)$ (C) $-3 \cos(3x)$ (D) $3 \sin(3x)$
5	$d/dx [\ln(x^2 + 1)] =$	(A) $1/(x^2 + 1)$ (B) $2x/(x^2 + 1)$ (C) $2x \ln(x^2 + 1)$ (D) $1/(2x)$
6	If $y = e^{(2x)}$, then $d^2y/dx^2 =$	(A) $e^{(2x)}$ (B) $2e^{(2x)}$ (C) $4e^{(2x)}$ (D) $4e^{(x)}$
7	$f(x) = x^3 - 3x^2$ has a local minimum at $x =$	(A) -2 (B) 0 (C) 1 (D) 2
8	The integral from 0 to 2 of $(3x^2 + 2x) dx =$	(A) 8 (B) 10 (C) 12 (D) 16
9	The integral of $\cos(2x) dx =$	(A) $\sin(2x) + C$ (B) $(1/2) \sin(2x) + C$ (C) $2 \sin(2x) + C$ (D) $-(1/2) \sin(2x) + C$
10	If $F(x) =$ the integral from 1 to x of $\sqrt{t^3 + 1} dt$, then $F'(2) =$	(A) 1 (B) 3 (C) 9 (D) $\sqrt{2}$
11	The average value of $f(x) = x^2$ on $[0, 3]$ is	(A) 1 (B) 3 (C) $9/2$ (D) 9
12	If $x^2 + y^2 = 25$, then dy/dx at the point $(3, 4)$ is	(A) $-4/3$ (B) $-3/4$ (C) $3/4$ (D) $4/3$

Part B: graphing calculator allowed (3 minutes each)

No.	Question	Choices
13	A particle moves on a line with velocity $v(t) = t^2 - 4t + 3$ for $t \geq 0$. When is it at rest, and what is its acceleration at $t = 1$?	(A) $t = 1, 3$; $a = -2$ (B) $t = 1, 3$; $a = 2$ (C) $t = 2$; $a = 0$ (D) $t = 3$; $a = -2$
14	$dy/dx = 2y$ and $y(0) = 3$. Then $y =$	(A) $3e^{(2x)}$ (B) $2e^{(3x)}$ (C) $3x^2 + 3$ (D) $e^{(2x)} + 2$
15	The area of the region between $y = x$ and $y = x^2$ from $x = 0$ to $x = 1$ is	(A) $1/6$ (B) $1/3$ (C) $1/2$ (D) $5/6$
16	The radius of a circle grows at 2 cm/s. When $r = 5$ cm, the area grows at	(A) $10 \pi \text{ cm}^2/\text{s}$ (B) $20 \pi \text{ cm}^2/\text{s}$ (C) $25 \pi \text{ cm}^2/\text{s}$ (D) $50 \pi \text{ cm}^2/\text{s}$

Free-response style, the answers, and your score

Part C: free-response style (show your working; 9 points each on the real exam)

17. $f(x) = x^2$ on $[1, 3]$. (a) State the conclusion of the Mean Value Theorem for f on this interval. (b) Find the value of c it guarantees.
18. The region under $y = \sqrt{x}$ from $x = 0$ to $x = 4$ is rotated about the x -axis. (a) Write the integral for the volume. (b) Evaluate it.
19. (a) Estimate the integral from 0 to 4 of $x^2 dx$ with a left Riemann sum of four equal subintervals. (b) Is the estimate an under- or over-estimate? Justify in one sentence.
20. (a) Write the equation of the line tangent to $y = x^3$ at $x = 1$. (b) Use it to approximate the value of y at $x = 1.1$, and say whether the approximation is below or above the true value, with a reason.

Answers

No.	Answer	Why (one line)
1	C	Factor: $(x - 3)(x + 3)/(x - 3) = x + 3 \rightarrow 6$
2	B	Leading coefficients: $5/2$
3	C	$f'(x) = 3x^2 - 4$; $12 - 4 = 8$
4	B	Chain rule
5	B	Chain rule on $\ln$
6	C	Differentiate twice: 2 then 4 times $e^{(2x)}$
7	D	$f' = 3x(x - 2) = 0$ at 0, 2; $f'' = 6x - 6 > 0$ at $x = 2$
8	C	$[x^3 + x^2]$ from 0 to 2 = $8 + 4$
9	B	Reverse chain rule
10	B	Fundamental theorem: $\sqrt{8 + 1} = 3$
11	B	$(1/3)$ times the integral of x^2 from 0 to 3 = $(1/3)(9)$
12	B	$2x + 2y y' = 0 \rightarrow y' = -x/y = -3/4$
13	A	$v = (t - 1)(t - 3)$; $a = v' = 2t - 4 = -2$ at $t = 1$
14	A	Separable: $y = Ce^{(2x)}$, $C = 3$
15	A	Integral of $(x - x^2) = 1/2 - 1/3$
16	B	$dA/dt = 2\pi r dr/dt = 2\pi (5)(2)$
17	(a) $f'(c) = (9 - 1)/(3 - 1) = 4$ for some c in $(1, 3)$; (b) $2c = 4$, $c = 2$	f is continuous and differentiable, so the theorem applies
18	(a) π times the integral from 0 to 4 of $x dx$; (b) 8π	Disc method: $\pi (\sqrt{x})^2$
19	(a) $1(0 + 1 + 4 + 9) = 14$; (b) under-estimate	x^2 is increasing on $[0, 4]$, so each left rectangle is below the curve (true value $64/3$)
20	(a) $y = 3x - 2$; (b) 1.3, below the true value 1.331	$y'' = 6x > 0$ at $x = 1$: the curve is concave up, so the tangent lies below it

Score it the way the exam does

Multiple choice (1 to 16): ____ correct of 16. On the real exam each of 45 questions is worth 1.2 points. Free-response (17 to 20): mark each out of 9 (3 points per part, one for the method, one for the working, one for the answer or the justification). Composite (real exam) = $1.2 \times \text{MC correct} + \text{the six FRQ scores}$, out of 108. A 5 is usually about 69 and above, a 4 about 57 to 68, a 3 about 45 to 56 (estimates; the College Board sets the cut points each year). A weak Part A means derivative and integral rules; a weak Part C means the justification in words, which is where most 4s become 5s.

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