AP Calculus AB
Practice Multiple Choice

Questions with this symbol next to them, *, are calculator active questions. You should not be using your calculator for any of the other questions.

Name: _____

Set A

1. Find the equation of the line tangent to $y = \dfrac{x+3}{x^2+1}$ at $x = 1$.

   (A) $y = -\frac{5}{2}x + \frac{9}{2}$ (B) $y = \frac{5}{2}x - \frac{1}{2}$

   (C) $y = \frac{1}{2}x + \frac{3}{2}$ (D) $y = -\frac{3}{2}x + \frac{1}{2}$

   (E) $y = -\frac{3}{2}x + \frac{7}{2}$

2. What is the instantaneous rate of change at $x = 3$ of the function f given by $f(x) = \dfrac{x^2-2}{x+1}$?

   (A) $-\frac{17}{16}$ (B) $-\frac{1}{8}$ (C) $\frac{1}{8}$

   (D) $\frac{13}{16}$ (E) $\frac{17}{16}$

3. Evaluate $\lim\limits_{x \to 1} \dfrac{\ln x}{3x}$

   (A) 0 (B) $\frac{3}{e}$ (C) e

   (D) 3 (E) The limit does not exist.

4. If $f(x) = x\sqrt{4x-1}$, then $f'(x)$ is

   (A) $\dfrac{6x-1}{\sqrt{4x-1}}$. (B) $\dfrac{2x}{\sqrt{4x-1}}$. (C) $\dfrac{1}{\sqrt{4x-1}}$.

   (D) $\dfrac{-6x+2}{\sqrt{4x-1}}$. (E) $\dfrac{9x-2}{2\sqrt{4x-1}}$.

5. Find the slope of the line normal to the curve $y = -\sqrt{x+4}$ at the point where $x = 0$.

(A) -4 (B) $-\frac{1}{4}$ (C) $-\frac{1}{8}$

(D) $\frac{1}{4}$ (E) 4

6. At what point on the graph of $y = \frac{1}{2}x^2 - \frac{3}{2}$ is the tangent line parallel to the line $4x - 8y = 5$?

(A) $\left(\frac{1}{2}, -\frac{3}{8}\right)$ (B) $\left(\frac{1}{2}, -\frac{11}{8}\right)$ (C) $\left(2, \frac{3}{8}\right)$

(D) $\left(2, \frac{1}{2}\right)$ (E) $\left(-\frac{1}{2}, -\frac{11}{8}\right)$

7. If $f(x) = -x^5 + x + \frac{1}{x^2}$, then $f'(-1) =$

(A) 8. (B) 2. (C) -2.

(D) -3. (E) -8.

8. What is $\lim_{h\to 0} \frac{8\left(\frac{1}{2}+h\right)^8 - 8\left(\frac{1}{2}\right)^8}{h}$?

(A) 0 (B) $\frac{1}{2}$ (C) 1 (D) The limit does not exist.

(E) It cannot be determined from the information given.

Set B

1. An equation of the line tangent to the graph of $y=\dfrac{2x+3}{3x-2}$ at the point $(1,5)$ is

(A) $13x-y=8$ (B) $13x+y=18$ (C) $x-13y=64$

(D) $x+13y=66$ (E) $-2x+3y=13$

2. $\lim\limits_{h\to 0}\dfrac{\sin(x+h)-\sin x}{h}$ is

(A) 0 (B) 1 (C) $\sin x$ (D) $\cos x$ (E) nonexistent

3. The value of the derivative of $y=\dfrac{\sqrt[3]{x^2+8}}{\sqrt[4]{2x+1}}$ at $x=0$ is

(A) -1 (B) $-\dfrac{1}{2}$ (C) 0 (D) $\dfrac{1}{2}$ (E) 1

4. An equation of the line tangent to the graph of $y=\cos(2x)$ at $x=\dfrac{\pi}{4}$ is

(A) $y-1=-\left(x-\dfrac{\pi}{4}\right)$

(B) $y-1=-2\left(x-\dfrac{\pi}{4}\right)$

(C) $y=2\left(x-\dfrac{\pi}{4}\right)$

(D) $y=-\left(x-\dfrac{\pi}{4}\right)$

(E) $y=-2\left(x-\dfrac{\pi}{4}\right)$

5. The line normal to the curve $y=\sqrt{16-x}$ at the point $(0,4)$ has slope

(A) 8 (B) 4 (C) $\dfrac{1}{8}$ (D) $-\dfrac{1}{8}$ (E) -8

6. The $\lim\limits_{h\to 0}\dfrac{\tan 3(x+h)-\tan 3x}{h}$ is

(A) 0 (B) $3\sec^2(3x)$ (C) $\sec^2(3x)$ (D) $3\cot(3x)$ (E) nonexistent

Set C

1. If $f(x) = x + \sin x$, then $f'(x) =$

a) $1 + \cos x$ b) $1 - \cos x$ c) $\cos x$ d) $\sin x - x\cos x$ e) $\sin x + x\cos x$

2. If $y = \cos^2 3x$, then $\frac{dy}{dx} =$

a) $-6\sin 3x\cos 3x$ b) $-2\cos 3x$ c) $2\cos 3x$ d) $6\cos 3x$ e) $2\sin 3x\cos 3x$

3. An equation of the line tangent to the graph of $f(x) = x(1-2x)^3$ at the point $(1, -1)$ is

a) $y = -7x + 6$ b) $y = -6x + 5$ c) $y = -2x + 1$ d) $y = 2x - 3$ e) $y = 7x - 8$

4. $\frac{d}{dx}\left(\frac{1}{x^3} - \frac{1}{x} + x^2\right)$ at $x = -1$ is

a) -6 b) -4 c) 0 d) 2 e) 6

5. If $f(x) = \sin x$, then $f'\left(\frac{\pi}{3}\right) =$

a) $-\frac{1}{2}$ b) $\frac{1}{2}$ c) $\frac{\sqrt{2}}{2}$ d) $\frac{\sqrt{3}}{2}$ e) $\sqrt{3}$

6. If $f(x) = \sqrt{2x}$, then $f'(2) =$

a) $\frac{1}{4}$ b) $\frac{1}{2}$ c) $\frac{\sqrt{2}}{2}$ d) 1 e) $\sqrt{2}$

7. The $\lim_{h\to 0}\dfrac{\tan 3(x+h)-\tan 3x}{h}$ is

a) 0 b) $3\sec^2(3x)$ c) $\sec^2(3x)$ d) $3\cot(3x)$ e) nonexistent

8. If $f(x)=(x-1)^2\sin x$, then $f'(0)=$

a) -2 b) -1 c) 0 d) 1 e) 2

9. If $f(x)=\left(x^2-2x-1\right)^{\frac{2}{3}}$, then $f'(0)$ is

a) $\dfrac{4}{3}$ b) 0 c) $-\dfrac{2}{3}$ d) $-\dfrac{4}{3}$ e) -2

10. $\dfrac{d}{dx}\cos^2\left(x^3\right)=$

a) $6x^2\sin(x^3)\cos(x^3)$

b) $6x^2\cos(x^3)$

c) $\sin^2(x^3)$

d) $-6x^2\sin(x^3)\cos(x^3)$

e) $-2\sin(x^3)\cos(x^3)$

11. At what point on the graph of $y=\dfrac{1}{2}x^2$ is the tangent line parallel to the line $2x-4y=3$?

a) $\left(\dfrac{1}{2},-\dfrac{1}{2}\right)$ b) $\left(\dfrac{1}{2},\dfrac{1}{8}\right)$ c) $\left(1,-\dfrac{1}{4}\right)$ d) $\left(1,\dfrac{1}{2}\right)$ e) $(2,2)$

12. The position of a particle moving along a straight line at any time t is given by $s(t)=t^2+4t+4$. What is the acceleration of the particle when $t=4$?

a) 0 b) 2 c) 4 d) 8 e) 12

13. If $y=2\cos\left(\dfrac{x}{2}\right)$, then $\dfrac{d^2y}{dx^2}=$

a) $-8\cos\left(\dfrac{x}{2}\right)$ b) $-2\cos\left(\dfrac{x}{2}\right)$ c) $-\sin\left(\dfrac{x}{2}\right)$ d) $-\cos\left(\dfrac{x}{2}\right)$ e) $-\dfrac{1}{2}\cos\left(\dfrac{x}{2}\right)$

Set D

1. A particle moves along a line so that at time t, where $0 \le t \le \pi$, its position is given by $s(t) = -4\cos t - \frac{t^2}{2} + 10$. What is the velocity of the particle when its acceleration is zero?

(A) -5.19 (B) 0.74 (C) 1.32 (D) 2.55 (E) 8.13

2. If $f(x) = \frac{e^{2x}}{2x}$, then $f'(x) =$

(A) 1 (B) $\frac{e^{2x}(1-2x)}{2x^2}$ (C) e^{2x} (D) $\frac{e^{2x}(2x+1)}{x^2}$ (E) $\frac{e^{2x}(2x-1)}{2x^2}$

3. $\lim_{h \to 0} \frac{\ln(e+h)-1}{h}$ is

(A) $f'(e)$, where $f(x) = \ln x$
(B) $f'(e)$, where $f(x) = \frac{\ln x}{x}$
(C) $f'(1)$, where $f(x) = \ln x$
(D) $f'(1)$, where $f(x) = \ln x$
(E) $f'(0)$, where $f(x) = \ln x$

4. If $f(x) = e^x$, then $\ln(f'(2)) =$

(A) 2 (B) 0 (C) $\frac{1}{e^2}$ (D) $2e$ (E) e^2

5. The slope of the tangent line to the graph of $y = \ln\left(\frac{x}{2}\right)$ at $x = 4$ is

(A) $\frac{1}{8}$ (B) $\frac{1}{4}$ (C) $\frac{1}{2}$ (D) 1 (E) 4

6. If $f(x) = x\ln(x^2)$, then $f'(x) =$

(A) $\ln(x^2)+1$ (B) $\ln(x^2)+2$ (C) $\ln(x^2)+\frac{1}{x}$ (D) $\frac{1}{x^2}$ (E) $\frac{1}{x}$

7. The position of a particle moving along a straight line at any given time t is given by $x(t) = \frac{4}{3}t^3 - 6t^2 + 8t$.

(a) What is the average velocity of the particle for $0 \le t \le 3$?
(b) When is the particle at rest?
(c) During what time interval(s) is the particle moving to the left? Right?

Set E

1) A particle moves along the x-axis so that its position at time t is given by $x(t) = 2t^2 - 12t + 9$. For what value of t is the particle at rest?

A) 1 B) 9 C) 3 D) 4 E) 0

2) A particle travels along the x-axis so that at any time $t \geq 0$, its position is given by $x(t) = t^3 - 9t^2 + 24t + 2$. For what value(s) of t is the velocity equal to zero?

A) $t = 3$, only B) $t = 0$ and $t = 3$ C) $t = 4$, only
D) $t = 2$, only E) $t = 2$ and $t = 4$

3) A particle moves along a horizontal axis so that its position is given by $x(t) = 4t^5 - 5t^3$ for any time t. How many times does the particle change direction?

A) 1 B) 2 C) 3 D) 0 E) 5

4) A particle moves on the x-axis such that its position at any time $t > 0$ is given by $x(t) = t^3 - 9t^2 + 24t$. What is the velocity of the particle when its acceleration is zero?

A) 24 B) 105 C) 3 D) 0 E) -3

5) A particle moves along a horizontal axis so that its position is defined by $S(t) = 4 \cos \frac{\pi}{2} t$ for $0 \leq t \leq 5$. What is the velocity of the particle at the time its acceleration is first equal to zero?

A) -4π B) 4π C) -2π D) $-\pi^2$ E) 2π

6) A particle moves along the x-axis in such a way that its position at any time t is given by $x(t) = t^4 - 8t^3 + 18t^2 + 2$ for $t > 0$. At what time is acceleration of the particle equal to 36?

A) 3 B) 4 C) 12 D) 2 E) 6

7) A particle moves along the x-axis so that at any time $t \geq 0$, its position is given by $x(t) = 2t + \sin(\pi t)$. What is the acceleration of the particle at time $t = \frac{3}{2}$?

A) 0 B) π C) 2 D) π^2 E) $-\pi^2$

8) If the position of a particle moving on the x-axis at any time t is given by $x(t) = 2t^3 - 3t^2$, what is the average acceleration of the particle for $0 \leq t \leq 3$?

A) 15 B) 9 C) 8 D) 12 E) 18

9) The position of a particle moving on a horizontal axis for time t, where $t \geq 0$, is $S(t) = 3 \sin \frac{1}{2}t + 1$. What is the average velocity of the particle for $0 \leq t \leq \frac{3\pi}{2}$?

A) $\frac{\pi}{\sqrt{2}}$ B) $\frac{\sqrt{2}}{\pi}$ C) $-\frac{\pi}{\sqrt{2}}$ D) $\frac{3\sqrt{2}}{\pi}$ E) $\frac{-\sqrt{2}}{\pi}$