AP Calculus AB
Set 1 – AP Exam Problems

Precalculus Review

1. The graph of which of the following equations has $y = 1$ has an asymptote?

   a. A) $y = \ln x$ B) $y = \sin x$ C) $y = \dfrac{x}{x+1}$ D) $y = \dfrac{x^2}{x-1}$ E) $y = e^{-x}$

2. Which of the following is continuous for all real numbers x?

   a. I. $y = x^{2/3}$ II. $y = e^x$ III. $y = \tan x$

   b. A) None B) I only C) II only D) I and II E) I and III

3. If $f(x)$ is continuous for all real numbers and if $f(x) = \dfrac{x^2 - 4}{x+2}$ when $x \neq -2$, then $f(-2) =$

   A) -4 B) -2 C) -1 D) 0 E) 2

4. If $h(x) = f(g(x))$, where $f(x) = 3x^2 - 1$ and $g(x) = |x|$, then $h(x) =$

   A) $3x^2 - |x|$ C) $3x^2|x| - 1$ E) $3x^2 - 1$
   B) $|3x^2 - 1|$ D) $3|x| - 1$

5. The fundamental period of $2\cos(3x)$ is

   A) $\dfrac{2\pi}{3}$ B) 2π C) 6π D) 2 E) 3

6. If the graph of $y = \dfrac{ax + b}{x + c}$ has a horizontal asymptote $y = 2$ and a vertical asymptote $x = -3$, then $a + c =$

   A) -5 B) -1 C) 0 D) 1 E) 5

Limits and Continuity

7. If $f(x) = \begin{cases} \ln x & \text{for } 0 < x \leq 2 \\ x^2 \ln 2 & \text{for } 2 < x \leq 4 \end{cases}$ then $\lim\limits_{x \to 2} f(x)$ is

   A) $\ln 2$ B) $\ln 8$ C) $\ln 16$ D) 4 E) nonexistent

8. $\lim_{n\to\infty} \frac{4n^2}{n^2+10{,}000n}$ is

A) 0 B) $\frac{1}{2{,}500}$ C) 1 D) 4 E) nonexistent

9. If $\lim_{x\to a} f(x) = L$, where L is a real number, which of the following must be true?

A) $f'(a)$ exists.
B) $f(x)$ is continuous at $x = a$.
C) $f(x)$ is defined at $x = a$.
D) $f(a) = L$
E) None of the above

10. $\lim_{n\to\infty} \frac{3n^3-5n}{n^3-2n^2+1}$ is

A) -5 B) -2 C) 1 D) 3 E) nonexistent

11. $\lim_{\theta\to 0} \frac{1-\cos\theta}{2\sin^2\theta}$ is

A) 0 B) $\frac{1}{8}$ C) $\frac{1}{4}$ D) 1 E) nonexistent

12. If $a \neq 0$, then $\lim_{x\to a} \frac{x^2-a^2}{x^4-a^4}$ is

A) $\frac{1}{a^2}$ B) $\frac{1}{2a^2}$ C) $\frac{1}{6a^2}$ D) 0 E) nonexistent

Derivatives

13. If $f(x) = e^x$, which of the following is equal to $f'(e)$?

A) $\lim_{h\to 0} \frac{e^{x+h}}{h}$
B) $\lim_{h\to 0} \frac{e^{x+h}-e^e}{h}$
C) $\lim_{h\to 0} \frac{e^{e+h}-e}{h}$
D) $\lim_{h\to 0} \frac{e^{x+h}-1}{h}$
E) $\lim_{h\to 0} \frac{e^{e+h}-e^e}{h}$

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

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

15. If f is a differentiable function, then $f'(a)$ is given by which of the following?

I. $\lim_{h\to 0}\dfrac{f(a+h)-f(a)}{h}$ II. $\lim_{x\to a}\dfrac{f(x)-f(a)}{x-a}$ III. $\lim_{x\to a}\dfrac{f(x+h)-f(x)}{h}$

A) I only B) II only C) I and II only D) I and III only E) I, II, and III

16. $\lim_{h\to 0}\dfrac{\sin(x+h)-\sin x}{h}$ is

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

17. At $x = 3$, the function given by $f(x)=\begin{cases} x^2 & \text{if } x<3 \\ 6x-9 & \text{if } x\geq 3 \end{cases}$ is

A) undefined
B) continuous but not differentiable
C) differentiable but not continuous
D) neither continuous nor differentiable
E) both continuous and differentiable

18. If $f(x)=x$, then $f'(5)=$

A) 0 B) $\dfrac{1}{5}$ C) 1 D) 5 E) $\dfrac{25}{2}$

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

A) -6 B) -4 C) 0 D) 2 E) 6

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

A) $\dfrac{1}{4}$ B) $\dfrac{1}{2}$ C) $\dfrac{\sqrt{2}}{2}$ D) 1 E) $\sqrt{2}$

21. If $y=\cos^2 x-\sin^2 x$, then $y'=$

A) -1 C) $-2\sin(2x)$ E) $2(\cos x-\sin x)$
B) 0 D) $-2(\cos x+\sin x)$

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

A) $-\dfrac{1}{2}$ B) $\dfrac{1}{2}$ C) $\dfrac{\sqrt{2}}{2}$ D) $\dfrac{\sqrt{3}}{2}$ E) $\sqrt{3}$

23. If $y=\tan x-\cot x$, then $\dfrac{dy}{dx}=$

A) $\sec x\csc x$ C) $\sec x+\csc x$ E) $\sec^2 x+\csc^2 x$
B) $\sec x-\csc x$ D) $\sec^2 x-\csc^2 x$

24. If $y = \tan^{-1}(\cos x)$, then $\frac{dy}{dx} =$

A) $\frac{-\sin x}{1+\cos^2 x}$ C) $\left(\sec^{-1}(\cos x)\right)^2$ E) $\frac{1}{1+\cos^2 x}$

B) $-\left(\sec^{-1}(\cos x)\right)^2 \sin x$ D) $\frac{1}{\left(\cos^{-1} x\right)^2+1}$

25. $\frac{d}{dx}\left(2^x\right) =$

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

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

A) -2 B) $\frac{1}{6}$ C) $\frac{1}{2}$ D) 2 E) 6

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

A) $2xe^x$ C) $xe^x(x+2)$ E) $2x+e$

B) $x\left(x+2e^x\right)$ D) $2x+e^x$

28. If $y = 10^{\left(x^2-1\right)}$, then $\frac{dy}{dx} =$

A) $(\ln 10)10^{\left(x^2-1\right)}$ C) $\left(x^2-1\right)10^{\left(x^2-2\right)}$ E) $x^2(\ln 10)10^{\left(x^2-1\right)}$

B) $(2x)10^{\left(x^2-1\right)}$ D) $2x(\ln 10)10^{\left(x^2-1\right)}$

29. If $f(x) = (2x+1)^4$, then the fourth derivative of $f(x)$ at $x = 0$ is

A) 0 B) 24 C) 48 D) 240 E) 384

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

A) $-8\cos\left(\frac{x}{2}\right)$ C) $-\sin\left(\frac{x}{2}\right)$ E) $-\frac{1}{2}\cos\left(\frac{x}{2}\right)$

B) $-2\cos\left(\frac{x}{2}\right)$ D) $-\cos\left(\frac{x}{2}\right)$