Cumulative Review Multiple Choice

(Most questions are 2013-2014 AP-like)

1. $\lim_{x \to 3} \frac{x^2 + x - 12}{x^2 - 9}$

(A) 0

(B) 1

(C) $\frac{7}{6}$

(D) $\frac{4}{3}$

(E) does not exist

2. $\int_3^x (4t^2 + 3)\,dt$

(A) $8x + 36$

(B) $4x^2 + 3$

(C) $4x^2 + 36$

(D) $\frac{4}{3}x^3 + 3x$

(E) $\frac{4}{3}x^3 + 3x - 45$

3. A particle moving along the x – axis has velocity given by $v(t) = \cos(3t)$ at time t. If the particle is at $x = 5$ when $t = 0$, what is the position of the particle when $t = \frac{\pi}{2}$?

(A) -3

(B) $-\frac{1}{3}$

(C) 0

(D) 4

(E) $\frac{14}{3}$

4. The function $y = h(x)$ is differentiable and decreasing for all real numbers. On what intervals is the function $y = h(3x^2 - 4x)$ increasing?

(A) $\left(-\infty, \frac{2}{3}\right)$

(B) $\left(-\infty, \frac{4}{3}\right)$

(C) $\left(0, \frac{2}{3}\right)$

(D) $\left(0, \frac{4}{3}\right)$

(E) $\left(\frac{2}{3}, \infty\right)$

5. If $\cos\left(\frac{1}{x^2+1}\right)$ is an antiderivative for $f(x)$, then $\int_1^3 f(x)\,dx =$

(A) $-.380$

(B) $-.117$

(C) $.117$

(D) $.380$

(E) 1.873

6. Given that f and g are continuous functions such that $\int_0^5 f(x)\,dx = 7$, $\int_2^5 f(x)\,dx = 4$, and $\int_2^0 g(x)\,dx = -5$, what is the value of $\int_0^2 \left(3f(x) - \frac{1}{2}g(x)\right) dx$?

(A) $\frac{13}{2}$

(B) $\frac{23}{2}$

(C) 17

(D) 19

(E) $\frac{49}{2}$

7. Let h be the function defined by $h(x) = \int_0^x (t^3 - \frac{9}{2}t^2 + 6t)\,dt$. Determine the intervals on which the graph of $y = h(x)$ is concave up.

(A) $(-\infty, 0)$ only

(B) $(-\infty, 1) \cup (2, \infty)$

(C) $(0, \infty)$ only

(D) $(1, 2)$

(E) $(2, \infty)$ only

8. Which of the following definite integrals has the same value as $\int_1^2 \frac{1}{3-x}\,dx$?

(A) $-3\int_2^1 \frac{1}{u}\,du$

(B) $-\int_1^2 \frac{1}{u}\,du$

(C) $\int_2^1 \frac{1}{u}\,du$

(D) $\frac{1}{3}\int_1^2 \frac{1}{u}\,du$

(E) $\int_1^2 \frac{1}{u}\,du$

9. $\int \frac{x}{x^2-4}\,dx =$

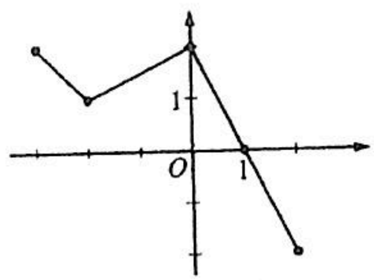
(A) $\frac{-1}{4\left(x^2-4\right)^2}+C$

(B) $\frac{1}{2\left(x^2-4\right)}+C$

(C) $\frac{1}{2}\ln\left|x^2-4\right|+C$

(D) $2\ln\left|x^2-4\right|+C$

(E) $\frac{1}{2}\arctan\left(\frac{x}{2}\right)+C$



Graph of f

10. The graph of the piecewise linear function f is shown in the figure above. If $g(x)=\int_{-2}^{x} f(t)\,dt$, which of the following values is greatest?

(A) $g(-3)$

(B) $g(-2)$

(C) $g(0)$

(D) $g(1)$

(E) $g(2)$

11. The function g is defined by $g(x) = \cos x + \sin x$ for $0 \leq x \leq 2\pi$. What is the x – coordinate of the point of inflection where the graph of g changes from concave up to concave down?

(A) $\frac{\pi}{4}$

(B) $\frac{3\pi}{4}$

(C) $\frac{5\pi}{4}$

(D) $\frac{7\pi}{4}$

(E) $\frac{9\pi}{4}$

12. The function g is continuous and $\int_0^{19} g(u)\,du = 12$. Determine the value of $\int_2^3 x^2 g(x^3 - 8)\,dx$.

(A) $\frac{1}{3}$

(B) 4

(C) 8

(D) 12

(E) 36

13. The temperature of a room, in degrees Fahrenheit, is modeled by H, a differentiable function of the number of minutes after the thermostat is adjusted. Of the following, which is the best interpretation of $H'(5) = 2$?

(A) The temperature of the room is 2 degrees Fahrenheit, 5 minutes after the thermostat is adjusted.

(B) The temperature of the room increases by 2 degrees Fahrenheit during the first 5 minutes after the thermostat is adjusted.

(C) The temperature of the room is increasing at a constant rate of $\frac{2}{5}$ degree Fahrenheit per minute.

(D) The temperature of the room is increasing at a rate of 2 degrees Fahrenheit per minute, 5 minutes after the thermostat is adjusted.

Learning Objectives	Essential Knowledge	Mathematical Practices for AP Calculus
LO 2.3A: Interpret the meaning of a derivative within a problem.	**EK 2.3A1:** The unit for $f'(x)$ is the unit for f divided by the unit for x.	**MPAC 2:** Connecting concepts **MPAC 5:** Building notational fluency
LO 2.3D: Solve problems involving rates of change in applied contexts.	**EK 2.3D1:** The derivative can be used to express information about rates of change in applied contexts.	

14. A function f is continuous on the closed interval $[2, 5]$ with $f(2) = 17$ and $f(5) = 17$. Which of the following additional conditions guarantees that there is a number c in the open interval $(2, 5)$ such that $f'(c) = 0$?

(A) No additional conditions are necessary.

(B) f has a relative extremum on the open interval $(2, 5)$.

(C) f is differentiable on the open interval $(2, 5)$.

(D) $\int_2^5 f(x)\,dx$ exists.

Learning Objective	Essential Knowledge	Mathematical Practices for AP Calculus
LO 2.4A: Apply the Mean Value Theorem to describe the behavior of a function over an interval.	**EK 2.4A1:** If a function f is continuous over the interval $[a, b]$ and differentiable over the interval (a, b), the Mean Value Theorem guarantees a point within that open interval where the instantaneous rate of change equals the average rate of change over the interval.	**MPAC 1:** Reasoning with definitions and theorems **MPAC 5:** Building notational fluency

15. A rain barrel collects water off the roof of a house during three hours of heavy rainfall. The height of the water in the barrel increases at the rate of $r(t) = 4t^3e^{-1.5t}$ feet per hour, where t is the time in hours since the rain began. At time $t = 1$ hour, the height of the water is 0.75 foot. What is the height of the water in the barrel at time $t = 2$ hours?

(A) 1.361 ft

(B) 1.500 ft

(C) 1.672 ft

(D) 2.111 ft

Learning Objectives	Essential Knowledge	Mathematical Practices for AP Calculus
LO 3.4E: Use the definite integral to solve problems in various contexts.	**EK 3.4E1:** The definite integral can be used to express information about accumulation and net change in many applied contexts.	**MPAC 2:** Connecting concepts **MPAC 3:** Implementing algebraic/computational processes
LO 3.3B(b): Evaluate definite integrals.	**EK 3.3B2:** If f is continuous on the interval $[a, b]$ and F is an antiderivative of f, then $\int_a^b f(x)\,dx = F(b) - F(a)$.	