Sample Documents

AP Calculus
(APC)

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Solve each of the following problems then indicate which is the best choice by blackening the corresponding circle.

1. Given the parametric equations \( x = 2\cos^3 t \) and \( y = 2\sin^3 t \), find \( \frac{d^2 y}{dx^2} \).
   (A) \( \frac{2}{3}\cos^4 t \sin t \)  
   (B) \( \frac{2}{3}\cos^3 t \sin t \)  
   (C) \( \frac{2}{3}\cos t \sin^4 t \)  
   (D) \( \frac{5}{2}\cos^4 t \sin t \)  
   (E) \( \frac{1}{3}\cos^4 t \sin t \)

This figure shows the graph of \( f \). Use this figure to answer the following question(s).

2. \( \lim_{x \to 3^-} f \) is
   (A) 1  
   (B) 3  
   (C) 2  
   (D) 0  
   (E) no limit

3. If \( f(x) = \sqrt{4 + e^{2x}} \), then \( f'(x) = \)
   (A) \( \frac{e^{2x}}{\sqrt{4 + e^{2x}}} \)  
   (B) \( e^x \)  
   (C) \( \frac{1}{\sqrt{4 + e^{2x}}} \)  
   (D) \( \frac{1}{2\sqrt{2e^{2x}}} \)  
   (E) \( \frac{x e^{2x-1}}{\sqrt{4 + e^{2x}}} \)

4. Integrate: \( \int \frac{4 + 5x^{3/2}}{\sqrt{x}} \, dx \)
   (A) \( 2x^{3} + \frac{5}{2}x^2 + C \)  
   (B) \( -2x^{-3/2} + 5 + C \)  
   (C) \( 8x^{3} + \frac{5}{2}x^2 + C \)  
   (D) \( 2x^{-3/2} + \frac{5}{2}x^2 + C \)  
   (E) \( 4x^{-1/2} + 5x + C \)
5. The figure shows the graph of \( f' \), the derivative of the function \( f \). The domain of the function \( f \) is \(-10 \leq x \leq 10\). For what value(s) is the graph of \( f \) concave downwards?

(A) \(-3 < x < 3\)  
(B) \(0 < x < 3\)  
(C) \(-1 < x < 1\)  
(D) \(\emptyset\)  
(E) \(-3 < x < 0\)

6. Find the area of the region bounded by the graphs of \( f(x) = 6x - x^2 \) and \( g(x) = x^2 - 2x \).

(A) 128  
(B) \(\frac{64}{3}\)  
(C) 36  
(D) \(\frac{20}{3}\)  
(E) 32

7. The graph of the derivative of \( f(x) \) is shown. From the following graphs choose \( f \).

8. A particle’s motion is described by \( x(t) = 4t^3 - 5t^2 \), \( t \geq 0 \), where \( t \) is in seconds and distance in meters. Find the average velocity in the third second.

(A) 48 m/s  
(B) 51 m/s  
(C) 19 m/s  
(D) 78 m/s  
(E) 38 m/s
### Answer List

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>A</td>
<td>2. C</td>
</tr>
<tr>
<td>4</td>
<td>C</td>
<td>5. C</td>
</tr>
<tr>
<td>7</td>
<td>A</td>
<td>8. D</td>
</tr>
</tbody>
</table>

### Catalog List

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>APC DH 20</td>
<td>2. APC CA 14</td>
</tr>
<tr>
<td>4</td>
<td>APC FA 22</td>
<td>5. APC EH 20</td>
</tr>
<tr>
<td>7</td>
<td>APC EH 31</td>
<td>8. APC GA 4</td>
</tr>
</tbody>
</table>
Calculus
Problem Set 12

Name ___________________ Date ___________________

1. \( \lim_{x \to -1^+} \frac{x^2}{(1-x)(1+x)} \) is
   a) \( \infty \)  b) 1  c) \(-\infty\)  d) 1+
   e) none of these

2. \( \lim_{x \to -2^-} \frac{x}{(x+2)(x-3)} \) is
   a) 3  b) \( \infty \)  c) \(-\infty\)  d) 0
   e) none of these

3. Assume \( f(7) = 0, \ f'(7) = 14, \ g(7) = 1, \) and \( g'(7) = \frac{1}{7} \). Find \( h'(7) \) given \( h(x) = \frac{f(x)}{g(x)} \).
   a) \( \frac{49}{2} \)  b) 14  c) \(-14\)  d) \(-2\)
   e) none of these

4. Assume \( f(3) = 0, \ f'(3) = 6, \ g(3) = 1, \) and \( g'(3) = \frac{1}{3} \). Find \( h'(3) \) given \( h(x) = \frac{f(x)}{g(x)} \).
   a) \( \frac{9}{2} \)  b) \(-2\)  c) 6  d) 18
   e) none of these

5. Given a function defined by \( f(x) = 3x^5 - 5x^3 + 12 \), for what value(s) of \( x \) is there a point of relative minimum?
   a) \(-1\) only  b) 0 only
   c) 0 and \(-1\)  d) 0 and 1
   e) none of these

6. Given a function defined by \( f(x) = 3x^5 - 5x^3 - 8 \), for what value(s) of \( x \) is there a point of relative maximum?
   a) 1 and \(-1\)  b) 1 only
   c) 0 and \(-1\)  d) 0 and 1
   e) none of these

7. Evaluate: \( \int_0^2 x(x^4 + 4x^2 + 4) \, dx \)
   a) 104  b) \( \frac{3}{104} \)  c) \( \frac{104}{3} \)  d) \( \frac{104}{9} \)
   e) none of these

8. Evaluate: \( \int_0^1 x^2(x^3 + 8)^2 \, dx \)
   a) \( \frac{103}{9} \)  b) \( \frac{31}{9} \)  c) \( \frac{217}{3} \)  d) \( \frac{217}{9} \)
   e) none of these

9. Which of the following definite integrals represents the area of the shaded region?
   a) \( \int_0^4 (4-x^2) \, dx \)
   b) \( \int_0^2 (4-x^2) \, dx \)
   c) \( \int_2^4 (4-x^2) \, dx \)
   d) \( \int_0^2 (4-x^2) \, dx \)
   e) none of these

10. Which of the following definite integrals represents the area of the shaded region?
    a) \( \int_1^2 x^2 \, dx \)
    b) \( \int_0^2 x^2 \, dx \)
    c) \( \int_0^4 x^2 \, dx \)
    d) \( \int_0^4 x^2 \, dx \)
    e) none of these
11. Determine whether the integral \( \int_{1}^{\infty} \frac{1}{x^{3/4}} \, dx \) converges or diverges and evaluate the integral if it converges.

a) converges, \( \frac{1}{3} \)  

b) converges, 1  

c) converges, \( \frac{4}{3} \)  

d) diverges  

e) none of these

12. Determine whether the integral \( \int_{-\infty}^{0} \frac{1}{(x-1)^{3}} \, dx \) converges or diverges and evaluate the integral if it converges.

a) converges, \( -\frac{1}{2} \)  

b) converges, 1  

c) converges, \( \frac{3}{2} \)  

d) converges, 2  

e) none of these

13. Which of the following is the graph of \( f(x) = \ln(\sqrt{x}) \)?

a)  

b)  

c)  

d)  

e) none of these

14. A mold culture doubles its mass every three days. Find the growth model for a plate seeded with 1.2 grams of mold.

a) \( y = 1.2e^{0.10034t} \)  

b) \( y = 1.2e^{0.23856t} \)  

c) \( y = 1.2e^{0.54931t} \)  

d) \( y = 1.2e^{0.38761t} \)  

e) none of these

15. A mold culture doubles its mass every seven days. Find the growth model for a plate seeded with 0.9 grams of mold.

a) \( y = 0.9e^{0.12183t} \)  

b) \( y = 0.9e^{0.38541t} \)  

c) \( y = 0.9e^{0.81818t} \)  

d) \( y = 0.9e^{0.45128t} \)  

e) none of these

16. Evaluate: \( \sum_{i=1}^{10} (i^2 - 2i + 3) \)

a) 83  

b) 865  

c) 81  

d) 305  

e) none of these

17. Evaluate: \( \sum_{i=1}^{10} (2 - 3i + 2i^2) \).

a) 625  

b) 735  

c) 1395  

d) 717  

e) none of these

18. Find the point on the curve \( f(x) = x^2 + 1 \) that is nearest to the the point \( B(3, 1) \).

a) (0, 1)  

b) (2, 5)  

c) \( \left( \frac{1}{3}, \frac{2}{3} \right) \)  

d) (5, 2)  

e) none of these

19. Find a point on the curve \( x^2 - 9y = 0 \) that is closest to the point \( P(5, -2) \).

a) (2, 5)  

b) (-1, 4)  

c) (-3, 1)  

d) (2, 1)  

e) none of these

20. For any time \( t \geq 0 \), \( x(t) = e^{2t} \) and \( y(t) = e^{-4t} \).

Find \( \frac{dy}{dx} \) at \( t = \frac{1}{6} \).

a) \( -\frac{2}{e} \)  

b) 4e  

c) 2  

d) e  

e) none of these

21. For any time \( t \geq 0 \), \( x(t) = t^3 \) and \( y(t) = 3\ln t \).

Find \( \frac{dy}{dx} \).

a) \( \frac{1}{t^2} \)  

b) \( t^4 \)  

c) \( t^3 \)  

d) \( t^2 \)  

e) none of these
Answer List

1. a
2. c
3. b
4. c
5. e
6. e
7. c
8. d
9. b
10. e
11. d
12. a
13. e
14. e
15. e
16. d
17. a
18. e
19. e
20. a
21. e

Catalog List

1. APC CD 17
2. APC CD 13
3. APC DC 11
4. APC DC 13
5. APC EF 19
6. APC EF 21
7. APC FL 9
8. APC FL 13
9. APC FO 2
10. APC FO 3
11. APC FQ 3
12. APC FQ 9
13. APC BG 35
14. APC GB 18
15. APC GB 21
16. APC HA 5
17. APC HA 8
18. APC EK 3
19. APC EK 5
20. APC DH 3
21. APC DH 4