NORTHWEST TERRITORIES CALCULUS 12 (MCALC12) · UNIT C · 25 QUESTIONS

Applications of Differentiation — Practice Test

This practice test was made by AI and there may be mistakes. If a question or answer looks wrong, use the Flag a mistake button to let Brett know so he can fix it.

1 **The critical points of $f(x) = x^3 - 3x^2$ are**

- **A** $x = 0$ and $x = 2$
- **B** $x = 0$ and $x = 3$
- **C** $x = 1$ and $x = 2$
- **D** $x = 0$ only

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2 **The function $f(x) = x^2 - 4x + 3$ is increasing on**

- **A** $x < 2$
- **B** $x > 2$
- **C** $x < -2$
- **D** $x > -2$

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3 **The function $f(x) = -x^2 + 6x$ is decreasing on**

- **A** $x < 3$
- **B** $x > 6$
- **C** $x < 6$
- **D** $x > 3$

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4 The local maximum value of $f(x) = -x^2 + 4x - 1$ is

- A 2
- B 3
- C 4
- D 1

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5 The local minimum value of $f(x) = x^3 - 3x$ is

- A 2
- B 0
- C -2
- D -1

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6 The function $f(x) = x^3$ is concave up on

- A $x < 0$
- B $x > 0$
- C all x
- D never

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7 The inflection point of $f(x) = x^3 - 6x^2$ occurs at x equals

- A 0
- B 6
- C 2
- D 3

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8 **For $f(x) = x^3 - 3x^2 + 2$, the second derivative test shows $x = 0$ is a**

A local maximum

B local minimum

C inflection point

D neither an extremum nor an inflection point

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9 **The maximum value of $f(x) = x^2 - 2x$ on $[-1, 3]$ is**

A 3

B 1

C 0

D -1

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10 The minimum value of $f(x) = x^3 - 3x^2$ on $[0, 2]$ is

- A 0
- B -2
- C -4
- D -3

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11 For $f(x) = x^3 - 3x$, the local maximum occurs at x equals

- A 1
- B -1
- C 0
- D 2

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12 The derivative is f'(x) = 2x - 4. The function f is increasing on

- **A** x > 2
- **B** x < 2
- **C** x < -2
- **D** x > 4

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13 A circle expands with $\frac{dr}{dt}$ = 2 cm/s. When r = 5 cm, $\frac{dA}{dt}$ is

- **A** 10π cm²/s
- **B** 20π cm²/s
- **C** 25π cm²/s
- **D** 5π cm²/s

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14 **A square has side s growing at 3 cm/s . When s = 4 cm, the area grows at**

- **A** 12 cm^2/s
- **B** 16 cm^2/s
- **C** 24 cm^2/s
- **D** 9 cm^2/s

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15 **A sphere expands with $\frac{dr}{dt}$ = 0.5 cm/s . When r = 6 cm, $\frac{dV}{dt}$ is**

- **A** $36\pi\ cm^3/s$
- **B** $72\pi\ cm^3/s$
- **C** $18\pi\ cm^3/s$
- **D** $144\pi\ cm^3/s$

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16 **A rectangle has length 10 cm growing at 2 cm/s and width 4 cm shrinking at 1 cm/s. The rate of change of its area is**

- **A** -2 cm^2/s
- **B** 2 cm^2/s
- **C** -10 cm^2/s
- **D** 8 cm^2/s

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17 **A cone has radius half its height and its height grows at 2 cm/s. When h = 6 cm, $\frac{dV}{dt}$ is**

- **A** 9π cm^3/s
- **B** 36π cm^3/s
- **C** 6π cm^3/s
- **D** 18π cm^3/s

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18 **With 100 m of fencing for a rectangle, the greatest possible area is**

- A 500 m²
- B 625 m²
- C 1000 m²
- D 2500 m²

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19 **With 120 m of fencing and one side along a wall, the greatest possible area is**

- A 1200 m²
- B 1800 m²
- C 2400 m²
- D 900 m²

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20 **Two positive numbers sum to 20. Their greatest possible product is**

ANSWER _____

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21 **The profit function is $P(x) = -2x^2 + 40x - 50$. The maximum profit is**

A 100

B 200

C 50

D 150

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22 A ball has height $h(t) = -5t^2 + 20t$ metres. Its maximum height is

- **A** 10 m
- **B** 40 m
- **C** 20 m
- **D** 15 m

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23 For $f(x) = x^2 - 4x + 3$, with vertex at (2, -1), the local minimum value is

- **A** -1
- **B** 2
- **C** 3
- **D** 1

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24 A cylinder has fixed radius 3 cm and its height grows at 2 cm/s. Then $\frac{dV}{dt}$ is

- A $9\pi\ cm^3/s$
- B $6\pi\ cm^3/s$
- C $18\pi\ cm^3/s$
- D $36\pi\ cm^3/s$

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25 For $f(x) = x^3$, the function is concave down on

- A $x > 0$
- B $x < 0$
- C all x
- D never

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ANSWER KEY

1. A
2. B
3. D
4. B
5. C
6. B
7. C
8. A
9. A
10. C
11. B
12. A
13. B
14. C
15. B
16. A
17. D
18. B
19. B
20. 100
21. D
22. C
23. A
24. C
25. B

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