NUNAVUT MATH 31 · UNIT 3 · 25 QUESTIONS

Applications of Derivatives — 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 graph of a function f is shown. The function f is decreasing on the interval**

- A (3, ∞)
- B (-∞, -3)
- C (-∞, 3)
- D (-3, ∞)

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2 **The critical numbers of the function $f(x) = x^3 - 12x$ are**

- A x = 2 only
- B x = -2 and x = 2
- C x = 0 only
- D x = -4 and x = 4

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3 **A particle moves along a line with position $s(t) = t^3 - 6t^2 + 9t$, where s is in metres and t is in seconds. The velocity of the particle at t = 2 s is**

- **A** 3 m/s
- **B** -3 m/s
- **C** 9 m/s
- **D** -9 m/s

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4 **If f''(x) > 0 for all x in an interval, then the graph of f on that interval is**

- **A** increasing
- **B** concave down
- **C** concave up
- **D** decreasing

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5 **The function $f(x) = 2x^3 - 3x^2 - 12x + 1$ has a local maximum. The local maximum value of f is _____**

ANSWER _____

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6 **The function $f(x) = x^4 - 2x^2 + 1$ is increasing on the intervals**

A (-1, 0) and (1, ∞)

B (-∞, -1) and (0, 1)

C (0, ∞) only

D (-∞, 0) only

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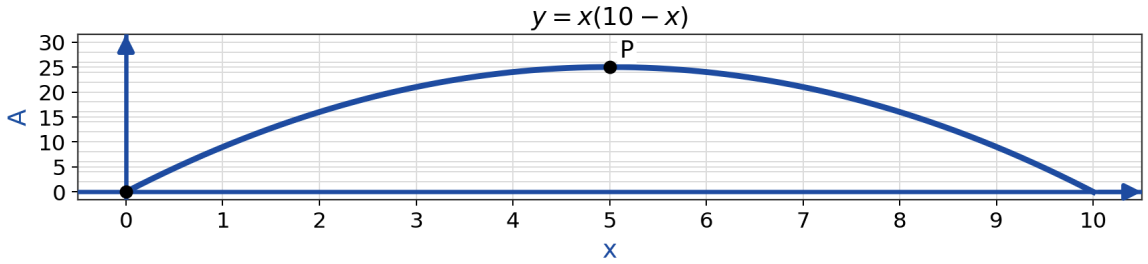
7 **The graph shows the area A of a rectangle with a perimeter of 20 m, as a function of one side length x The maximum area of the rectangle, in m², is**



A 25

B 20

C 50

D 30

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8 **Air is pumped into a spherical balloon. At the instant when the radius is 5 cm, the radius is increasing at 2 cm/s. The volume of the balloon is increasing at this instant at**

- **A** 40π cm³/s
- **B** 100π cm³/s
- **C** 200π cm³/s
- **D** 250π cm³/s

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9 **The graph of $f(x) = x^3 - 3x^2 + 2$ has an inflection point at**

- **A** $x = 0$
- **B** $x = 1$
- **C** $x = 2$
- **D** no inflection point

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10 A particle has position $s(t) = 2t^3 - 9t^2 + 12t + 3$ metres at time t seconds. The acceleration of the particle at $t = 2$ s, in m/s², is _____

ANSWER

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11 The absolute maximum value of $f(x) = x^3 - 3x + 1$ on the interval $[-2, 2]$ is

A -1

B 1

C 5

D 3

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12 **A farmer has 600 m of fencing to enclose a rectangular field along a straight river. The side along the river needs no fence. The greatest area that can be enclosed, in m², is**

A 45 000

B 22 500

C 30 000

D 90 000

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13 **Two nonnegative numbers have a sum of 12. The product of the square of the first number and the second number is as large as possible. This maximum product is _____**

ANSWER _____

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14 **A 10 m ladder leans against a vertical wall. The bottom of the ladder is 6 m from the wall and is sliding away from the wall at 1.2 m/s. The top of the ladder is sliding down the wall at**

- **A** 1.6 m/s
- **B** 1.2 m/s
- **C** 0.6 m/s
- **D** 0.9 m/s

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15 **A function f satisfies f'(x) > 0 for x < 1, f'(x) < 0 for x > 1, and f''(x) < 0 for all x. Which statement about f is true?**

- **A** It has a local maximum at x = 1 and is concave down everywhere.
- **B** It has a local minimum at x = 1 and is concave down everywhere.
- **C** It has an inflection point at x = 1.
- **D** It is decreasing for x < 1.

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16 **A circular oil spill has radius 10 m and its radius is increasing at 0.5 m/min. The area of the spill is increasing at _____ m²/min. Record your answer to the nearest tenth.**

ANSWER _____

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17 **A particle moves with position $s(t) = t^3 - 9t^2 + 24t$, where $t \geq 0$. The particle is speeding up on the intervals**

A (0, 2) and (3, 4)

B (2, 3) and (4, ∞)

C (3, ∞) only

D (0, 3) only

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18 **A closed box with a square base has a total surface area of 600 cm². The maximum volume of the box, in cm³, is**

- **A** 500
- **B** 750
- **C** 1000
- **D** 1250

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19 **The graph of $f(x) = x^4 - 6x^2$ changes concavity at each of its inflection points. The number of inflection points of the graph is _____**

ANSWER _____

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20 **The graph of f', the derivative of f, is shown. At x = 1 the function f has**

- **A** a local maximum
- **B** a local minimum
- **C** an absolute maximum
- **D** neither a local maximum nor a local minimum

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21 **The shortest distance from the point (3, 0) to the graph of $y = x^2$ is**

- **A** $\sqrt{3}$
- **B** 2
- **C** $\sqrt{5}$
- **D** 3

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22 **Water flows into a conical tank, point down, with radius 3 m and height 6 m, at 2 m^3/min. When the water is 2 m deep, the depth is increasing at _____ m/min. Record your answer to the nearest hundredth.**

ANSWER _____

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23 **The absolute minimum value of $f(x) = x^3 - 6x^2 + 9x + 2$ on the interval [0, 4] is**

A 6

B 0

C -2

D 2

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24 **The graph of f', the derivative of f, is shown. It follows that f has**

- **A** a local minimum at x = 4
- **B** a local maximum at x = 4
- **C** an inflection point at x = 4
- **D** no critical point at x = 4

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25 **The cost, in dollars, of producing x units is $C(x) = x^3 - 12x^2 + 60x + 100$. The marginal cost is C'(x). The minimum value of the marginal cost, in dollars per unit, is _____**

ANSWER _____

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ANSWER KEY

1. C
2. B
3. B
4. C
5. 8
6. A
7. A
8. C
9. B
10. 6
11. D
12. A
13. 256
14. D
15. A
16. 31.4
17. B
18. C
19. 2
20. D
21. C
22. 0.64
23. D
24. A
25. 12

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