Second derivatives, concavity and points of inflection worksheet – Grade 12

Grade 12 · Mixed level · 20 questions · **Version X8732**

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1. For $f(x) = -2x^4 + 2x^3 - x^2 + 9x - 8$, find $f''(-3)$.

   Answer: _____

2. An object's position, in metres, after t seconds is $s(t) = t^3 - 6t^2 - 12t + 1$. What is its acceleration at t = 0 s, in m/s²?

   Answer: _____

3. What is $f''(x)$ for $f(x) = x^4 - 6x^3 + 2x^2 - 5x - 8$?

   A. $12x^2 + 36x + 4$ **B.** $12x^2 - 18x + 4$ **C.** $12x^2 - 36x + 4$ **D.** $12x^2 - 36x - 1$

4. An object's position, in metres, after t seconds is $s(t) = -2t^3 + 6t^2 + 6t + 18$. What is its acceleration at t = 1 s, in m/s²?

   Answer: _____

5. What is $f''(x)$ for $f(x) = x^4 + 5x^3 - 8x^2 - 9x + 5$?

   A. $4x^3 + 15x^2 - 16x - 9$ **B.** $12x^2 - 30x - 16$ **C.** $12x^2 + 30x - 16$

   D. $12x^2 + 30x - 25$

6. For $f(x) = 2x^4 - 4x^3 - 5x^2 + 3x + 2$, find $f''(4)$.

   Answer: _____

7. An object's position, in metres, after t seconds is $s(t) = -t^3 + 3t^2 + 5t + 11$. What is its acceleration at t = 6 s, in m/s²?

   Answer: _____

8. Work out the point of inflection of $f(x) = -2x^3 + 30x^2 + 3$. Type it as (x, y).

   Answer: _____

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9. What is the x-coordinates of the points of inflection of $f(x) = -x^4 + 2x^3 + 120x^2 - x - 3$? Type both, separated by a comma.

   Answer: _____

10. Work out the x-coordinates of the points of inflection of $f(x) = -2x^4 + 192x^2 - x + 9$. Type both, separated by a comma.

    Answer: _____

11. Find the x-coordinates of the points of inflection of $f(x) = 3x^4 + 36x^3 + 90x^2 - 3x - 8$. Type both, separated by a comma.

    Answer: _____

12. Find the point of inflection of $f(x) = 2x^3 + 18x^2 + 7x + 4$. Type it as (x, y).

    Answer: _____

13. Describe the concavity of $f(x) = -4x^3 - 12x^2 - 3x - 9$.

    A. concave up for all x **B.** concave up for x > −1, concave down for x < −1

    C. concave up for x < −1, concave down for x > −1 **D.** concave down for all x

14. Find the x-coordinates of the points of inflection of $f(x) = x^4 + 14x^3 + 72x^2 - 7x - 6$. Type both, separated by a comma.

    Answer: _____

15. Work out the x-coordinate of the point of inflection of $f(x) = 4xe^{-x/6}$.

    Answer: _____

16. Find the x-coordinate of the point of inflection of $f(x) = 5xe^{-x/5}$.

    Answer: _____

17. $f(x) = -2x^3 + 12x^2 + 2$ has a critical number at x = 4. Use the second derivative test to classify it.

    A. a local maximum, because f''(4) = −24 < 0

    B. a local minimum, because f''(4) = −24 < 0 **C.** a point of inflection, because f'(4) = 0

    D. the test can't decide, because f''(4) = 0

18. What is the x-coordinate of the point of inflection of $f(x) = xe^{-x/8}$?

    Answer: _____

19. A particle moves along a line with position $s(t) = 2t^3 - 6t^2 + 21t + 17$ metres after t seconds. What is its velocity, in m/s, at the moment its acceleration is 0?

    Answer: _____

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20. Work out the x-coordinate of the point of inflection of $f(x) = xe^{-x/4}$.

    Answer: _____

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Answer key · Version X8732

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1. **-254**
2. **-12**
3. **C (**$12x^2 - 36x + 4$**)**
4. **0**
5. **C (**$12x^2 + 30x - 16$**)**
6. **278**
7. **-30**
8. **(5, 503)**
9. **-4,5**
10. **-4,4**
11. **-5,-1**
12. **(-3, 91)**
13. **C (concave up for x < −1, concave down for x > −1)**
14. **-4,-3**
15. **12**
16. **10**
17. **A (a local maximum, because f′′(4) = −24 < 0)**
18. **16**
19. **15**
20. **8**

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