Section 4.1-4.3 Part 2 : Additional Problems

For problems 1-6 find the following:
A) Determine the the critical values(cv).
B) Determine the intervals where the function is increasing(inc) and where it is decreasing(dec).
C) Classify the critical values as local maxima, local minima or neither.

1. $y = x - 4\ln(3x - 9)$
2. $y = x^2 \ln(x) + 1$
3. $y = e^{x^4+4x^3}$
4. $y = xe^{x^2-3x}$
5. $y = (x^2 - 9)^{2/3}$
6. $y = \sqrt[3]{x^2 - 6x + 8}$

In problems 7-10, use the derivative and the domain of $f(x)$ to determine the following for the function $f(x)$.
A) Determine the the critical values(cv).
B) Determine the intervals where the function is increasing(inc) and where it is decreasing(dec).
C) Classify the critical values as relative maxima, relative minima or neither.

7. Domain of $f(x)$: all real numbers
   $f'(x) = 2x^2(x + 5)^3(x - 4)^4$
8. Domain of $f(x)$: all real numbers
   $f'(x) = (4 - x)^3(x + 5)^2e^{(x^2-1)}$
9. Domain of $f(x)$: all real numbers except $x = \pm 2$
   $f'(x) = \frac{-2(x^2-5x+4)}{(x^2-4)^2}$
10. Domain of $f(x)$: all real numbers except $x = -5$
    $f'(x) = \frac{(7-3x)e^{3x}}{(x+5)^3}$

In problems 11-16, give the intervals where the function, $f(x)$, is concave up and where it is concave down.

11. $f(x) = x^2 - \dfrac{27}{x}$
12. $f(x) = \dfrac{4 + 3x}{(x + 5)^2}$
13. $f(x) = e^{1-0.5x^2}$
14. $f(x) = x\ln(x - 2)$
15. $f(x) = \ln(x^2 + 9)$
16. The domain of $f(x)$ is all real numbers except $x = 4$ and it has derivatives of $f'(x) = \frac{-x-2}{(x-4)^3}$ and $f''(x) = \frac{2x+10}{(x-4)^4}$

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17. Find the values of a and b so that $f(x) = ax^3 - 9x^2 + b$ will have a critical point at $(2, 4)$.
18. Find the value of a so that $f(x) = xe^{ax}$ will have a critical value of $x = \dfrac{1}{2}$.
19. Find the values of a and b so that $f(x) = ax^3 - 4x^2 + bx + 2$ will have a tangent line at the point $(1, 20)$ with a slope of 2.
20. Find the value of B that makes $x = 3$ an inflection point of $f(x) = x^3 + Bx^2 + 4$
21. Find the values of a and b so that $f(x) = ax^2 - b\ln(x)$ will have an inflection point at $(1, 5)$.
22. Find the values of a and b so that $f(x) = ax^3 - 36x^2 + bx + 7$ will have an inflection point at $x = 3$ and a critical point at $x = 5$.