1. $\frac{1}{4}$

2. $\frac{4}{7}$

3. 1

4. $\varphi'(x) = 4x + 1$

5. $f'(x) = \dfrac{(3x^2+3)(x^2+7) - (x^3+3x-1)(2x)}{(x^2+7)^2}$

6. $y' = 2000(3x^3+2)^{1999} \cdot (9x^2)$

7. $h'(r) = 25(5r-6)^4(r^3-7)^7 + 21r^2(5r-6)^5(r^3-7)^6$

8. $\dfrac{dy}{dx} = \dfrac{-6x^5 - 3x^2y^2}{7y^6 + 2x^3y - 2y}$

9. $y = -65x + 1$

10. $y = -x + 6$

11. $h'(x) = 4x^2(x-3)$ and $h''(x) = 12x(x-2)$. The critical values are $x = 0$ and $x = 3$. The critical points are $(0,0)$ and $(3,-27)$. The function is increasing on $(3,\infty)$ and decreasing on $(-\infty,0) \cup (0,3)$. The function is concave up on $(-\infty,0) \cup (2,\infty)$ and concave down on $(0,2)$. There is a local minimum at $(3,-27)$ which is also an absolute minimum, and the inflection points occur at $x = 0$ and $x = 2$.

12. The two numbers are 50 and -50

13. $\dfrac{d^6y}{dx^6} = 6!$