Slopes of Tangents

1. What is the slope of the tangent to $f(x) = 5 - 3x - x^2$ at the point where $(1, 1)$?

2. Find the slope of the tangent to $y = 6x - 2x^2 - x^3$ at the point where $x = -3$

3. What is the slope of the tangent to $f(x) = 3x^3 + x^2 + 3x + 4$ at the point where $x = 2$?

4. What is the equation of the tangent to $y = x^2 + 2x - 4$ at the point $(1, -1)$?

5. Find the equation of the tangent to $f(x) = x^2 - 5x + 3$ at the point $(2, -3)$

6. Find the equation of the tangent to the curve at the indicated point in each of the following functions:

   (a) $y = x^2 - 5x + 4$ at $(2, -2)$

   (b) $y = 2x + \frac{2}{x}$ at $(\frac{1}{2}, 5)$

   (c) Find the equation of the tangent to the curve $y = 3x^2 - 2x + 1$ at the point $(1, 2)$.

7. What is the equation of the tangent to $y = x^3 + 3x^2 - 6x + 4$ where $x = 3$?

8. Find the equation of the tangent to the curve $y = \frac{3x^2}{1 - 2x^2}$ at the point where $x = 1$.

9. Find the equation of the tangent to the curve $y = 2e^{5x}$ at the point where $x = 0$.

10. At what point does the function $y = 3x^2 - 4x + 7$ have a slope of 2?

11. Find the coordinates where the tangent to the function $y = 2x^3 - 3x^2 - 13x + 4$ is parallel to the line $x + y - 5 = 0$.

12. Find the coordinates where the tangent to the function $y = x^3 - 3x^2 - 3x - 2$ has a slope of 21.

13. Given that the function $y = ax^2 + bx + 2$ has slope -1 at the point $(-1, 0)$, where a and b are constants. Find the values of a and b.

14. Given that the function $y = px^2 + qx + 1$ has slope 9 at the point $(3, 10)$, where p and q are constants. Find the values of p and q.

15. The curve $y = \frac{ax + 2}{bx - 1}$ has a slope -7 at the point $(1, 5)$. Find the values of the constants a and b, where $a > 0$ and $b > 0$.

16. A function is given as $y = ax^3 + bx^2 + cx + d$ where a, b, c and d are constants. The function contains the points $(0, -6)$ and $(-2, 0)$. At these points the slopes are -7 and 5, respectively.

    (a) Find the values of a, b, c and d.

    (b) Find the coordinates of the points where the curve cuts the x-axis.

    (c) Hence sketch the curve.

17. The equation of a curve is $y = ax^3 + bx^2 + cx + d$ where a, b, c and d are constants. The curve has a slope of -4 at the point $(1, -20)$ and the slope is -7 at $(-2, 10)$.

    (a) Find the values of a, b, c and d.

    (b) Show that the curve crosses the x-axis at the point $(-4, 0)$.

    (c) Find the coordinates of the other two points where the curve cuts the x-axis.

    (d) Hence sketch the curve.

18. For what values of x is the function $f(x) = x^2 - 6x + 5$ increasing?

19. For what values of x is the function $y = 15 - 12x - 3x^2$ decreasing?

20. For what values of x is the function $f(x) = x^3 - 3x^2 - 24x + 12$ increasing?

21. For what values of x is the function $y = x^3 - 3x + 7$ decreasing?

22. Show that $f(x) = x^3 - 3x^2 + 12x - 7$ is an increasing function for all values $x \in \mathbb{R}$.

23. Show that the curve $y = \dfrac{3x + 5}{2x + 1}$ is decreasing for all $x \neq -2$.

24. Prove that the function $y = 5 - 18x - 6x^2 - x^3$ is decreasing for all $x \in \mathbb{R}$.

25. What angle does the line $y = \sqrt{3}x + 11$ create with the x-axis?

26. What angle does the tangent of the function $y = x^2 - 3x + 7$ make with the horizontal at the point $(2, 5)$?

27. The function $y = x - \dfrac{4.9x^2}{400}$ describes the height of a thrown javelin after x metres.

    i. How high above the ground is the javelin after it has travelled a horizontal distance of 20 metres?

    ii. After how many metres will the javelin hit the ground?

    iii. At what angle does the javelin hit the ground?