ILLAWARRA TUTORING

In this worksheet you will learn how to find the equations of tangents and normals to curves. You will practise calculating gradients using differentiation and then writing the equations of the tangent and normal lines at specified points. Remember that the tangent line touches a curve at a point with the same gradient as the curve, and the normal line is perpendicular to the tangent.

Easy Questions

1. For the curve $f(x) = x^2$, find the equation of the tangent line at the point $(2, 4)$.
2. For the curve $f(x) = x^2$, determine the equation of the normal line at the point $(2, 4)$.
3. For the curve $f(x) = x^2 + 1$, find the equation of the tangent line at the point corresponding to $x = 0$.
4. For the curve $f(x) = x^2 + 1$, find the equation of the normal line at $x = 0$.
5. For the curve $f(x) = x^2 + 3x + 2$, and at the point where $x = -1$, first find $f(-1)$ and then determine the equations of both the tangent and the normal lines at that point.

Intermediate Questions

6. For the curve $f(x) = 3x^3 - 2x + 1$, find the equation of the tangent line at $x = 1$.
7. For the curve $f(x) = 4x^3 - x^2 + 2x - 5$, determine the equation of the normal line at the point where $x = 2$.
8. For the curve $f(x) = 2x^3 + 3x^2 - x + 4$, find both the tangent and the normal lines at $x = 0$.
9. For the curve $f(x) = x^4$, determine the equation of the tangent line at $x = 1$.
10. For the curve $f(x) = 2x^2 - 3x + 2$, find the equations of the tangent and normal lines at $x = -1$.
11. For the curve $f(x) = 5x - 7$, find the equation of the tangent line at any point.
12. For the curve $f(x) = 6 - x^2$, determine the equation of the normal line at $x = -2$.
13. For the curve $f(x) = -x^2 + 4x$, find the equations of both the tangent and the normal lines at $x = 1$.

14. For the curve $f(x) = x^3 - 3x$, find the tangent and normal lines at $x = -2$.

15. For the curve $f(x) = 2x^2 + 4$, find the equation of the tangent line at $x = 3$.

16. For the curve $f(x) = x^2 - 2x + 1$, determine the equations of the tangent and normal lines at $x = 1$.

17. For the curve $f(x) = -3x^3 + 2x^2 - x$, find the equations of the tangent and normal lines at $x = 0$.

18. For the curve $f(x) = x^2 + 5$, find the equations of both the tangent and normal lines at $x = 1$.

19. For the curve $f(x) = x^2 + 2x + 1$, determine the equations of the tangent and normal lines at $x = -2$.

20. For the curve $f(x) = 4x^2 - x$, find the tangent and normal line equations at $x = 1$.

Hard Questions

21. For the curve $f(x) = x^2 + 2x + 1$, find the point at which the tangent line is horizontal. Then, write the equation of the tangent line.

22. For the curve $f(x) = x^3 - 9x$, determine the point where the tangent is horizontal. Then, find the equations of both the tangent and normal lines at that point.

23. For the curve $f(x) = x^2 + 4$, find the point(s) at which the tangent line makes an angle of $45°$ with the x-axis. Then, provide the equation(s) of the tangent line(s).

24. For the curve $f(x) = 2x^2 - 8x + 5$, find the equation of the normal line at the point where it is parallel to the line $y = x + 3$.

25. For the curve $f(x) = x^2 - 6x + 9$, determine the point on the curve at which the tangent line passes through the origin. Then, write the equation of that tangent line.

26. For the curve $f(x) = -x^2 + 4x$, find the point where the normal line is vertical. Then, determine the equation of the tangent line at that point.

27. For the curve $f(x) = 3x^2 + 2$, find the equations of both the tangent and normal lines at $x = -2$.

28. For the curve $f(x) = x^4 - 2x^2$, find the tangent and normal lines at $x = 1$.

29. For the curve $f(x) = x^2 + 2x + 3$, determine the point at which the tangent line is perpendicular to the line $y = 2x + 1$. Then, provide the equation of that tangent line.

30. For the curve $f(x) = -2x^2 + 8x - 6$, find the point at which the tangent line is parallel to the line $y = -3x + 2$. Then, write the equations of both the tangent and normal lines at that point.