

1. Differentiate.

[K/U 11 marks]

<p>[1] a) $f(x) = \frac{2}{x} - \frac{3}{x^3} + \frac{4}{x^5}$</p>	<p>[1] b) $f(x) = 2\sqrt{x} - 3\sqrt[3]{x}$</p>
<p>[1.5] c) $f(x) = (x-1)^3(x+1)^4$</p>	<p>[1.5] d) $f(x) = \frac{x^2 - 1}{x^2 + x}$</p>
<p>[1.5] e) $f(x) = (x^3 + 2)^4$</p>	<p>[1.5] f) $f(x) = \sqrt{x^2 + 2x - 1}$</p>
<p>[3] g) $f(x) = (x^2 + 1)^2 \sqrt{x^2 - 1}$</p>	

2. Find the equation of the tangent line at the point $P(1,1)$ to the graph of the curve $y = f(x) = \sqrt{2x-1}$. Draw a diagram to illustrate the situation.

[K/U 3 marks]

3. Find the points on the graph of $f(x) = \frac{x}{x^2 + 1}$ where the tangent line is horizontal.

[K/U 3 marks]

4. Find the first, second and third derivative for the function: $f(x) = x^4 - x^3$

[K/U 3 marks]

5. Analyse the differentiability of the following function: $f(x) = |x^2 - 16|$.

[A 4 marks]

6. Use the first principles to find the derivative function for $f(x) = \sqrt{3x^2 + 2}$. Verify your answer using derivative rules.

[A 4 marks]

7. Find the equation of the tangent line to the curve $f(x) = x^2 + 1$ passing through the point $P(-1, -2)$. Draw a diagram to illustrate the situation. [A 5 marks]

8. Differentiate: $f(x) = \sqrt{x^2 + 1} \left(\frac{x-1}{x+2} \right)^3$. [A 4 marks]

9. Consider $y = t^{1/3}(4t-5)^{2/3}$. [A 4 marks]

Find $\left. \frac{dy}{dt} \right|_{t=8}$ (the rate of change in y with respect to t at $t = 8$).

10. A position function of a particle is given by $s(t) = (t^2 - 4)^2$. [A 9 marks]
[1] a) Find the moments of time when the particle is in origin.

[1.5] b) Find the velocity function and the moments of time when the particle is at rest.

[1.5] c) Find the acceleration function and the moments of time when the acceleration is zero.

[1] d) Find intervals of time when the particle is moving away from the origin.

[2] e) Find the displacement and the total distance travelled over the interval of time $[0,3]$.

[2] d) Sketch the graph of $s(t)$, $v(t)$, and $a(t)$ on the grid provided.



