Name:

1. (4 points)
   (a) Differentiate $f(x) = 3x^2 + x - 1$ from the first principles.

   (b) Hence find the gradient of tangent line to the graph of f when $x = 2$.

   (c) Find the coordinates of the point on the graph of f, at which the gradient is -1.

2. (6 points) Find the second derivative of each of the following functions:

(a) $f(x) = xe^{2x}$

(b) $g(x) = \sin(x^2 + 1)$
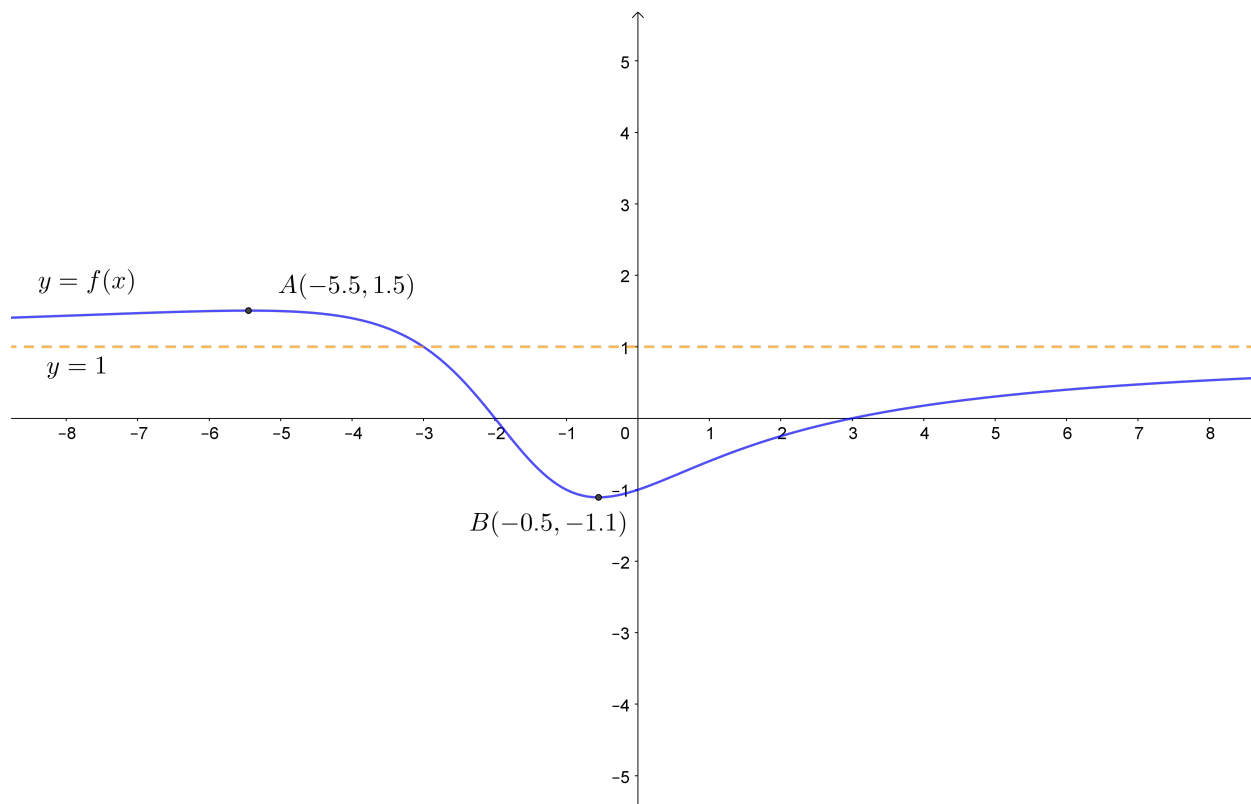
(c) $h(x) = \sqrt{x} + \ln(\sin x)$

3. (4 points) Solve the following equation:

$$2\cos^3 x = -3\sin x \cos x$$

for $0 \leqslant x \leqslant 2\pi$.

4. (6 points) The graph of $f(x)$ is shown below. Use the diagrams to sketch the graph of

(a) $g(x) = \dfrac{1}{f(|x|)}$

(b) $h(x) = [f(x)]^2 - 1$