

## SAMPLE EXAM PROBLEMS ON CONTINUITY, DERIVATIVES, SLOPES AND INTEGRALS

**Question 1** Let  $f(x)$  be given by:  $f(x) = \begin{cases} 2x - 4 \tan(x) & \text{if } x \leq 0 \\ x^a + x^2 & \text{if } 0 < x < 1 \\ 9x - 8 & \text{if } x \geq 1 \end{cases}$

For what values of  $a$  is  $f(x)$  differentiable at  $x=1$ ? For each of those values of  $a$ , find  $f'(1)$ .

**Question 2** The function in the figure below is:

- Odd
- even
- Neither even or odd.

**Question 3** Find the equation of the tangent line to the graph of  $y = \csc(x) \sec(x)$  at  $x = \frac{\pi}{6}$

**Question 4** At what points does the function  $\frac{3x}{x^2 + 1}$  have a horizontal tangent line?

**Question 5** The function  $y = 2x^2 + 8x - 7$  is increasing on the intervals:

**Question 6** At the point  $(2,3)$ , the graph of the equation  $x^2 - y^2 = 1 - xy$  has slope equal to

**Question 7** The function  $y = 4x^3 - 12x^2$  is concave downwards on the intervals:

**Question 8** If  $f(x) = \sqrt[3]{2x-2}$ , then at  $x=1$ , the graph of  $f(x)$  has

- a relative maximum
- a relative minimum
- a removable discontinuity
- a nonremovable discontinuity
- an inflection point
- None of the above.

**Question 9** If  $y = \sin^2(4x)$  then  $y'\left(\frac{\pi}{12}\right) =$

- 8
- 0
- $4\sqrt{3}$
- $2\sqrt{2}$
- None of the above

**Question 10** The area of the region bounded by the curves  $y = x^3 - 2x$  and  $y = x^2$  is

- 3

- $\frac{27}{12}$
- $\frac{37}{12}$
- 2
- None of the above.

**Question 11** Find the area of the region enclosed by the graphs of  $y = x^3 + x^2$  and  $y = 3x^2 + 3x$ .