

1. Let  $f(x) = (x + 1000)^2$ . Find the exact value of  $f'(9)$ .

2. Let  $r$  denote a positive constant with  $r < 57$ . Let  $C$  denote the circle centred at  $(57, r)$  with radius  $r$ . It is known that  $C$  is tangent to the parabola  $y = x^2 + r$  from the outside in the first quadrant. Find the value of  $r$ . Give your answer correct to two decimal places.

3. Let  $a$  and  $b$  denote two positive constants. If

$$\lim_{x \rightarrow 0} \left( \frac{\int_0^x \frac{t^2}{\sqrt{a+2t^5}} dt}{bx - e \sin x} \right) = \frac{1}{\pi},$$

find the value of  $a$ . Give your answer correct to two decimal places.

4. Find the total area of the finite domains bounded between the curve  $y = x^3 - 4x$  and the line  $x + 2y = 2$ . Give your answer correct to two decimal places.