2014 **12d** The parabola $y = -2x^2 + 8x$ and the line $y = 2x$ intersect at the origin and at the point A.

(i) Find the x-coordinate of the point A. **1**

(ii) Calculate the area enclosed by the parabola and the line. **3**
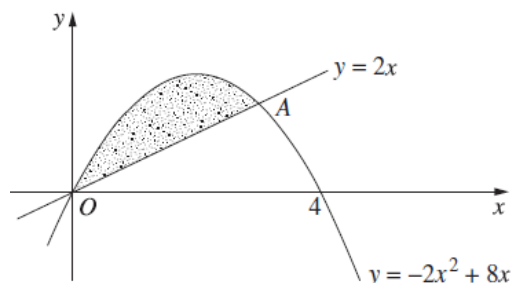
(i)
$$2x = -2x^2 + 8x$$

$$2x^2 + 2x - 8x = 0$$

$$2x^2 - 6x = 0$$

$$2x(x - 3) = 0$$

$$x = 0, 3$$

∴ At A, $x = 3$.

(ii)
$$\text{Area} = \int_0^3 -2x^2 + 8x - 2x \ dx$$

$$= \int_0^3 -2x^2 + 6x \ dx$$

$$= \left[\frac{-2x^3}{3} + 3x^2 \right]_0^3$$

$$= \frac{-2(3)^3}{3} + 3(3)^2 - 0$$

$$= -18 + 27$$

$$= 9 \qquad \therefore \text{ area is 9 units}^2$$

State Mean:
0.87
2.37

* These solutions have been provided by *projectmaths* and are not supplied or endorsed by BOSTES.

Board of Studies: Notes from the Marking Centre

(i) Most candidates equated the two functions $f(x)$ and $g(x)$ and set up a quadratic equation leading to the correct answer $x = 3$. The use of the quadratic formula was usually successful here.

Common problems were:

- incorrectly factorising the quadratic equation;
- dividing by x and eliminating the solution $x = 0$.

(ii) Most candidates found a primitive function and used $x = 0$ and their x-value from (d)(i) as limits for their definite integral.

Common problems were:

- finding an incorrect primitive function;
- incorrectly simplifying $f(x) - g(x)$ before integrating;
- using incorrect limits or making calculation errors;
- differentiating instead of integrating.

http://www.boardofstudies.nsw.edu.au/hsc_exams/2014/pdf_doc/2014-maths.pdf