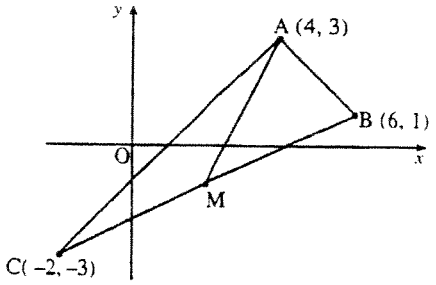
1. A triangle ABC has vertices A(4, 3), B(6, 1) and C(-2, -3) as shown on the diagram.



Determine the equation of AM, the median from A.

3 marks

2. Determine the **exact value** of $f'(4)$, given that $f(x) = \dfrac{x-1}{\sqrt{x}}$.

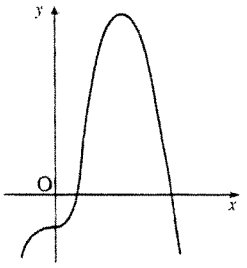
5 marks

3. (a) Show that the function $f(x) = 2x^2 + 8x - 3$ can be written in the form $f(x) = a(x+b)^2 + c$, where a, b and c are constants.

(b) Hence, or otherwise, determine the co-ordinates of the turning point of $f(x)$.

4 marks

4. A curve has equation $y = -x^4 + 4x^3 - 2$.
An incomplete sketch of the graph is shown.



(a) Find the co-ordinates of the stationary points.

(b) Justify, algebraically, the nature of the stationary points.

8 marks

5. The functions f and g are defined on suitable domains by :-

$$f(x) = \frac{1}{x^2 - 4} \text{ and } g(x) = 2x + 1.$$

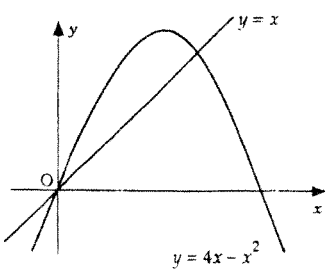
(a) Determine an expression for $h(x)$, where $h(x) = g(f(x))$. Give your answer as a **single** fraction.

(b) State a suitable domain for h.

4 marks

6. Find the gradient of the **tangent** to the parabola with equation $y = 4x - x^2$ at (0, 0).

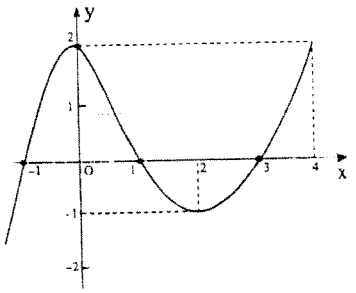
Hence calculate the size of the angle between the line $y = x$, shown, and this tangent.



6 marks

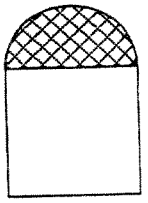
7. The diagram shows the equation of $y = f(x)$.

Sketch and annotate the graph of $y = 2 - f(x)$.



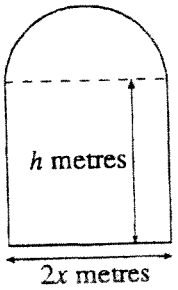
3 marks

8. A window in the shape of a rectangle surmounted by a semicircle is being designed to let in the maximum amount of light possible.



The glass to be used for the semicircular part is stained glass which lets in 1 unit of light per square metre; the rectangular part uses clear glass which lets in 2 units of light per square metre.

The rectangle measures $2x$ metres by h metres.



(a) If the perimeter of the whole window is 10 metres, express h in terms of x.

(b) Hence show that the amount of light, L, let in by the window is given by

$$L = 20x - 4x^2 - \frac{3}{2}\pi x^2.$$

(c) Determine the values of x, and hence h, that must be used to allow this design to let in the maximum amount of light.

9 marks

Total = 42 marks