School Name Here : Mathematics Department

Higher Mathematics : Lesson Starters

Block 2 Graphs

Only use a calculator if necessary

Task 1

1 The vectors $x\boldsymbol{i} + 5\boldsymbol{j} + 7\boldsymbol{k}$ and $-3\boldsymbol{i} + 2\boldsymbol{j} - \boldsymbol{k}$ are perpendicular.
What is the value of x?

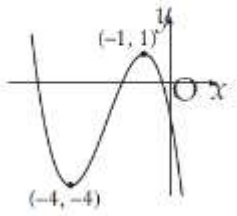
2 Find the size of the angle a^0 that the line joining the points A(0,-1) and B($3\sqrt{3}$, 2) makes with the positive direction of the x-axis.

3 Find the equation of the median AD of triangle ABC where the coordinates of A, B and C are (-2, 3), (-3,-4) and (5, 2) respectively

4 Express $x^2 - 6x + 15$ in the form $(x + a)^2 + b$

Task 2

1 The diagram shows the graph of $y = f(x)$
Sketch $y = f(x + 3)$



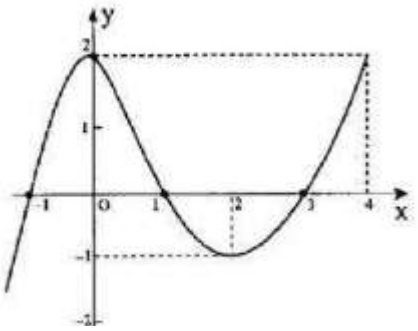
2 For the graph above, sketch $y = f(x) - 10$

3 For what value of k does the equation $x^2 - 5x + (k + 6) = 0$ have equal roots?

4 The points A and B have coordinates (a, a^2) and $(2b, 4b^2)$ respectively. Determine the gradient of AB in its simplest form.

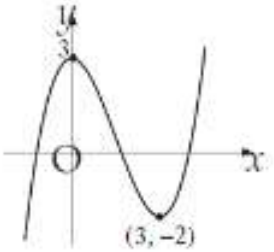
Task 3

1 The diagram shows the graph of $y = f(x)$



Sketch $y = -f(x)$

2 The diagram shows the graph of $y = f(x)$



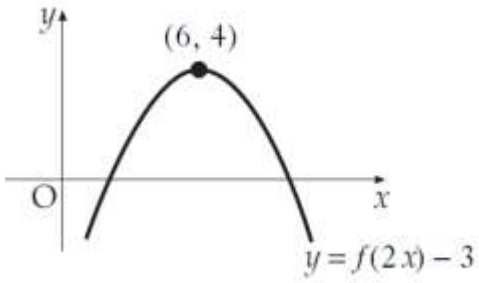
Sketch $y = f(-x)$

3 Differentiate $2\sqrt[3]{x}$ with respect to x

4 The vertices of a triangle are P(-1, 1), Q(2, 1) and R(-6, 2). Find the equation of the altitude of triangle PQR, drawn from P.

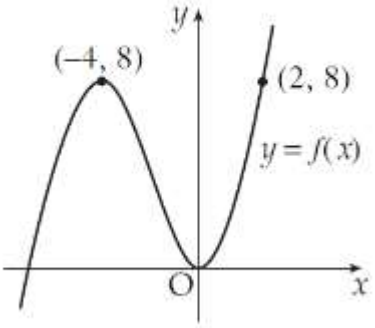
Task 4

1 The diagram shows the graph of $y = f(2x) - 3$.



What are the coordinates of the turning point on the graph of $y = f(x)$?

2 The diagram shows a sketch of the function $y = f(x)$.



(a) Copy the diagram and on it sketch the graph of $y = f(2x)$.

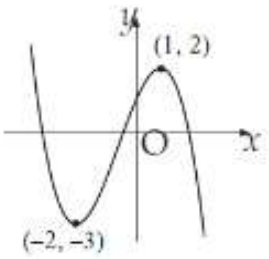
(b) On a separate diagram sketch the graph of $y = 1 - f(2x)$.

3 A tangent to the curve with equation $y = x^3 - 2x$ is drawn at the point (2, 4). What is the gradient of this tangent?

4 A function f is defined on the set of real numbers by $f(x) = x^3 - x^2 + x + 3$. What is the remainder when $f(x)$ is divided by $(x - 1)$?

Task 5

1 The diagram shows the graph of $y = f(x)$



Sketch on separate graphs

(a) $y = -f(x) + 3$

(b) $y = 4f(x + 1)$

(c) $y = f(-2x) - 2$

2 Express $f(x) = x^2 - 4x + 5$ in the form $f(x) = (x - a)^2 + b$.

(b) On the same diagram sketch:

(i) the graph of $y = f(x)$;

(ii) the graph of $y = 10 - f(x)$.

3 If $f(x) = (x - 3)(x + 5)$, for what values of x is the graph of $y = f(x)$ above the x-axis?

4 Find the values of x for which the function $f(x) = 2x^3 - 3x^2 - 36x$ is increasing.