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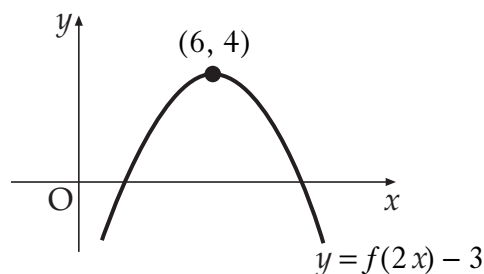
1. The diagram shows the graph of $y = f(2x) - 3$.

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

   A. $(12, 7)$

   B. $(12, 1)$

   C. $(3, 7)$

   D. $(3, 1)$ **2**

2. A function f is defined by $f(x) = \sqrt{x + 2}$.

   For which values of x is the function f undefined?

   A. $x > -2$

   B. $x < -2$

   C. $x < -1$
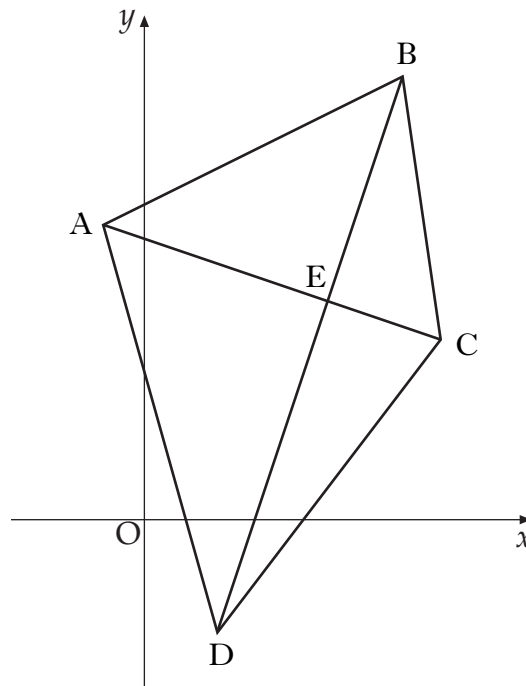
   D. $x < 0$ **2**

3. A function f is defined by $f(x) = x^3 + kx^2 + 2x$.

   Given that $f'(2) = 26$, what is the value of k?

   A. 3

   B. $\frac{7}{2}$

   C. 5

   D. 10 **2**

[SQA] 4. A quadrilateral has vertices $A(-1,8)$, $B(7,12)$, $C(8,5)$ and $D(2,-3)$ as shown in the diagram.

(a) Find the equation of diagonal BD. **2**

(b) The equation of diagonal AC is $x + 3y = 23$.

Find the coordinates of E, the point of intersection of the diagonals. **3**

(c) (i) Find the equation of the perpendicular bisector of AB.

(ii) Show that this line passes through E. **5**

[SQA] 5. The diagram shows the graph of a cosine function from 0 to π.

(a) State the equation of the graph. **1**

(b) The line with equation $y = -\sqrt{3}$ intersects this graph at point A and B.

Find the coordinates of B. **3**
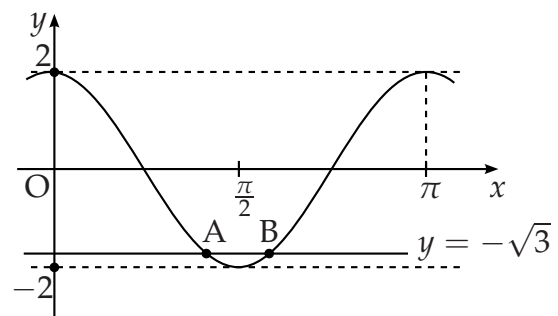
[SQA] 6. Two sequences are defined by these recurrence relations:

$$u_{n+1} = 3u_n - 0.4 \text{ with } u_0 = 1, \qquad v_{n+1} = 0.3v_n + 4 \text{ with } v_0 = 1.$$

(a) Explain why only one of these sequences approaches a limit as $n \rightarrow \infty$. 1

(b) Find algebraically the exact value of the limit. 2

(c) For the other sequence, find

   (i) the smallest value of n for which the nth term exceeds 1000, and

   (ii) the value of that term. 2

[END OF QUESTIONS]