2015 **11 f** Consider the polynomials $P(x) = x^3 - kx^2 + 5x + 12$ and $A(x) = x - 3$.

(i) Given that $P(x)$ is divisible by $A(x)$, show that $k = 6$. **1**

(ii) Find all the zeros of $P(x)$ when $k = 6$. **2**

(i)

$$P(x) = x^3 - kx^2 + 5x + 12$$

$$P(3) = (3)^3 - k(3)^2 + 5(3) + 12 = 0$$

$$27 - 9k + 15 + 12 = 0$$

$$-9k = -54$$

$$k = 6$$

State Mean: **0.91**

(ii) $(x^3 - 6x^2 + 5x + 12) \div (x - 3)$:

$$\begin{array}{r}
x^2 - 3x - 4 \\
x - 3 \,\big)\, \overline{x^3 - 6x^2 + 5x + 12} \\
\underline{x^3 - 3x^2} \qquad\qquad \\
-3x^2 + 5x \qquad \\
\underline{-3x^2 + 9x} \qquad \\
-4x + 12 \\
\underline{-4x + 12} \\
0
\end{array}$$

$$\therefore (x - 3)(x^2 - 3x - 4) = 0$$

$$(x - 3)(x - 4)(x + 1) = 0$$

$$x = 3, 4, -1.$$

State Mean: **1.54**

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

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(f)(i)

The majority of students answered this part well.

There were no common problems with this part, although a few candidates found that $k \square 6$.

(ii)

In the better responses, candidates factorised $P(x) = x^3 - 6x^2 + 5x + 12$ by using their result from part (i) and found the remaining quadratic factor $x^2 - 3x - 4$. Hence, factorising this quadratic, the correct zeroes of -1, 3 and 4 were obtained.

In many responses, the fact that the zeroes would be factors of the constant term 12 was used. Fortunately the zeroes were integers and the question was answered correctly.

Common problems were:

- incorrectly factorising $x^2 - 3x - 4$
- testing all of the factors of 12, including $x = 3$, and not realising the significance of the information provided in part (i)
- not showing any working for solutions and/or guessing values.