

1.

(a) $f(a) = 4a^3 + 2a^2 - 7a = -10$ M1
 $4a^3 + 2a^2 - 7a + 10 = 0$
 $(a + 2)(4a^2 - 6a + 5) = 0$ or sketch or GDC (M1)
 $a = -2$ A1

(b) substituting $a = -2$ into $f(x)$
 $f(x) = 4x^3 - 4x + 14 = 0$ A1

EITHER

graph showing unique solution which is indicated (must include max and min) R1

OR

convincing argument that only one of the solutions is real ($-1.74, 0.868 \pm 1.12i$) R1

[5]

2.

using the factor theorem or long division M1
 $-A + B - 1 + 6 = 0 \Rightarrow A - B = 5$ A1
 $8A + 4B + 2 + 6 = 0 \Rightarrow 2A + B = -2$ A1
 $3A = 3 \Rightarrow A = 1$ A1
 $B = -4$ A1 N3

Note: Award M1A0A0A1A1 for using $(x - 3)$ as the third factor, without justification that the leading coefficient is 1.

[5]

3.

$q(-1) = k + 9$ M1A1
 $q(-2) = 4k + 9$ A1
 $k + 9 = 7(4k + 9)$ M1
 $k = -2$ A1

Notes: The first M1 is for one substitution and the consequent equations. Accept expressions for $q(-1)$ and $q(-2)$ that are not simplified.

[5]

4.

(a) $f(1) = 3 - a + b$ (A1)
 $f(-1) = -3 + a + b$ (A1)
 $3 - a + b = -3 + a + b$ M1
 $2a = 6$
 $a = 3$ A1 N4

(b) b is any real number A1

[5]

5.

METHOD 1

As $(x + 1)$ is a factor of $P(x)$, then $P(-1) = 0$ (M1)
 $\Rightarrow a - b + 1 = 0$ (or equivalent) A1
 As $(x - 2)$ is a factor of $P(x)$, then $P(2) = 0$ (M1)
 $\Rightarrow 4a + 2b + 10 = 0$ (or equivalent) A1
 Attempting to solve for a and b M1
 $a = -2$ and $b = -1$ A1 N1

METHOD 2

By inspection third factor must be $x - 1$. (M1)A1
 $(x + 1)(x - 2)(x - 1) = x^3 - 2x^2 - x + 2$ (M1)A1
 Equating coefficients $a = -2, b = -1$ (M1)A1 N1

METHOD 3

Considering $\frac{P(x)}{x^2 - x - 2}$ or equivalent (M1)
 $\frac{P(x)}{x^2 - x - 2} = (x + a + 1) + \frac{(a + b + 3)x + 2(a + 2)}{x^2 - x - 2}$ A1A1
 Recognizing that $(a + b + 3)x + 2(a + 2) = 0$ (M1)
 Attempting to solve for a and b M1
 $a = -2$ and $b = -1$ A1 N1

[6]

6.

$f(2) = 16 + 24 + 4p - 4 + q = 15$ M1
 $\Rightarrow 4p + q = -21$ A1
 $f(-3) = 81 - 81 + 9p + 6 + q = 0$ M1
 $\Rightarrow 9p + q = -6$ A1
 $\Rightarrow p = 3$ and $q = -33$ A1A1 N0

[6]

7.

Attempting to find $f(2) = 8 + 12 + 2a + b$ (M1)
 $= 2a + b + 20$ A1
 Attempting to find $f(-1) = -1 + 3 - a + b$ (M1)
 $= 2 - a + b$ A1
 Equating $2a + 20 = 2 - a$ A1
 $a = -6$ A1 N2

[6]