AQA, Edexcel, OCR, MEI

A Level

A Level Mathematics

C1 Polynomials (Answers)

Name:

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Total Marks: /87

C1 - Polynomials (ANSWERS)
MEI, OCR, AQA, Edexcel

1.
$$
\begin{array}{r@{}l}
 & x^2 + 4x + 1 \\
\cline{2-2}
x-2 \big) & x^3 + 2x^2 - 7x - 2 \\
 & -x^3 + 2x^2 \\
\cline{2-2}
 & \quad 4x^2 - 7x \\
 & \quad -4x^2 + 8x \\
\cline{2-2}
 & \qquad x - 2 \\
 & \qquad -x + 2 \\
\cline{2-2}
 & \qquad\quad 0
\end{array}
$$

and so the answer is $x^2 + 4x + 1$. [2]

2. 53. [2]

3. $k = 2$. [3]

4. Factorise fully the following polynomials. *You may need to use the factor theorem*:

 (a) $x(x+1)^2$ [2]

 (b) $(x-1)(x-2)(x-3)$. [3]

 (c) $(x-2)(x-1)^2$. [3]

 (d) $(2x-1)(x+1)(x+3)$. [3]

 (e) $(x-1)^2(x+1)^2$. [2]

5. Solve the following equations. *Hint: to save time, use your answers from the previous question*:

 (a) $x = 0$ or $x = -1$. [2]

 (b) $x = 1$ or $x = 2$ or $x = 3$. [3]

 (c) $x = -3$ or $x = -1$ or $x = \frac{1}{2}$. [3]

6. Consider the function $f(x) = ax^3 + bx^2 + 27x - 10$, where a and b are unknown coefficients:

 (a) $a = 6$ and $b = -23$. [3]

 (b) $f(x) = (6x-5)(x-1)(x-2)$. [3]

 (c) $x = \frac{5}{6}$ or $x = 1$ or $x = 2$. [2]

7. Sketch the following functions, clearly indicating the points of any intersections with the axes:

(a) [2]

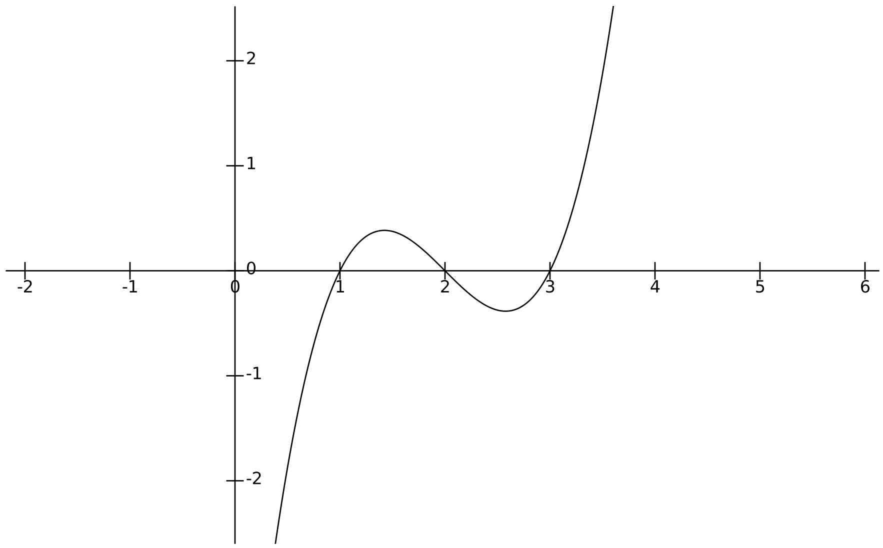

Figure 1: $y = (x-1)(x-2)(x-3)$

(b) [2]

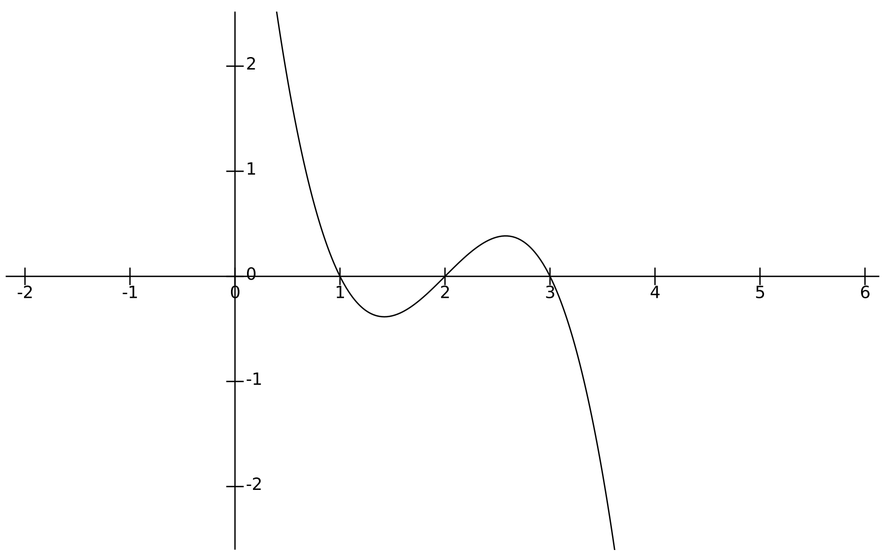

Figure 2: $y = -(x-1)(x-2)(x-3)$

(c) [2]

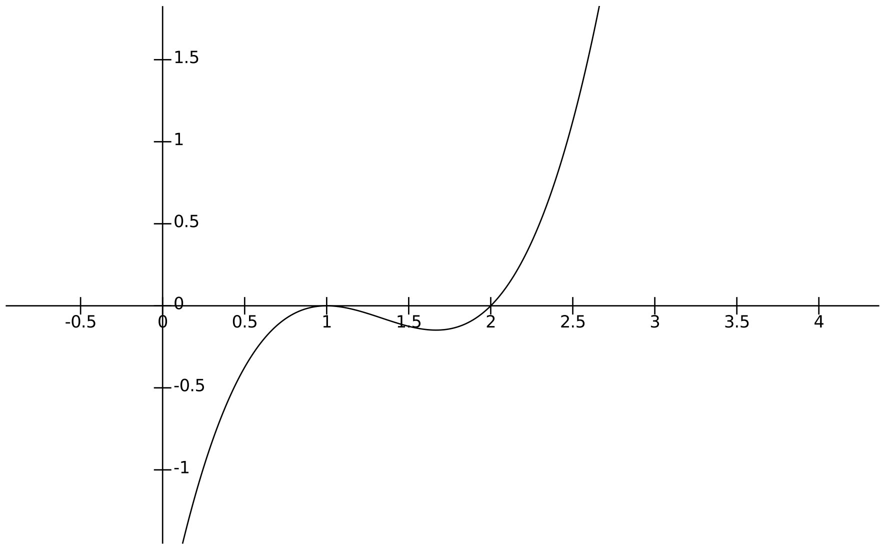

Figure 3: $y = (x-1)^2(x-2)$

(d) [2]

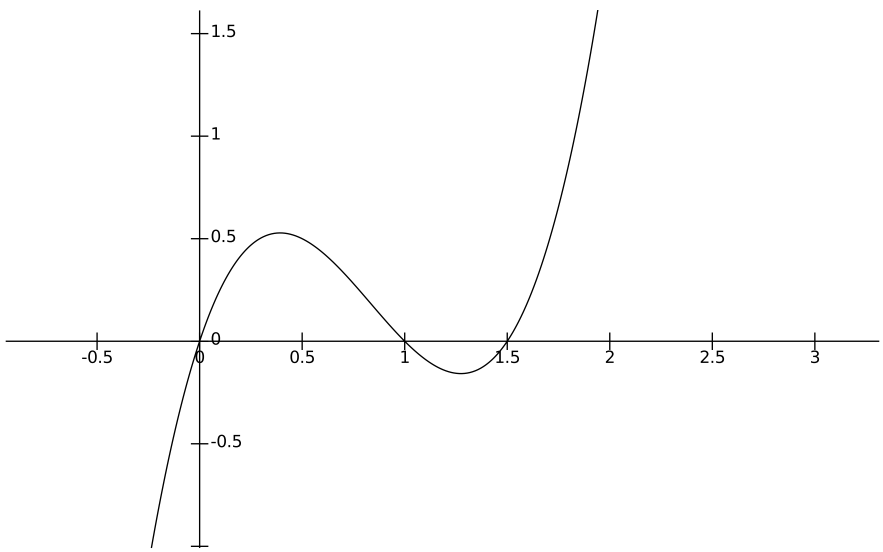

Figure 4: $y = x(2x-3)(x-1)$

8. Expand the following expressions. *Hint: use Pascal's triangle and binomial expansion:*

   (a) $x^4 + 4x^3 + 6x^2 + 4x + 1$. [2]

   (b) $x^3 + 6x^2 + 12x + 8$. [2]

   (c) $16x^4 + 96x^3 + 216x^2 + 216x + 81$. [2]

   (d) $8x^4 + 28x^3 + 30x^2 + 13x + 2$. [3]

9. Evaluate the following binomial coefficients:

   (a) 1. [2]

   (b) 5. [2]

   (c) 3. [2]

   (d) 4. [2]

   (e) 10. [2]

   (f) 1. [2]

   (g) 3. [2]

   (h) 4. [2]

   (i) 1. [2]

10. 8. [3]

11. 5103. [4]

12. 30375. [4]

13. To find the coefficient of x^3 in the expansion of $(2-x)^6(x-3)$ we first must think about how we could get x^3 terms in the final expansion. Cearly, we need to find the x^2 and x^3 terms in the expansion of $(2-x)^6$. The reason for this is that if we expanded $(2-x)^6$ then the only way we can generate x^3 terms when we multiply by $(x-3)$ is by an x^2 term multiplied by the x or an x^3 term multiplied by the -3 term. Since we are doing an expansion to the power 6, we need the 6^{th} row of Pascal's triangle:

$$1 \quad 6 \quad 15 \quad 20 \quad 15 \quad 6 \quad 1$$

The x^2 term in this expansion is: $15 \times (2)^4 \times (-x)^2 = 240x^2$.
And the x^3 term is: $20 \times (2)^3 \times (-x)^3 = -160x^3$.

In the final multiplication we x^3 terms by: $240x^2 \times x = 240x^3$,
and: $-160x^3 \times (-3) = 480x^3$,

And so the coefficient of the x^3 term is: $240 + 480 = 720$. [5]