5.7 Expanding and Factorising Quadratics: Test Pack

EDEXCEL 1MA1 · Calculator allowed · about 70 minutes

Total Marks

Name: _____ Date: ____ / ____ / _____

Answer ALL questions. Show all your working.

1 Expand the single bracket $3(x + 4)$.

(Total for Question 1 is 1 mark)

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2 Expand each expression.

(a) Expand $4(x + 6)$ **(1)**

(b) Expand $5(2x - 3)$ **(1)**

(Total for Question 2 is 2 marks)

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3 Which of these is the correct expansion of $(x - 4)(x + 9)$?

- ☐ $x^2 + 5x - 36$
- ☐ $x^2 - 5x - 36$
- ☐ $x^2 + 5x + 36$
- ☐ $x^2 - 13x - 36$

(Total for Question 3 is 1 mark)

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4 The area of a rectangle is given by $x^2 + 6x + 8$ square cm. The length is $(x + 2)$ cm. Show your working.

(a) Factorise the expression for the area $x^2 + 6x + 8$. **(2)**

(b) Use part (a) to find the width of the rectangle in terms of x. **(2)**

(c) Find the width when $x = 3$. **(2)**

(Total for Question 4 is 6 marks)

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5 Factorise fully each expression.

(a) Factorise fully $2x^2 + 14x + 20$ **(3)**

(b) Factorise fully $5x^2 - 45$ **(3)**

(Total for Question 5 is 6 marks)

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6 Expand and simplify each expression.

(a) $(x - 4)(x + 9)$ **(2)**

(b) $(2x + 1)(x - 5)$ **(2)**

(c) $(3x - 2)(2x - 5)$ **(3)**

(Total for Question 6 is 7 marks)

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7 Factorise fully $4x^2 + 2x - 12$.

(Total for Question 7 is 4 marks)

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8 Solve the quadratic equation by factorising: $x^2 - x - 30 = 0$. Give answers in exact form.

(Total for Question 8 is 5 marks)

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9 Simplify fully $(x^2 - 16) / (x^2 + x - 12)$

(Total for Question 9 is 3 marks)

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10 The quadratic $4x^2 - 12x + p$ is a perfect square trinomial. Find p and write the quadratic as a square of a binomial.

(a) Find p so that $4x^2 - 12x + p$ is a perfect square trinomial. **(2)**

(b) Write $4x^2 - 12x + 9$ as a square of a binomial. **(2)**

(Total for Question 10 is 4 marks)

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11 Given that $3x^2 + bx - 16 = 0$ has roots $x = 2$ and $x = -8/3$, find the value of b. Show working.

(Total for Question 11 is 5 marks)

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12 Show that $x^2 + (m - 3)x + (2 - m)$ is divisible by $x - 1$ for all values of m. Hence find the other (linear) factor.

(a) Show that $x - 1$ is a factor for all m by evaluating the expression at $x = 1$. **(2)**

(b) Hence find the other linear factor, and write down the full factorisation of the expression. **(4)**

(Total for Question 12 is 6 marks)

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Mark scheme · 5.7 Expanding and Factorising Quadratics: Test Pack

Question 1

3x + 12 cao **B1**

Answer: 3x + 12 (or 12 + 3x).

Question 2

(a) 4x + 24 oe **B1**

(a) Answer: 4x + 24

(b) 10x - 15 oe **B1**

(b) Answer: 10x - 15

Question 3

$x^2 + 5x - 36$ **B1**

Answer: $x^2 + 5x - 36$

Question 4

(a) identify two numbers that multiply to 8 and add to 6 (2 and 4) or show splitting the middle term **M1**

(a) (x + 2)(x + 4) cao **A1**

(a) Answer: (x + 2)(x + 4).

(b) divide the area expression by length (x + 2) or cancel a factor to show method **M1**

(b) width = x + 4 cao **A1**

(b) Answer: x + 4

(c) substitute x = 3 into width expression or show calculation 3 + 4 **M1**

(c) 7 cm cao **A1**

(c) Answer: 7 cm

Question 5

(a) takes out the common factor 2, $2(x^2 + 7x + 10)$ **M1**

(a) factorises the quadratic, (x + 2)(x + 5) **M1**

(a) 2(x + 2)(x + 5) cao, fully factorised **A1**

(a) Answer: 2(x + 2)(x + 5)

(b) takes out the common factor 5, $5(x^2 - 9)$ **M1**

(b) recognises the difference of two squares **M1**

(b) 5(x - 3)(x + 3) cao, fully factorised **A1**

(b) Answer: 5(x - 3)(x + 3)

Question 6

(a) attempts expansion, e.g. $x^2 + 9x - 4x - 36$ **M1**

(a) $x^2 + 5x - 36$ cao **A1**

(a) Answer: $x^2 + 5x - 36$

(b) attempts expansion, e.g. $2x^2 - 10x + x - 5$ **M1**

(b) $2x^2 - 9x - 5$ cao **A1**

(b) Answer: $2x^2 - 9x - 5$

(c) attempts expansion to 4 terms, e.g. $6x^2 - 15x - 4x + 10$ **M1**

(c) collects the two middle terms correctly (ft), -15x - 4x = -19x **M1**

(c) $6x^2 - 19x + 10$ cao **A1**

(c) Answer: $6x^2 - 19x + 10$

Question 7

factor out common factor 2 first to give $2(2x^2 + x - 6)$ **M1**

factorise the quadratic inside correctly or show splitting the middle term **M1**

2(2x - 3)(x + 2) cao or equivalent correct factorisation **A1**

correct check by expansion or statement **B1**

Answer: 2(2x - 3)(x + 2).

Question 8

factorise to (x + 5)(x - 6) or show factors giving product -30 and sum -1 **M1**

set each factor to zero: x + 5 = 0 or x - 6 = 0 **M1**

x = -5 **A1**

x = 6 **A1**

list both solutions as x = -5, 6 (exact) cao **B1**

Answer:x = -5 or x = 6

(Exact values)

Question 9

factorises the numerator, (x - 4)(x + 4) **M1**

factorises the denominator, (x + 4)(x - 3) **M1**

(x - 4) / (x - 3) cao, fully cancelled **A1**

Answer: (x - 4) / (x - 3)

Question 10

(a) recognise form $(ax)^2 - 2abx + b^2$ or complete the square: $(2x - m)^2$ expands to $4x^2 - 4mx + m^2$ **M1**

(a) match -4m = -12 so m = 3 then $p = m^2 = 9$ cao **A1**

(a) Answer: p = 9

(b) show rewriting as $(2x - 3)^2$ or equivalent **M1**

(b) $(2x - 3)^2$ cao **A1**

(b) Answer: $(2x - 3)^2$

Question 11

use factor form 3(x - r1)(x - r2) or substitute a root into equation **M1**

construct factors from roots: factors proportional to (x - 2) and (x + 8/3) or clear fractions to 3(x - 2)(x + 8/3) **M1**

expand 3(x - 2)(x + 8/3) correctly to get $3x^2 + bx - 16$ or equivalent **M1**

show b = -6 + 8 = 2 or correct evaluation (see working) **A1**

final answer b = 2 cao **B1**

Answer:b = 2

(Using 3(x - 2)(x + 8/3) -> expand: $3[x^2 + (8/3 - 2)x - 16/3] = 3x^2 + 2x - 16$, so b = 2.)

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Question 12

(a) substitute x = 1 into the expression to obtain 1 + (m - 3) + (2 - m) or equivalent **M1**

(a) simplify to 0, independent of m, so x = 1 is a root for every value of m and x - 1 is always a factor **A1**

(a) Answer: f(1) = 1 + (m - 3) + (2 - m) = 0 for every value of m, so x - 1 is always a factor.

(b) attempt polynomial division (or write $x^2 + (m-3)x + (2-m) = (x-1)(x+c)$ and compare coefficients) **M1**

(b) correct method leading to quotient x + m - 2 (e.g. bring down terms of the division, or match coefficients c - 1 = m - 3) **A1**

(b) check the constant term: -c = 2 - m gives c = m - 2, consistent with the x coefficient **M1**

(b) full factorisation $x^2 + (m - 3)x + (2 - m) = (x - 1)(x + m - 2)$ cao **A1**

(b) Answer: The other factor is x + m - 2. Full factorisation: $x^2 + (m - 3)x + (2 - m) = (x - 1)(x + m - 2)$.

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