HIGHER

6.5 Expanding Triple Brackets: Test Pack

EDEXCEL 1MA1 · Calculator allowed · about 60 minutes

Total Marks

Name: _____ Date: ____ / ____ / _____

Answer ALL questions. Show all your working.

1 Expand and simplify $(x - 3)(x + 6)$.

(Total for Question 1 is 2 marks)

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2 When you fully expand three linear brackets, each containing a term in x, such as $(x + a)(x + b)(x + c)$, what is the highest power of x in the fully simplified answer?

- ☐ A) x
- ☐ B) x^2
- ☐ C) x^3
- ☐ D) x^4

(Total for Question 2 is 1 mark)

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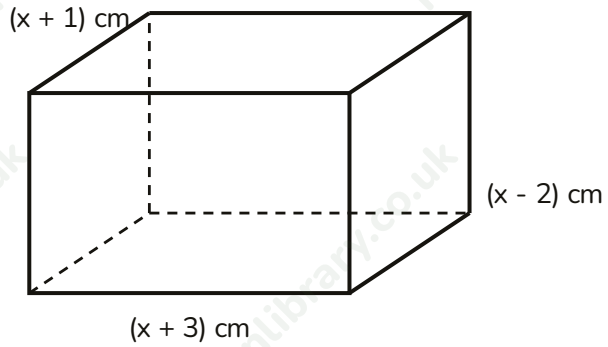
3 A student expands $(x - 3)(x + 2)(x - 1)$ and writes the final answer as $x^3 - 2x^2 - 5x - 6$.
The student has made one error.
Work out the correct expansion, and state which term in the student's answer is wrong.

(Total for Question 3 is 3 marks)

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4 The volume of a fish tank in the shape of a cuboid is given by $V = (x + 3)(x + 1)(x - 2)$ cm^3, where $x > 2$.

Diagram NOT accurately drawn



(a) Show that $V = x^3 + 2x^2 - 5x - 6$ **(3)**

(b) The volume of the tank is 144 cm³. Show that $x = 5$ fits this volume, and use it to find the three dimensions of the tank. **(3)**

(Total for Question 4 is 6 marks)

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5 Expand and simplify $(x + 6)(x + 2)(x + 4)$.

(Total for Question 5 is 3 marks)

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6 Work out the coefficient of x in the expansion of $(x + 1)(x + 5)(x + 5)$.

(Total for Question 6 is 3 marks)

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7 Expand and simplify $(x + 3)(4x + 5)(x + 5)$.

(Total for Question 7 is 3 marks)

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8 Expand and simplify $(x - 4)(x + 5)(x + 2)$.

(Total for Question 8 is 3 marks)

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9 Given that $(x + 4)(x - 1)(x + 2) = x^3 + 5x^2 + kx - 8$, find the value of k.

(Total for Question 9 is 2 marks)

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10 $(x + 1)(x - 2)(x + 4) = x^3 + ax^2 + bx + c$ for all values of x.

(a) Find the values of a, b and c. **(3)**

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(b) Hence write down the three roots of the equation $x^3 + ax^2 + bx + c = 0$. **(2)**

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(Total for Question 10 is 5 marks)

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11 Prove algebraically that, for any positive integer n,
$(n + 1)(n + 2)(n + 3) - n(n + 1)(n + 2)$ is always a multiple of 6.

(Total for Question 11 is 4 marks)

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12 Expand and simplify $(x + 5)(x - 5)(x + 6)$. Give your answer in the form $x^3 + ax^2 + bx + c$.

(Total for Question 12 is 4 marks)

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13 Given that $(x + a)(x + 4)(x - 3) = x^3 + 3x^2 - 10x - 24$, find the value of a.

(Total for Question 13 is 4 marks)

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Mark scheme · 6.5 Expanding Triple Brackets: Test Pack

Question 1

attempt to multiply out the two brackets with at least 3 of the 4 terms correct, e.g. $x^2 + 6x - 3x (- 18)$ oe — **M1**

$x^2 + 3x - 18$ cao — **A1**

Answer: $x^2 + 3x - 18$

Question 2

C selected (cao) — **B1**

Answer: C (x^3)

Question 3

complete correct method to expand all three brackets, e.g. via $(x-3)(x+2) = x^2-x-6$ then $x(x^2-x-6) - 1...$ or equivalent grid method — **M1**

correct expansion $x^3 - 2x^2 - 5x + 6$ (cao) — **A1**

identifies the constant term as the error, stating it should be +6, not -6 (since (-3) x (2) x (-1) = +6) — **B1**

Answer: Correct expansion: $x^3 - 2x^2 - 5x + 6$; the student's constant term is wrong (should be +6, not -6)

Question 4

(a) expands $(x + 3)(x + 1)$ correctly, $x^2 + 4x + 3$ (oe) — **M1**

(a) multiplies their quadratic by $(x - 2)$, with at least 4 of the 6 terms correct — **M1**

(a) $x^3 + 2x^2 - 5x - 6$ shown correctly with no errors (cso) — **A1**

(a) Answer: $x^3 + 2x^2 - 5x - 6$ (shown)

(b) substitutes $x = 5$ into $V = x^3 + 2x^2 - 5x - 6$ (or into $(x+3)(x+1)(x-2)$) and evaluates — **M1**

(b) correctly shows $V = 144$ when $x = 5$ (cso) — **A1**

(b) states all three dimensions: 8 cm, 6 cm and 3 cm — **A1**

(b) Answer: V(5) = 144, confirmed; dimensions are 8 cm, 6 cm and 3 cm

Question 5

expands two brackets: $x^2 + 8x + 12$ (at least 3 terms correct) — **M1**

multiplies by the third bracket (at least 6 terms, at most 1 error) — **M1**

$x^3 + 12x^2 + 44x + 48$ cao — **A1**

Answer: $x^3 + 12x^2 + 44x + 48$

Question 6

expands two brackets correctly — **M1**

identifies the terms of the cubic giving x — **M1**

35 cao — **A1**

Answer: 35

Question 7

expands two brackets (at least 3 terms correct) — **M1**

multiplies by the third bracket (at least 6 terms, at most 1 error) — **M1**

$4x^3 + 37x^2 + 100x + 75$ cao — **A1**

Answer: $4x^3 + 37x^2 + 100x + 75$

Question 8

expands two of the three brackets correctly, e.g. $(x-4)(x+5) = x^2+x-20$ oe — **M1**

(dep) multiplies their quadratic by the remaining bracket, with at least 4 of the 6 terms correct — **M1**

$x^3 + 3x^2 - 18x - 40$ cao — **A1**

Answer: $x^3 + 3x^2 - 18x - 40$

Question 9

expands $(x+4)(x-1)(x+2)$ fully, or compares coefficients of x, to form an equation for k — **M1**

$k = 2$ cao — **A1**

Answer: $k = 2$

Question 10

(a) expands $(x + 1)(x - 2)$ correctly, $x^2 - x - 2$ (oe) — **M1**

(a) multiplies their quadratic by $(x + 4)$, with at least 4 of the 6 terms correct — **M1**

(a) $a = 3$, $b = -6$, $c = -8$, all correct (cao) — **A1**

(a) Answer: $a = 3$, $b = -6$, $c = -8$

(b) two of $x = -1$, $x = 2$, $x = -4$ correct (ft from the original factorised form) — **B1**

(b) all three of $x = -1$, $x = 2$, $x = -4$ correct — **B1**

(b) Answer: $x = -1$, $x = 2$, $x = -4$

Question 11

identifies $(n+1)(n+2)$ as a common factor of both terms — **M1**

factorises correctly to $(n+1)(n+2)[(n+3) - n]$, oe — **A1**

simplifies to $3(n+1)(n+2)$, oe — **A1**

complete reasoning: (n+1) and (n+2) are consecutive integers so one must be even, making $(n+1)(n+2)$ even, so $3(n+1)(n+2)$ is a multiple of 3 x 2 = 6 — **B1**

Answer: Proven: $(n+1)(n+2)(n+3) - n(n+1)(n+2) = 3(n+1)(n+2)$, which is always a multiple of 6

Question 12

recognises $(x+5)(x-5)$ as the difference of two squares — **M1**

$x^2 - 25$ oe correct — **A1**

(dep) multiplies (x^2-25) by $(x+6)$, with at least 3 of the 4 terms correct — **M1**

$x^3 + 6x^2 - 25x - 150$ cao — **A1**

Answer: $x^3 + 6x^2 - 25x - 150$

Question 13

expands $(x+4)(x-3)$ correctly to get x^2+x-12 oe — **M1**

(dep) multiplies by $(x+a)$ and compares coefficients to form an equation in a — **M1**

correct equation, e.g. $a + 1 = 3$, or $-12a = -24$ — **M1**

$a = 2$ cao — **A1**

Answer: $a = 2$

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