HIGHER

6.5 Expanding Triple Brackets: 2-hour Pack

EDEXCEL 1MA1 · Calculator allowed · about 120 minutes

Total Marks

Name: _____ Date: ____ / ____ / _____

Answer ALL questions. Show all your working.

1 Expand and simplify $(x + 3)(x + 6)(x + 5)$.

(Total for Question 1 is 3 marks)

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

(Total for Question 2 is 3 marks)

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

(Total for Question 3 is 3 marks)

4 Expand and simplify $(x + 5)(x - 5)(x - 1)$.

(Total for Question 4 is 3 marks)

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

(Total for Question 5 is 3 marks)

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6 Expand and simplify $(x + 1)(x - 1)(x + 5)$.

(Total for Question 6 is 3 marks)

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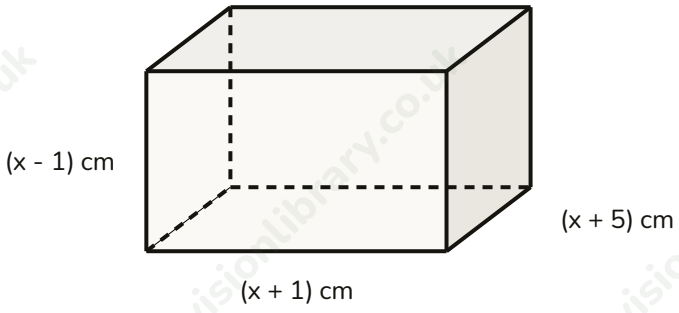
7 Expand and simplify $(x + 3)(4x + 4)(x - 4)$.

(Total for Question 7 is 3 marks)

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8 A cuboid has length $(x + 1)$ cm, width $(x + 5)$ cm and height $(x - 1)$ cm. Find an expression for the volume of the cuboid in the form $ax^3 + bx^2 + cx + d$.

Diagram NOT accurately drawn



(Total for Question 8 is 3 marks)

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9 Expand and simplify $(2x - 4)(x + 1)(x + 3)$.

(Total for Question 9 is 3 marks)

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10 Work out the coefficient of x^2 in the expansion of $(x - 5)(x - 5)(x + 2)$.

(Total for Question 10 is 3 marks)

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11 Expand and simplify $(x - 2)(x + 3)(x - 1)$.

(Total for Question 11 is 3 marks)

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12 Expand and simplify $(x + 7)(x - 7)(x + 3)$.

(Total for Question 12 is 3 marks)

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13 Expand and simplify $(2x + 1)(x + 2)(x - 3)$.

(Total for Question 13 is 4 marks)

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14 Expand and simplify $2(x + 1)(x - 2)(x + 3)$.

(Total for Question 14 is 4 marks)

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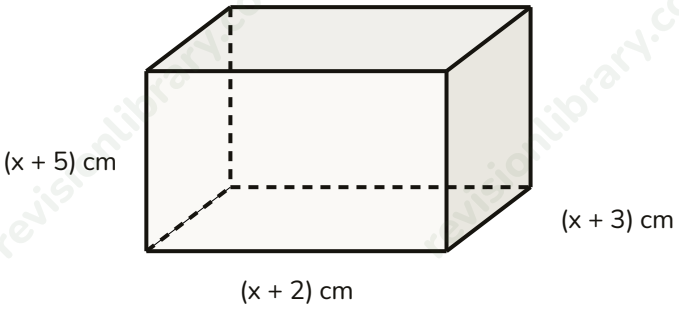
15 Show that $(x - 3)(x + 4)(x + 1) = x^3 + 2x^2 - 11x - 12$.

(Total for Question 15 is 3 marks)

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16 A cuboid has length $(x + 2)$ cm, width $(x + 3)$ cm and height $(x + 5)$ cm.

Diagram NOT accurately drawn



(a) Show that the volume, V cm^3, of the cuboid is given by $V = x^3 + 10x^2 + 31x + 30$. **(3)**

(b) Work out the volume of the cuboid when $x = 1$. **(2)**

(Total for Question 16 is 5 marks)

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17 Expand and simplify $(x + 2)^3$, giving your answer in the form $x^3 + ax^2 + bx + c$.

(Total for Question 17 is 4 marks)

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18 Expand and simplify $(x + 4)^3$, giving your answer in the form $x^3 + ax^2 + bx + c$.

(Total for Question 18 is 4 marks)

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19 $f(x) = (x - 2)(x + 5)(x - 3)$

(a) Show that $f(x) = x^3 - 19x + 30$. **(3)**

(b) Hence write down the coefficient of x^2 in the expansion of $f(x)$. **(1)**

(Total for Question 19 is 4 marks)

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20 Expand and simplify $(x + 2)(3x - 1)(x - 4)$.

(Total for Question 20 is 5 marks)

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21 $f(x) = (x - 5)(x + 2)(x + 1)$

(a) Expand f(x) fully, giving your answer in the form $x^3 + ax^2 + bx + c$. **(3)**

(b) Find f(0). **(2)**

.....

(c) Hence write down the coordinates of the point where the graph of $y = f(x)$ crosses the y-axis. **(1)**

.....

(Total for Question 21 is 6 marks)

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22 Expand and simplify $(3x + 1)(x - 2)(2x + 3)$.

(Total for Question 22 is 5 marks)

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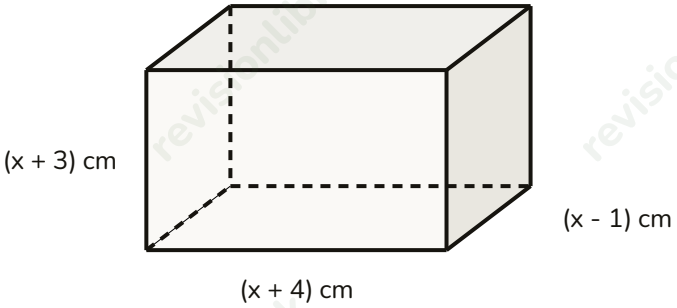
23 Show that $(x + 2)(x + 3)(x + 4) - (x - 2)(x - 3)(x - 4) = 18x^2 + 48$.

(Total for Question 23 is 4 marks)

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24 A cuboid has dimensions $(x + 4)$ cm, $(x - 1)$ cm and $(x + 3)$ cm, where $x > 1$.

Diagram NOT accurately drawn



(a) Show that the volume, V cm^3, of the cuboid is given by $V = x^3 + 6x^2 + 5x - 12$. **(3)**

(b) The volume of the cuboid is 30 cm^3. Show that $x^3 + 6x^2 + 5x - 42 = 0$. **(1)**

(c) Show that $x = 2$ satisfies the equation in part (b), and hence write down the three dimensions of the cuboid. **(2)**

(Total for Question 24 is 6 marks)

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Mark scheme · 6.5 Expanding Triple Brackets: 2-hour Pack

Question 1

expands two brackets: $x^2 + 9x + 18$ (at least 3 terms correct)	**M1**
multiplies by the third bracket (at least 6 terms, at most 1 error)	**M1**
$x^3 + 14x^2 + 63x + 90$ cao	**A1**

Answer: $x^3 + 14x^2 + 63x + 90$

Question 2

expands the first two brackets: $x^2 - 1$	**M1**
multiplies by the third bracket	**M1**
$x^3 - 3x^2 - x + 3$ cao	**A1**

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

Question 3

expands two brackets (at least 3 terms correct)	**M1**
multiplies by the third bracket (at least 6 terms, at most 1 error)	**M1**
$4x^3 + 5x^2 - 64x - 80$ cao	**A1**

Answer: $4x^3 + 5x^2 - 64x - 80$

Question 4

expands the first two brackets: $x^2 - 25$	**M1**
multiplies by the third bracket	**M1**
$x^3 - x^2 - 25x + 25$ cao	**A1**

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

Question 5

expands two brackets (at least 3 terms correct)	**M1**
multiplies by the third bracket (at least 6 terms, at most 1 error)	**M1**
$4x^3 - 7x^2 - 77x + 60$ cao	**A1**

Answer: $4x^3 - 7x^2 - 77x + 60$

Question 6

expands the first two brackets: $x^2 - 1$	**M1**
multiplies by the third bracket	**M1**
$x^3 + 5x^2 - x - 5$ cao	**A1**

Answer: $x^3 + 5x^2 - x - 5$

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**
$4x^3 - 52x - 48$ cao	**A1**

Answer: $4x^3 - 52x - 48$

Question 8

multiplies two of the expressions	**M1**
multiplies by the third expression	**M1**
$x^3 + 5x^2 - x - 5$ cm³ cao	**A1**

Answer: $x^3 + 5x^2 - x - 5$ cm^3

Question 9

expands two brackets (at least 3 terms correct)	**M1**
multiplies by the third bracket (at least 6 terms, at most 1 error)	**M1**
$2x^3 + 4x^2 - 10x - 12$ cao	**A1**

Answer: $2x^3 + 4x^2 - 10x - 12$

Question 10

expands two brackets correctly	**M1**
identifies the terms of the cubic giving x^2	**M1**
-8 cao	**A1**

Answer: -8

Question 11

expands any two of the three brackets correctly, e.g. $x^2 + x - 6$ (oe)	**M1**
multiplies their quadratic by the remaining linear bracket, with at least 4 of the 6 terms correct	**M1**
$x^3 - 7x + 6$ (cao)	**A1**

Answer: $x^3 - 7x + 6$

Question 12

uses the difference of two squares on the first pair of brackets, $x^2 - 49$ (oe)	**M1**
multiplies ($x^2 - 49$) by ($x + 3$), with at least 3 of the 4 terms correct	**M1**
$x^3 + 3x^2 - 49x - 147$ (cao)	**A1**

Answer: $x^3 + 3x^2 - 49x - 147$

Question 13

expands $(2x + 1)(x + 2)$ correctly, $2x^2 + 5x + 2$ (oe)	**M1**
correct method to multiply their quadratic by $(x - 3)$	**M1**
at least 4 of the 6 resulting terms correct before final simplifying, ft their quadratic	**A1**
$2x^3 - x^2 - 13x - 6$ (cao)	**A1**

Answer: $2x^3 - x^2 - 13x - 6$

Question 14

expands $(x + 1)(x - 2)$ correctly, $x^2 - x - 2$ (oe)	**M1**
multiplies their quadratic by $(x + 3)$, with at least 4 of the 6 terms correct	**M1**
$x^3 + 2x^2 - 5x - 6$ (oe, ft) before doubling	**A1**
$2x^3 + 4x^2 - 10x - 12$ (cao)	**A1**

Answer: $2x^3 + 4x^2 - 10x - 12$

Question 15

expands two of the three brackets correctly, e.g. $(x-3)(x+4) = x^2+x-12$ oe	**M1**
(dep) multiplies their quadratic by the remaining bracket, with at least 4 of the 6 terms correct	**M1**
cso - fully correct working shown leading to $x^3 + 2x^2 - 11x - 12$, with no errors	**A1**

Answer: $x^3 + 2x^2 - 11x - 12$ (shown)

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Question 16

(a) expands two of the three brackets correctly, e.g. (x+2)(x+3) = x^2+5x+6 oe **M1**

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

(a) cso - fully correct working shown leading to $x^3 + 10x^2 + 31x + 30$, with no errors **A1**

(a) Answer: $x^3 + 10x^2 + 31x + 30$ (shown)

(b) substitutes x = 1 into their expression from part (a) or into (x+2)(x+3)(x+5) directly **M1**

(b) 72 cao (cm^3) **A1**

(b) Answer: 72 cm^3

Question 17

writes $(x+2)^3$ as (x+2)(x+2)(x+2) and expands (x+2)(x+2) = x^2+4x+4 oe **M1**

(dep) multiplies their quadratic by (x+2), with at least 4 of the 6 terms correct **M1**

correct unsimplified expansion, e.g. x^3+2x^2+4x^2+8x+4x+8 oe **A1**

$x^3 + 6x^2 + 12x + 8$ cao **A1**

Answer: $x^3 + 6x^2 + 12x + 8$

Question 18

writes $(x+4)^3$ as (x+4)(x+4)(x+4) and expands (x+4)(x+4) = x^2+8x+16 oe **M1**

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

correct unsimplified expansion, e.g. x^3+4x^2+8x^2+32x+16x+64 oe **A1**

$x^3 + 12x^2 + 48x + 64$ cao **A1**

Answer: $x^3 + 12x^2 + 48x + 64$

Question 19

(a) expands two of the three brackets correctly, e.g. (x-2)(x+5) = x^2+3x-10 oe **M1**

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

(a) cso - fully correct working shown leading to x^3 - 19x + 30, including the x^2 term correctly cancelling to 0, with no errors **A1**

(a) Answer: x^3 - 19x + 30 (shown)

(b) 0 (ft from their part (a) cubic, must be consistent with an $x^3 + 0x^2$ + ... form) **B1**

(b) Answer: 0

Question 20

expands (3x-1)(x-4) correctly to get 3x^2-13x+4 oe **M1**

$3x^2$ - 13x + 4 correct **A1**

(dep) multiplies their quadratic by (x+2), with at least 4 of the 6 terms correct **M1**

correct unsimplified expansion, e.g. 3x^3-13x^2+4x+6x^2-26x+8 oe **A1**

$3x^3$ - $7x^2$ - 22x + 8 cao **A1**

Answer: $3x^3$ - $7x^2$ - 22x + 8

Question 21

(a) expands two of the three brackets correctly, e.g. (x-5)(x+2) = x^2-3x-10 oe **M1**

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

(a) x^3 - $2x^2$ - 13x - 10 cao **A1**

(a) Answer: x^3 - $2x^2$ - 13x - 10

(b) substitutes x = 0 into f(x) = (x-5)(x+2)(x+1), or into their expanded expression from part (a) **M1**

(b) f(0) = -10 cao **A1**

(b) Answer: f(0) = -10

(c) (0, -10) stated (ft from part (b)) **B1**

(c) Answer: (0, -10)

Question 22

expands (x-2)(2x+3) correctly to get 2x^2-x-6 oe **M1**

$2x^2$ - x - 6 correct **A1**

(dep) multiplies their quadratic by (3x+1), with at least 4 of the 6 terms correct **M1**

correct unsimplified expansion, e.g. 6x^3-3x^2-18x+2x^2-x-6 oe **A1**

$6x^3$ - x^2 - 19x - 6 cao **A1**

Answer: $6x^3$ - x^2 - 19x - 6

Question 23

expands (x+2)(x+3)(x+4) correctly to x^3+9x^2+26x+24 oe **M1**

expands (x-2)(x-3)(x-4) correctly to x^3-9x^2+26x-24 oe **M1**

(dep on both) subtracts the two cubics correctly, with the x^3 and x terms cancelling **M1**

cso - fully correct working shown leading to $18x^2$ + 48, with no errors **A1**

Answer: $18x^2$ + 48 (shown)

Question 24

(a) expands two of the three brackets correctly, e.g. (x+4)(x-1) = x^2+3x-4 oe **M1**

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

(a) cso - fully correct working shown leading to $x^3 + 6x^2 + 5x - 12$, with no errors **A1**

(a) Answer: $x^3 + 6x^2 + 5x - 12$ (shown)

(b) sets V = 30 and rearranges x^3+6x^2+5x-12=30 to x^3+6x^2+5x-42=0 with no errors **B1**

(b) Answer: $x^3 + 6x^2 + 5x - 42 = 0$ (shown)

(c) substitutes x = 2 into x^3+6x^2+5x-42 and evaluates to 0, e.g. 8+24+10-42=0 **M1**

(c) dimensions 6 cm, 1 cm and 5 cm (ft from x = 2), all three stated **A1**

(c) Answer: x = 2 satisfies the equation (8 + 24 + 10 - 42 = 0); dimensions are 6 cm, 1 cm and 5 cm

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