

Algebra and functions
Exercise A, Question 1

Question:

Simplify this expression:

$$4x - 5y + 3x + 6y$$

Solution:

$$\begin{aligned} &4x - 5y + 3x + 6y \\ &= 4x + 3x - 5y + 6y \\ &= 7x + y \end{aligned}$$

Algebra and functions
Exercise A, Question 2

Question:

Simplify this expression:

$$3r + 7t - 5r + 3t$$

Solution:

$$\begin{aligned} 3r + 7t - 5r + 3t \\ = 3r - 5r + 7t + 3t \\ = -2r + 10t \end{aligned}$$

Algebra and functions
Exercise A, Question 3

Question:

Simplify this expression:

$$3m - 2n - p + 5m + 3n - 6p$$

Solution:

$$\begin{aligned} &3m - 2n - p + 5m + 3n - 6p \\ &= 3m + 5m - 2n + 3n - p - 6p \\ &= 8m + n - 7p \end{aligned}$$

Algebra and functions
Exercise A, Question 4

Question:

Simplify this expression:

$$3ab - 3ac + 3a - 7ab + 5ac$$

Solution:

$$\begin{aligned} &3ab - 3ac + 3a - 7ab + 5ac \\ &= 3ab - 7ab - 3ac + 5ac + 3a \\ &= 3a - 4ab + 2ac \end{aligned}$$

Algebra and functions
Exercise A, Question 5

Question:

Simplify this expression:

$$7x^2 - 2x^2 + 5x^2 - 4x^2$$

Solution:

$$\begin{aligned} 7x^2 - 2x^2 + 5x^2 - 4x^2 \\ = 6x^2 \end{aligned}$$

Algebra and functions

Exercise A, Question 6

Question:

Simplify this expression:

$$4m^2n + 5mn^2 - 2m^2n + mn^2 - 3mn^2$$

Solution:

$$\begin{aligned} &4m^2n + 5mn^2 - 2m^2n + mn^2 - 3mn^2 \\ &= 4m^2n - 2m^2n + 5mn^2 + mn^2 - 3mn^2 \\ &= 2m^2n + 3mn^2 \end{aligned}$$

Algebra and functions
Exercise A, Question 7

Question:

Simplify this expression:

$$5x^2 + 4x + 1 - 3x^2 + 2x + 7$$

Solution:

$$\begin{aligned} &5x^2 + 4x + 1 - 3x^2 + 2x + 7 \\ &= 5x^2 - 3x^2 + 4x + 2x + 1 + 7 \\ &= 2x^2 + 6x + 8 \end{aligned}$$

Algebra and functions
Exercise A, Question 8

Question:

Simplify this expression:

$$6x^2 + 5x - 12 + 3x^2 - 7x + 11$$

Solution:

$$\begin{aligned} &6x^2 + 5x - 12 + 3x^2 - 7x + 11 \\ &= 6x^2 + 3x^2 + 5x - 7x - 12 + 11 \\ &= 9x^2 - 2x - 1 \end{aligned}$$

Algebra and functions
Exercise A, Question 9

Question:

Simplify this expression:

$$3x^2 - 5x + 2 + 3x^2 - 7x - 12$$

Solution:

$$\begin{aligned} & 3x^2 - 5x + 2 + 3x^2 - 7x - 12 \\ &= 3x^2 + 3x^2 - 5x - 7x + 2 - 12 \\ &= 6x^2 - 12x - 10 \end{aligned}$$

Algebra and functions
Exercise A, Question 10

Question:

Simplify this expression:

$$4c^2d + 5cd^2 - c^2d + 3cd^2 + 7c^2d$$

Solution:

$$\begin{aligned} &4c^2d + 5cd^2 - c^2d + 3cd^2 + 7c^2d \\ &= 4c^2d - c^2d + 7c^2d + 5cd^2 + 3cd^2 \\ &= 10c^2d + 8cd^2 \end{aligned}$$

Algebra and functions
Exercise A, Question 11

Question:

Simplify this expression:

$$2x^2 + 3x + 1 + 2(3x^2 + 6)$$

Solution:

$$\begin{aligned} 2x^2 + 3x + 1 + 2(3x^2 + 6) \\ &= 2x^2 + 3x + 1 + 6x^2 + 12 \\ &= 8x^2 + 3x + 13 \end{aligned}$$

Algebra and functions
Exercise A, Question 12

Question:

Simplify this expression:

$$4(a + a^2b) - 3(2a + a^2b)$$

Solution:

$$\begin{aligned} &4(a + a^2b) - 3(2a + a^2b) \\ &= 4a + 4a^2b - 6a - 3a^2b \\ &= a^2b - 2a \end{aligned}$$

Algebra and functions
Exercise A, Question 13

Question:

Simplify this expression:

$$2(3x^2 + 4x + 5) - 3(x^2 - 2x - 3)$$

Solution:

$$\begin{aligned} &2(3x^2 + 4x + 5) - 3(x^2 - 2x - 3) \\ &= 6x^2 + 8x + 10 - 3x^2 + 6x + 9 \\ &= 3x^2 + 14x + 19 \end{aligned}$$

Algebra and functions
Exercise A, Question 14

Question:

Simplify this expression:

$$7(1 - x^2) + 3(2 - 3x + 5x^2)$$

Solution:

$$\begin{aligned}7(1 - x^2) + 3(2 - 3x + 5x^2) \\&= 7 - 7x^2 + 6 - 9x + 15x^2 \\&= 8x^2 - 9x + 13\end{aligned}$$

Algebra and functions
Exercise A, Question 15

Question:

Simplify this expression:

$$4(a + b + 3c) - 3a + 2c$$

Solution:

$$\begin{aligned}4(a + b + 3c) - 3a + 2c \\&= 4a + 4b + 12c - 3a + 2c \\&= a + 4b + 14c\end{aligned}$$

Algebra and functions
Exercise A, Question 16

Question:

Simplify this expression:

$$4(c + 3d^2) - 3(2c + d^2)$$

Solution:

$$\begin{aligned} &4(c + 3d^2) - 3(2c + d^2) \\ &= 4c + 12d^2 - 6c - 3d^2 \\ &= -2c + 9d^2 \end{aligned}$$

Algebra and functions
Exercise A, Question 17

Question:

Simplify this expression:

$$5 - 3(x^2 + 2x - 5) + 3x^2$$

Solution:

$$\begin{aligned} 5 - 3(x^2 + 2x - 5) + 3x^2 \\ = 5 - 3x^2 - 6x + 15 + 3x^2 \\ = 20 - 6x \end{aligned}$$

Algebra and functions
Exercise A, Question 18

Question:

Simplify this expression:

$$(r^2 + 3t^2 + 9) - (2r^2 + 3t^2 - 4)$$

Solution:

$$\begin{aligned} & (r^2 + 3t^2 + 9) - (2r^2 + 3t^2 - 4) \\ &= r^2 + 3t^2 + 9 - 2r^2 - 3t^2 + 4 \\ &= 13 - r^2 \end{aligned}$$

Algebra and functions
Exercise B, Question 1

Question:

Simplify this expression:

$$x^3 \times x^4$$

Solution:

$$= x^{3+4}$$

$$= x^7$$

Algebra and functions
Exercise B, Question 2

Question:

Simplify this expression:

$$2x^3 \times 3x^2$$

Solution:

$$\begin{aligned} &= 2 \times 3 \times x^{3+2} \\ &= 6x^5 \end{aligned}$$

Algebra and functions
Exercise B, Question 3

Question:

Simplify this expression:

$$4p^3 \div 2p$$

Solution:

$$\begin{aligned} &= 4 \div 2 \times p^3 \div p \\ &= 2 \times p^{3-1} \\ &= 2p^2 \end{aligned}$$

Algebra and functions
Exercise B, Question 4

Question:

Simplify this expression:

$$3x^{-4} \div x^{-2}$$

Solution:

$$\begin{aligned} &= 3x^{-4--2} \\ &= 3x^{-2} \end{aligned}$$

Algebra and functions
Exercise B, Question 5

Question:

Simplify this expression:

$$k^3 \div k^{-2}$$

Solution:

$$= k^{3 - -2}$$

$$= k^5$$

Algebra and functions
Exercise B, Question 6

Question:

Simplify this expression:

$$(y^2)^5$$

Solution:

$$= y^{2 \times 5}$$

$$= y^{10}$$

Algebra and functions
Exercise B, Question 7

Question:

Simplify this expression:

$$10x^5 \div 2x^{-3}$$

Solution:

$$\begin{aligned} &= 5x^{5 - -3} \\ &= 5x^8 \end{aligned}$$

Algebra and functions
Exercise B, Question 8

Question:

Simplify this expression:

$$(p^3)^2 \div p^4$$

Solution:

$$\begin{aligned} &= p^6 \div p^4 \\ &= p^{6-4} \\ &= p^2 \end{aligned}$$

Algebra and functions
Exercise B, Question 9

Question:

Simplify this expression:

$$(2a^3)^2 \div 2a^3$$

Solution:

$$\begin{aligned} &= 4a^6 \div 2a^3 \\ &= 2a^{6-3} \\ &= 2a^3 \end{aligned}$$

Algebra and functions
Exercise B, Question 10

Question:

Simplify this expression:

$$8p^{-4} \div 4p^3$$

Solution:

$$\begin{aligned} &= 2p^{-4-3} \\ &= 2p^{-7} \end{aligned}$$

Algebra and functions
Exercise B, Question 11

Question:

Simplify this expression:

$$2a^{-4} \times 3a^{-5}$$

Solution:

$$\begin{aligned} &= 6a^{-4+-5} \\ &= 6a^{-9} \end{aligned}$$

Algebra and functions
Exercise B, Question 12

Question:

Simplify this expression:

$$21a^3b^2 \div 7ab^4$$

Solution:

$$\begin{aligned} &= 3a^{3-1}b^{2-4} \\ &= 3a^2b^{-2} \end{aligned}$$

Algebra and functions
Exercise B, Question 13

Question:

Simplify this expression:

$$9x^2 \times 3 (x^2)^3$$

Solution:

$$\begin{aligned} &= 27x^2 \times x^2 \times 3 \\ &= 27x^{2+6} \\ &= 27x^8 \end{aligned}$$

Algebra and functions
Exercise B, Question 14

Question:

Simplify this expression:

$$3x^3 \times 2x^2 \times 4x^6$$

Solution:

$$\begin{aligned} &= 24 \times x^{3+2+6} \\ &= 24x^{11} \end{aligned}$$

Algebra and functions
Exercise B, Question 15

Question:

Simplify this expression:

$$7a^4 \times (3a^4)^2$$

Solution:

$$\begin{aligned} &= 7a^4 \times 9a^8 \\ &= 63a^{12} \end{aligned}$$

Algebra and functions
Exercise B, Question 16

Question:

Simplify this expression:

$$(4y^3)^3 \div 2y^3$$

Solution:

$$\begin{aligned} &= 64y^9 \div 2y^3 \\ &= 32y^6 \end{aligned}$$

Algebra and functions
Exercise B, Question 17

Question:

Simplify this expression:

$$2a^3 \div 3a^2 \times 6a^5$$

Solution:

$$\begin{aligned} &= 4a^{3-2+5} \\ &= 4a^6 \end{aligned}$$

Algebra and functions
Exercise B, Question 18

Question:

Simplify this expression:

$$3a^4 \times 2a^5 \times a^3$$

Solution:

$$\begin{aligned} &= 6a^{4+5+3} \\ &= 6a^{12} \end{aligned}$$

Algebra and functions
Exercise C, Question 1

Question:

Expand and simplify if possible:

$$9(x - 2)$$

Solution:

$$= 9x - 18$$

Algebra and functions
Exercise C, Question 2

Question:

Expand and simplify if possible:

$$x(x + 9)$$

Solution:

$$= x^2 + 9x$$

Algebra and functions
Exercise C, Question 3

Question:

Expand and simplify if possible:

$$-3y(4 - 3y)$$

Solution:

$$= -12y + 9y^2$$

Algebra and functions
Exercise C, Question 4

Question:

Expand and simplify if possible:

$$x (y + 5)$$

Solution:

$$= xy + 5x$$

Algebra and functions
Exercise C, Question 5

Question:

Expand and simplify if possible:

$$-x(3x + 5)$$

Solution:

$$= -3x^2 - 5x$$

Algebra and functions
Exercise C, Question 6

Question:

Expand and simplify if possible:

$$- 5x (4x + 1)$$

Solution:

$$= - 20x^2 - 5x$$

Algebra and functions
Exercise C, Question 7

Question:

Expand and simplify if possible:

$$(4x + 5)x$$

Solution:

$$= 4x^2 + 5x$$

Algebra and functions
Exercise C, Question 8

Question:

Expand and simplify if possible:

$$-3y(5 - 2y^2)$$

Solution:

$$= -15y + 6y^3$$

Algebra and functions
Exercise C, Question 9

Question:

Expand and simplify if possible:

$$- 2x (5x - 4)$$

Solution:

$$= - 10x^2 + 8x$$

Algebra and functions
Exercise C, Question 10

Question:

Expand and simplify if possible:

$$(3x - 5)x^2$$

Solution:

$$= 3x^3 - 5x^2$$

Algebra and functions
Exercise C, Question 11

Question:

Expand and simplify if possible:

$$3(x + 2) + (x - 7)$$

Solution:

$$\begin{aligned} &= 3x + 6 + x - 7 \\ &= 4x - 1 \end{aligned}$$

Algebra and functions
Exercise C, Question 12

Question:

Expand and simplify if possible:

$$5x - 6 - (3x - 2)$$

Solution:

$$\begin{aligned} &= 5x - 6 - 3x + 2 \\ &= 2x - 4 \end{aligned}$$

Algebra and functions
Exercise C, Question 13

Question:

Expand and simplify if possible:

$$x(3x^2 - 2x + 5)$$

Solution:

$$= 3x^3 - 2x^2 + 5x$$

Algebra and functions
Exercise C, Question 14

Question:

Expand and simplify if possible:

$$7y^2 (2 - 5y + 3y^2)$$

Solution:

$$= 14y^2 - 35y^3 + 21y^4$$

Algebra and functions
Exercise C, Question 15

Question:

Expand and simplify if possible:

$$-2y^2(5 - 7y + 3y^2)$$

Solution:

$$= -10y^2 + 14y^3 - 6y^4$$

Algebra and functions
Exercise C, Question 16

Question:

Expand and simplify if possible:

$$7(x - 2) + 3(x + 4) - 6(x - 2)$$

Solution:

$$\begin{aligned} &= 7x - 14 + 3x + 12 - 6x + 12 \\ &= 4x + 10 \end{aligned}$$

Algebra and functions
Exercise C, Question 17

Question:

Expand and simplify if possible:

$$5x - 3(4 - 2x) + 6$$

Solution:

$$\begin{aligned} &= 5x - 12 + 6x + 6 \\ &= 11x - 6 \end{aligned}$$

Exercise C, Question 18**Question:**

Expand and simplify if possible:

$$3x^2 - x(3 - 4x) + 7$$

Solution:

$$= 3x^2 - 3x + 4x^2 + 7$$

$$= 7x^2 - 3x + 7$$

Algebra and functions
Exercise C, Question 19

Question:

Expand and simplify if possible:

$$4x(x + 3) - 2x(3x - 7)$$

Solution:

$$\begin{aligned} &= 4x^2 + 12x - 6x^2 + 14x \\ &= 26x - 2x^2 \end{aligned}$$

Algebra and functions
Exercise C, Question 20

Question:

Expand and simplify if possible:

$$3x^2(2x + 1) - 5x^2(3x - 4)$$

Solution:

$$\begin{aligned} &= 6x^3 + 3x^2 - 15x^3 + 20x^2 \\ &= 23x^2 - 9x^3 \end{aligned}$$

Algebra and functions
Exercise D, Question 1

Question:

Factorise this expression completely:

$$4x + 8$$

Solution:

$$= 4 (x + 2)$$

Algebra and functions
Exercise D, Question 2

Question:

Factorise this expression completely:

$$6x - 24$$

Solution:

$$= 6(x - 4)$$

Algebra and functions
Exercise D, Question 3

Question:

Factorise this expression completely:

$$20x + 15$$

Solution:

$$= 5 (4x + 3)$$

Algebra and functions
Exercise D, Question 4

Question:

Factorise this expression completely:

$$2x^2 + 4$$

Solution:

$$= 2 (x^2 + 2)$$

Algebra and functions
Exercise D, Question 5

Question:

Factorise this expression completely:

$$4x^2 + 20$$

Solution:

$$= 4 (x^2 + 5)$$

Algebra and functions
Exercise D, Question 6

Question:

Factorise this expression completely:

$$6x^2 - 18x$$

Solution:

$$= 6x (x - 3)$$

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Exercise D, Question 7

Question:

Factorise this expression completely:

$$x^2 - 7x$$

Solution:

$$= x(x - 7)$$

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Exercise D, Question 8

Question:

Factorise this expression completely:

$$2x^2 + 4x$$

Solution:

$$= 2x (x + 2)$$

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Exercise D, Question 9

Question:

Factorise this expression completely:

$$3x^2 - x$$

Solution:

$$= x (3x - 1)$$

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Exercise D, Question 10

Question:

Factorise this expression completely:

$$6x^2 - 2x$$

Solution:

$$= 2x (3x - 1)$$

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Exercise D, Question 11

Question:

Factorise this expression completely:

$$10y^2 - 5y$$

Solution:

$$= 5y (2y - 1)$$

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Algebra and functions
Exercise D, Question 12

Question:

Factorise this expression completely:

$$35x^2 - 28x$$

Solution:

$$= 7x (5x - 4)$$

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Exercise D, Question 13

Question:

Factorise this expression completely:

$$x^2 + 2x$$

Solution:

$$= x (x + 2)$$

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Exercise D, Question 14

Question:

Factorise this expression completely:

$$3y^2 + 2y$$

Solution:

$$= y (3y + 2)$$

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Exercise D, Question 15

Question:

Factorise this expression completely:

$$4x^2 + 12x$$

Solution:

$$= 4x (x + 3)$$

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Exercise D, Question 16

Question:

Factorise this expression completely:

$$5y^2 - 20y$$

Solution:

$$= 5y (y - 4)$$

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Exercise D, Question 17

Question:

Factorise this expression completely:

$$9xy^2 + 12x^2y$$

Solution:

$$= 3xy (3y + 4x)$$

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Algebra and functions
Exercise D, Question 18

Question:

Factorise this expression completely:

$$6ab - 2ab^2$$

Solution:

$$= 2ab (3 - b)$$

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Exercise D, Question 19

Question:

Factorise this expression completely:

$$5x^2 - 25xy$$

Solution:

$$= 5x (x - 5y)$$

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Exercise D, Question 20

Question:

Factorise this expression completely:

$$12x^2y + 8xy^2$$

Solution:

$$= 4xy (3x + 2y)$$

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Exercise D, Question 21

Question:

Factorise this expression completely:

$$15y - 20yz^2$$

Solution:

$$= 5y (3 - 4z^2)$$

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Exercise D, Question 22

Question:

Factorise this expression completely:

$$12x^2 - 30$$

Solution:

$$= 6 (2x^2 - 5)$$

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Exercise D, Question 23

Question:

Factorise this expression completely:

$$xy^2 - x^2y$$

Solution:

$$= xy (y - x)$$

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Exercise D, Question 24

Question:

Factorise this expression completely:

$$12y^2 - 4yx$$

Solution:

$$= 4y (3y - x)$$

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Exercise E, Question 1

Question:

Factorise:

$$x^2 + 4x$$

Solution:

$$= x (x + 4)$$

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Exercise E, Question 2

Question:

Factorise:

$$2x^2 + 6x$$

Solution:

$$= 2x (x + 3)$$

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Exercise E, Question 3

Question:

Factorise:

$$x^2 + 11x + 24$$

Solution:

$$\begin{aligned} &= x^2 + 8x + 3x + 24 \\ &= x(x + 8) + 3(x + 8) \\ &= (x + 8)(x + 3) \end{aligned}$$

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Algebra and functions
Exercise E, Question 4

Question:

Factorise:

$$x^2 + 8x + 12$$

Solution:

$$\begin{aligned} &= x^2 + 2x + 6x + 12 \\ &= x(x + 2) + 6(x + 2) \\ &= (x + 2)(x + 6) \end{aligned}$$

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Exercise E, Question 5

Question:

Factorise:

$$x^2 + 3x - 40$$

Solution:

$$\begin{aligned} &= x^2 + 8x - 5x - 40 \\ &= x(x + 8) - 5(x + 8) \\ &= (x + 8)(x - 5) \end{aligned}$$

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Algebra and functions
Exercise E, Question 6

Question:

Factorise:

$$x^2 - 8x + 12$$

Solution:

$$\begin{aligned} &= x^2 - 2x - 6x + 12 \\ &= x(x - 2) - 6(x - 2) \\ &= (x - 2)(x - 6) \end{aligned}$$

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Algebra and functions
Exercise E, Question 7

Question:

Factorise:

$$x^2 + 5x + 6$$

Solution:

$$\begin{aligned} &= x^2 + 3x + 2x + 6 \\ &= x(x + 3) + 2(x + 3) \\ &= (x + 3)(x + 2) \end{aligned}$$

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Algebra and functions
Exercise E, Question 8

Question:

Factorise:

$$x^2 - 2x - 24$$

Solution:

$$\begin{aligned} &= x^2 - 6x + 4x - 24 \\ &= x(x - 6) + 4(x - 6) \\ &= (x - 6)(x + 4) \end{aligned}$$

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Algebra and functions
Exercise E, Question 9

Question:

Factorise:

$$x^2 - 3x - 10$$

Solution:

$$\begin{aligned} &= x^2 - 5x + 2x - 10 \\ &= x(x - 5) + 2(x - 5) \\ &= (x - 5)(x + 2) \end{aligned}$$

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Algebra and functions
Exercise E, Question 10

Question:

Factorise:

$$x^2 + x - 20$$

Solution:

$$\begin{aligned} &= x^2 - 4x + 5x - 20 \\ &= x(x - 4) + 5(x - 4) \\ &= (x - 4)(x + 5) \end{aligned}$$

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Algebra and functions
Exercise E, Question 11

Question:

Factorise:

$$2x^2 + 5x + 2$$

Solution:

$$\begin{aligned} &= 2x^2 + x + 4x + 2 \\ &= x(2x + 1) + 2(2x + 1) \\ &= (2x + 1)(x + 2) \end{aligned}$$

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Algebra and functions
Exercise E, Question 12

Question:

Factorise:

$$3x^2 + 10x - 8$$

Solution:

$$\begin{aligned} &= 3x^2 - 2x + 12x - 8 \\ &= x(3x - 2) + 4(3x - 2) \\ &= (3x - 2)(x + 4) \end{aligned}$$

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Algebra and functions
Exercise E, Question 13

Question:

Factorise:

$$5x^2 - 16x + 3$$

Solution:

$$\begin{aligned} &= 5x^2 - 15x - x + 3 \\ &= 5x(x - 3) - (x - 3) \\ &= (x - 3)(5x - 1) \end{aligned}$$

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Algebra and functions
Exercise E, Question 14

Question:

Factorise:

$$6x^2 - 8x - 8$$

Solution:

$$\begin{aligned} &= 6x^2 - 12x + 4x - 8 \\ &= 6x(x - 2) + 4(x - 2) \\ &= (x - 2)(6x + 4) = 2(x - 2)(3x + 2) \end{aligned}$$

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Exercise E, Question 15

Question:

Factorise:

$$2x^2 + 7x - 15$$

Solution:

$$\begin{aligned} &= 2x^2 + 10x - 3x - 15 \\ &= 2x(x + 5) - 3(x + 5) \\ &= (x + 5)(2x - 3) \end{aligned}$$

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Exercise E, Question 16

Question:

Factorise:

$$2x^4 + 14x^2 + 24$$

Solution:

$$\begin{aligned} &= 2y^2 + 14y + 24 \\ &= 2y^2 + 6y + 8y + 24 \\ &= 2y(y + 3) + 8(y + 3) \\ &= (y + 3)(2y + 8) \\ &= (x^2 + 3)(2x^2 + 8) = 2(x^2 + 3)(x^2 + 4) \end{aligned}$$

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Exercise E, Question 17

Question:

Factorise:

$$x^2 - 4$$

Solution:

$$\begin{aligned} &= x^2 - 2^2 \\ &= (x + 2)(x - 2) \end{aligned}$$

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Edexcel Modular Mathematics for AS and A-Level

Algebra and functions
Exercise E, Question 18

Question:

Factorise:

$$x^2 - 49$$

Solution:

$$\begin{aligned} &= x^2 - 7^2 \\ &= (x + 7)(x - 7) \end{aligned}$$

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Edexcel Modular Mathematics for AS and A-Level

Algebra and functions
Exercise E, Question 19

Question:

Factorise:

$$4x^2 - 25$$

Solution:

$$\begin{aligned} &= (2x)^2 - 5^2 \\ &= (2x + 5)(2x - 5) \end{aligned}$$

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Edexcel Modular Mathematics for AS and A-Level

Algebra and functions
Exercise E, Question 20

Question:

Factorise:

$$9x^2 - 25y^2$$

Solution:

$$\begin{aligned} &= (3x)^2 - (5y)^2 \\ &= (3x + 5y)(3x - 5y) \end{aligned}$$

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Edexcel Modular Mathematics for AS and A-Level

Algebra and functions
Exercise E, Question 21

Question:

Factorise:

$$36x^2 - 4$$

Solution:

$$\begin{aligned} &= 4 (9x^2 - 1) \\ &= 4 [(3x)^2 - 1] \\ &= 4 (3x + 1) (3x - 1) \end{aligned}$$

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Algebra and functions
Exercise E, Question 22

Question:

Factorise:

$$2x^2 - 50$$

Solution:

$$\begin{aligned} &= 2 (x^2 - 25) \\ &= 2 (x^2 - 5^2) \\ &= 2 (x + 5) (x - 5) \end{aligned}$$

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Algebra and functions
Exercise E, Question 23

Question:

Factorise:

$$6x^2 - 10x + 4$$

Solution:

$$\begin{aligned} &= 2 (3x^2 - 5x + 2) \\ &= 2 (3x^2 - 3x - 2x + 2) \\ &= 2 [3x (x - 1) - 2 (x - 1)] \\ &= 2 (x - 1) (3x - 2) \end{aligned}$$

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Algebra and functions
Exercise E, Question 24

Question:

Factorise:

$$15x^2 + 42x - 9$$

Solution:

$$\begin{aligned} &= 3 (5x^2 + 14x - 3) \\ &= 3 (5x^2 - x + 15x - 3) \\ &= 3 [x (5x - 1) + 3 (5x - 1)] \\ &= 3 (5x - 1) (x + 3) \end{aligned}$$

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Edexcel Modular Mathematics for AS and A-Level

Algebra and functions

Exercise F, Question 1

Question:

Factorise:

Simplify:

(a) $x^3 \div x^{-2}$

(b) $x^5 \div x^7$

(c) $x^{\frac{3}{2}} \times x^{\frac{5}{2}}$

(d) $(x^2)^{\frac{3}{2}}$

(e) $(x^3)^{\frac{5}{3}}$

(f) $3x^{0.5} \times 4x^{-0.5}$

(g) $9x^{\frac{2}{3}} \div 3x^{\frac{1}{6}}$

(h) $5x^1 \frac{2}{5} \div x^{\frac{2}{5}}$

(i) $3x^4 \times 2x^{-5}$

Solution:

(a) $= x^3 - -2$
 $= x^5$

(b) $= x^{5-7}$
 $= x^{-2}$

(c) $= x^{\frac{3}{2} + \frac{5}{2}}$
 $= x^4$

(d) $= x^{2 \times \frac{3}{2}}$
 $= x^3$

(e) $= x^3 \times \frac{5}{3}$
 $= x^5$

(f) $= 12x^{0.5 + -0.5}$
 $= 12x^0$

$$= 12$$

$$\begin{aligned} \text{(g)} &= 3x^{\frac{2}{3} - \frac{1}{6}} \\ &= 3x^{\frac{1}{2}} \end{aligned}$$

$$\begin{aligned} \text{(h)} &= 5x^{1 - \frac{2}{5} - \frac{2}{5}} \\ &= 5x \end{aligned}$$

$$\begin{aligned} \text{(i)} &= 6x^{4 + -5} \\ &= 6x^{-1} \end{aligned}$$

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Algebra and functions

Exercise F, Question 2

Question:

Factorise:

Evaluate:

(a) $25^{\frac{1}{2}}$

(b) $81^{\frac{1}{2}}$

(c) $27^{\frac{1}{3}}$

(d) 4^{-2}

(e) $9^{-\frac{1}{2}}$

(f) $(-5)^{-3}$

(g) $\left(\frac{3}{4}\right)^0$

(h) $1296^{\frac{1}{4}}$

(i) $\left(1\frac{9}{16}\right)^{\frac{3}{2}}$

(j) $\left(\frac{27}{8}\right)^{\frac{2}{3}}$

(k) $\left(\frac{6}{5}\right)^{-1}$

(l) $\left(\frac{343}{512}\right)^{-\frac{2}{3}}$

Solution:

(a) $= \sqrt{25}$
 $= \pm 5$

(b) $= \sqrt{81}$

$$= \pm 9$$

$$\begin{aligned} \text{(c)} &= \sqrt[3]{27} \\ &= 3 \end{aligned}$$

$$\begin{aligned} \text{(d)} &= \frac{1}{4^2} \\ &= \frac{1}{16} \end{aligned}$$

$$\begin{aligned} \text{(e)} &= \frac{1}{9^{\frac{1}{2}}} \\ &= \frac{1}{\sqrt{9}} \\ &= \pm \frac{1}{3} \end{aligned}$$

$$\begin{aligned} \text{(f)} &= \frac{1}{(-5)^3} \\ &= \frac{1}{-125} \end{aligned}$$

$$\text{(g)} = 1$$

$$\begin{aligned} \text{(h)} &= \sqrt[4]{1296} \\ &= \pm 6 \end{aligned}$$

$$\begin{aligned} \text{(i)} &= \left(\frac{25}{16} \right)^{\frac{3}{2}} \\ &= \frac{(\sqrt{25})^3}{(\sqrt{16})^3} \\ &= \frac{5^3}{4^3} \\ &= \frac{125}{64} \end{aligned}$$

$$\begin{aligned} \text{(j)} &= \frac{(\sqrt[3]{27})^2}{(\sqrt[3]{8})^2} \\ &= \frac{(3)^2}{(2)^2} \\ &= \frac{9}{4} \end{aligned}$$

$$\begin{aligned} \text{(k)} &= \left(\frac{5}{6} \right)^1 \\ &= \frac{5}{6} \end{aligned}$$

$$\begin{aligned} (1) \quad & \frac{(\sqrt[3]{512})^2}{(\sqrt[3]{343})^2} \\ &= \frac{(8)^2}{(7)^2} \\ &= \frac{64}{49} \end{aligned}$$

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Edexcel Modular Mathematics for AS and A-Level

Algebra and functions
Exercise G, Question 1

Question:

Simplify:

$$\sqrt{28}$$

Solution:

$$\begin{aligned} &= \sqrt{4} \times \sqrt{7} \\ &= 2\sqrt{7} \end{aligned}$$

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Edexcel Modular Mathematics for AS and A-Level

Algebra and functions
Exercise G, Question 2

Question:

Simplify:

$$\sqrt{72}$$

Solution:

$$\begin{aligned} &= \sqrt{8} \times \sqrt{9} \\ &= \sqrt{2} \times \sqrt{4} \times \sqrt{9} \\ &= \sqrt{2} \times 2 \times 3 \\ &= 6\sqrt{2} \end{aligned}$$

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Edexcel Modular Mathematics for AS and A-Level

Algebra and functions
Exercise G, Question 3

Question:

Simplify:

$$\sqrt{50}$$

Solution:

$$\begin{aligned} &= \sqrt{25} \times \sqrt{2} \\ &= 5\sqrt{2} \end{aligned}$$

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Algebra and functions
Exercise G, Question 4

Question:

Simplify:

$$\sqrt{32}$$

Solution:

$$\begin{aligned} &= \sqrt{16} \times \sqrt{2} \\ &= 4\sqrt{2} \end{aligned}$$

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Algebra and functions
Exercise G, Question 5

Question:

Simplify:

$$\sqrt{90}$$

Solution:

$$\begin{aligned} &= \sqrt{9} \times \sqrt{10} \\ &= 3\sqrt{10} \end{aligned}$$

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Algebra and functions
Exercise G, Question 6

Question:

Simplify:

$$\frac{\sqrt{12}}{2}$$

Solution:

$$\begin{aligned} &= \frac{\sqrt{4 \times 3}}{2} \\ &= \frac{2 \times \sqrt{3}}{2} \\ &= \sqrt{3} \end{aligned}$$

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Algebra and functions
Exercise G, Question 7

Question:

Simplify:

$$\frac{\sqrt{27}}{3}$$

Solution:

$$\begin{aligned} &= \frac{\sqrt{9 \times 3}}{3} \\ &= \frac{3 \times \sqrt{3}}{3} \\ &= \sqrt{3} \end{aligned}$$

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Algebra and functions
Exercise G, Question 8

Question:

Simplify:

$$\sqrt{20} + \sqrt{80}$$

Solution:

$$\begin{aligned} &= \sqrt{4} \sqrt{5} + \sqrt{16} \sqrt{5} \\ &= 2 \sqrt{5} + 4 \sqrt{5} \\ &= 6 \sqrt{5} \end{aligned}$$

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Algebra and functions
Exercise G, Question 9

Question:

Simplify:

$$\sqrt{200} + \sqrt{18} - \sqrt{72}$$

Solution:

$$\begin{aligned} &= \sqrt{100} \sqrt{2} + \sqrt{9} \sqrt{2} - \sqrt{9} \sqrt{4} \sqrt{2} \\ &= 10 \sqrt{2} + 3 \sqrt{2} - 6 \sqrt{2} \\ &= 7 \sqrt{2} \end{aligned}$$

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Algebra and functions
Exercise G, Question 10

Question:

Simplify:

$$\sqrt{175} + \sqrt{63} + 2\sqrt{28}$$

Solution:

$$\begin{aligned} &= \sqrt{25} \times \sqrt{7} + \sqrt{9} \times \sqrt{7} + 2 \times \sqrt{4} \times \sqrt{7} \\ &= 5\sqrt{7} + 3\sqrt{7} + 4\sqrt{7} \\ &= 12\sqrt{7} \end{aligned}$$

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Algebra and functions
Exercise G, Question 11

Question:

Simplify:

$$1 \sqrt{28} - 2 \sqrt{63} + \sqrt{7}$$

Solution:

$$\begin{aligned} &= \sqrt{4} \sqrt{7} - 2 \sqrt{9} \sqrt{7} + \sqrt{7} \\ &= 2 \sqrt{7} - 6 \sqrt{7} + \sqrt{7} \\ &= -3 \sqrt{7} \end{aligned}$$

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Algebra and functions
Exercise G, Question 12

Question:

Simplify:

$$\sqrt{80} - 2\sqrt{20} + 3\sqrt{45}$$

Solution:

$$\begin{aligned} &= \sqrt{16}\sqrt{5} - 2\sqrt{4}\sqrt{5} + 3\sqrt{9}\sqrt{5} \\ &= 4\sqrt{5} - 4\sqrt{5} + 9\sqrt{5} \\ &= 9\sqrt{5} \end{aligned}$$

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Algebra and functions
Exercise G, Question 13

Question:

Simplify:

$$3\sqrt{80} - 2\sqrt{20} + 5\sqrt{45}$$

Solution:

$$\begin{aligned} &= 3\sqrt{16}\sqrt{5} - 2\sqrt{4}\sqrt{5} + 5\sqrt{9}\sqrt{5} \\ &= 12\sqrt{5} - 4\sqrt{5} + 15\sqrt{5} \\ &= 23\sqrt{5} \end{aligned}$$

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Algebra and functions
Exercise G, Question 14

Question:

Simplify:

$$\frac{\sqrt{44}}{\sqrt{11}}$$

Solution:

$$\begin{aligned} &= \frac{\sqrt{4} \sqrt{11}}{\sqrt{11}} \\ &= 2 \end{aligned}$$

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Algebra and functions
Exercise G, Question 15

Question:

Simplify:

$$\sqrt{12} + 3\sqrt{48} + \sqrt{75}$$

Solution:

$$\begin{aligned} &= \sqrt{4}\sqrt{3} + 3\sqrt{16}\sqrt{3} + \sqrt{25}\sqrt{3} \\ &= 2\sqrt{3} + 12\sqrt{3} + 5\sqrt{3} \\ &= 19\sqrt{3} \end{aligned}$$

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Algebra and functions
Exercise H, Question 1

Question:

Rationalise the denominator:

$$\frac{1}{\sqrt{5}}$$

Solution:

$$\begin{aligned} &= \frac{1 \times \sqrt{5}}{\sqrt{5} \times \sqrt{5}} \\ &= \frac{\sqrt{5}}{5} \end{aligned}$$

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Algebra and functions
Exercise H, Question 2

Question:

Rationalise the denominator:

$$\frac{1}{\sqrt{11}}$$

Solution:

$$\begin{aligned} &= \frac{1 \times \sqrt{11}}{\sqrt{11} \times \sqrt{11}} \\ &= \frac{\sqrt{11}}{11} \end{aligned}$$

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Algebra and functions
Exercise H, Question 3

Question:

Rationalise the denominator:

$$\frac{1}{\sqrt{2}}$$

Solution:

$$\begin{aligned} &= \frac{1 \times \sqrt{2}}{\sqrt{2} \times \sqrt{2}} \\ &= \frac{\sqrt{2}}{2} \end{aligned}$$

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Algebra and functions
Exercise H, Question 4

Question:

Rationalise the denominator:

$$\frac{\sqrt{3}}{\sqrt{15}}$$

Solution:

$$\begin{aligned} &= \frac{\sqrt{3} \times \sqrt{15}}{\sqrt{15} \times \sqrt{15}} \\ &= \frac{\sqrt{3 \times 15}}{15} \\ &= \frac{\sqrt{45}}{15} \\ &= \frac{\sqrt{9 \times 5}}{15} \\ &= \frac{\sqrt{9} \times \sqrt{5}}{15} \\ &= \frac{3 \times \sqrt{5}}{15} \\ &= \frac{\sqrt{5}}{5} \end{aligned}$$

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Algebra and functions
Exercise H, Question 5

Question:

Rationalise the denominator:

$$\frac{\sqrt{12}}{\sqrt{48}}$$

Solution:

$$\begin{aligned} &= \frac{\sqrt{12}}{\sqrt{12} \times \sqrt{4}} \\ &= \frac{1}{\sqrt{4}} \\ &= \frac{1}{2} \end{aligned}$$

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Algebra and functions
Exercise H, Question 6

Question:

Rationalise the denominator:

$$\frac{\sqrt{5}}{\sqrt{80}}$$

Solution:

$$\begin{aligned} &= \frac{\sqrt{5}}{\sqrt{5 \times 16}} \\ &= \frac{1}{\sqrt{16}} \\ &= \frac{1}{4} \end{aligned}$$

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Algebra and functions
Exercise H, Question 7

Question:

Rationalise the denominator:

$$\frac{\sqrt{12}}{\sqrt{156}}$$

Solution:

$$\begin{aligned} &= \frac{\sqrt{12}}{\sqrt{12} \times \sqrt{13}} \\ &= \frac{1}{\sqrt{13}} \\ &= \frac{1 \times \sqrt{13}}{\sqrt{13} \times \sqrt{13}} \\ &= \frac{\sqrt{13}}{13} \end{aligned}$$

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Algebra and functions
Exercise H, Question 8

Question:

Rationalise the denominator:

$$\frac{\sqrt{7}}{\sqrt{63}}$$

Solution:

$$\begin{aligned}\frac{\sqrt{7}}{\sqrt{7 \times 9}} \\ &= \frac{1}{\sqrt{9}} \\ &= \frac{1}{3}\end{aligned}$$

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Algebra and functions
Exercise H, Question 9

Question:

Rationalise the denominator:

$$\frac{1}{1 + \sqrt{3}}$$

Solution:

$$\begin{aligned} &= \frac{1 \times (1 - \sqrt{3})}{(1 + \sqrt{3})(1 - \sqrt{3})} \\ &= \frac{1 - \sqrt{3}}{1 + \sqrt{3} - \sqrt{3} - 3} \\ &= \frac{1 - \sqrt{3}}{-2} \text{ or} \\ &= \frac{-1 + \sqrt{3}}{2} \end{aligned}$$

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Algebra and functions
Exercise H, Question 10

Question:

Rationalise the denominator:

$$\frac{1}{2 + \sqrt{5}}$$

Solution:

$$\begin{aligned} &= \frac{1 \times (2 - \sqrt{5})}{(2 + \sqrt{5})(2 - \sqrt{5})} \\ &= \frac{2 - \sqrt{5}}{4 - 5} \\ &= \frac{2 - \sqrt{5}}{-1} \\ &= -2 + \sqrt{5} \end{aligned}$$

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Algebra and functions
Exercise H, Question 11

Question:

Rationalise the denominator:

$$\frac{1}{3 - \sqrt{7}}$$

Solution:

$$\begin{aligned} &= \frac{3 + \sqrt{7}}{(3 - \sqrt{7})(3 + \sqrt{7})} \\ &= \frac{3 + \sqrt{7}}{9 - 7} \\ &= \frac{3 + \sqrt{7}}{2} \end{aligned}$$

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Algebra and functions
Exercise H, Question 12

Question:

Rationalise the denominator:

$$\frac{4}{3 - \sqrt{5}}$$

Solution:

$$\begin{aligned} &= \frac{4 \times (3 + \sqrt{5})}{(3 - \sqrt{5})(3 + \sqrt{5})} \\ &= \frac{12 + 4\sqrt{5}}{9 - 5} \\ &= \frac{12 + 4\sqrt{5}}{4} \\ &= 3 + \sqrt{5} \end{aligned}$$

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Algebra and functions
Exercise H, Question 13

Question:

Rationalise the denominator:

$$\frac{1}{\sqrt{5} - \sqrt{3}}$$

Solution:

$$\begin{aligned} &= \frac{\sqrt{5} + \sqrt{3}}{(\sqrt{5} - \sqrt{3})(\sqrt{5} + \sqrt{3})} \\ &= \frac{\sqrt{5} + \sqrt{3}}{5 - 3} \\ &= \frac{\sqrt{5} + \sqrt{3}}{2} \end{aligned}$$

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Algebra and functions
Exercise H, Question 14

Question:

Rationalise the denominator:

$$\frac{3 - \sqrt{2}}{4 - \sqrt{5}}$$

Solution:

$$\begin{aligned} &= \frac{(3 - \sqrt{2})(4 + \sqrt{5})}{(4 - \sqrt{5})(4 + \sqrt{5})} \\ &= \frac{(3 - \sqrt{2})(4 + \sqrt{5})}{16 - 5} \\ &= \frac{(3 - \sqrt{2})(4 + \sqrt{5})}{11} \end{aligned}$$

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Algebra and functions
Exercise H, Question 15

Question:

Rationalise the denominator:

$$\frac{5}{2 + \sqrt{5}}$$

Solution:

$$\begin{aligned} &= \frac{5 \times (2 - \sqrt{5})}{(2 + \sqrt{5})(2 - \sqrt{5})} \\ &= \frac{5(2 - \sqrt{5})}{4 - 5} \\ &= \frac{5(2 - \sqrt{5})}{-1} \\ &= 5(\sqrt{5} - 2) \end{aligned}$$

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Algebra and functions
Exercise H, Question 16

Question:

Rationalise the denominator:

$$\frac{5\sqrt{2}}{\sqrt{8} - \sqrt{7}}$$

Solution:

$$\begin{aligned} &= \frac{5\sqrt{2}(\sqrt{8} + \sqrt{7})}{(\sqrt{8} - \sqrt{7})(\sqrt{8} + \sqrt{7})} \\ &= \frac{5(\sqrt{8 \times 2} + \sqrt{2}\sqrt{7})}{8 - 7} \\ &= \frac{5(\sqrt{16} + \sqrt{14})}{1} \\ &= 5(4 + \sqrt{14}) \end{aligned}$$

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Algebra and functions
Exercise H, Question 17

Question:

Rationalise the denominator:

$$\frac{11}{3 + \sqrt{11}}$$

Solution:

$$\begin{aligned} &= \frac{11(3 - \sqrt{11})}{(3 + \sqrt{11})(3 - \sqrt{11})} \\ &= \frac{11(3 - \sqrt{11})}{9 - 11} \\ &= \frac{11(3 - \sqrt{11})}{-2} \end{aligned}$$

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Algebra and functions
Exercise H, Question 18

Question:

Rationalise the denominator:

$$\frac{\sqrt{3} - \sqrt{7}}{\sqrt{3} + \sqrt{7}}$$

Solution:

$$\begin{aligned} &= \frac{(\sqrt{3} - \sqrt{7})(\sqrt{3} - \sqrt{7})}{(\sqrt{3} + \sqrt{7})(\sqrt{3} - \sqrt{7})} \\ &= \frac{3 - \sqrt{21} - \sqrt{21} + 7}{3 - 7} \\ &= \frac{10 - 2\sqrt{21}}{-4} \\ &= \frac{5 - \sqrt{21}}{-2} \end{aligned}$$

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Algebra and functions
Exercise H, Question 19

Question:

Rationalise the denominator:

$$\frac{\sqrt{17} - \sqrt{11}}{\sqrt{17} + \sqrt{11}}$$

Solution:

$$\begin{aligned} &= \frac{(\sqrt{17} - \sqrt{11})(\sqrt{17} - \sqrt{11})}{(\sqrt{17} + \sqrt{11})(\sqrt{17} - \sqrt{11})} \\ &= \frac{17 - \sqrt{187} - \sqrt{187} + 11}{17 - 11} \\ &= \frac{28 - 2\sqrt{187}}{6} \\ &= \frac{14 - \sqrt{187}}{3} \end{aligned}$$

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Algebra and functions
Exercise H, Question 20

Question:

Rationalise the denominator:

$$\frac{\sqrt{41} + \sqrt{29}}{\sqrt{41} - \sqrt{29}}$$

Solution:

$$\begin{aligned} &= \frac{(\sqrt{41} + \sqrt{29})(\sqrt{41} + \sqrt{29})}{(\sqrt{41} - \sqrt{29})(\sqrt{41} + \sqrt{29})} \\ &= \frac{41 + 2\sqrt{41}\sqrt{29} + 29}{41 - 29} \\ &= \frac{70 + 2\sqrt{1189}}{12} \\ &= \frac{35 + \sqrt{1189}}{6} \end{aligned}$$

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Algebra and functions
Exercise H, Question 21

Question:

Rationalise the denominator:

$$\frac{\sqrt{2} - \sqrt{3}}{\sqrt{3} - \sqrt{2}}$$

Solution:

$$\begin{aligned} &= \frac{(\sqrt{2} - \sqrt{3})(\sqrt{3} + \sqrt{2})}{(\sqrt{3} - \sqrt{2})(\sqrt{3} + \sqrt{2})} \\ &= \frac{\sqrt{6} - 3 + 2 - \sqrt{6}}{3 - 2} \\ &= \frac{-1}{1} \\ &= -1 \end{aligned}$$

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Algebra and functions

Exercise I, Question 1

Question:

Simplify:

(a) $y^3 \times y^5$

(b) $3x^2 \times 2x^5$

(c) $(4x^2)^3 \div 2x^5$

(d) $4b^2 \times 3b^3 \times b^4$

Solution:

(a) $= y^{3+5}$
 $= y^8$

(b) $= 3 \times 2 \times x^{2+5}$
 $= 6x^7$

(c) $= 4^3 x^{2 \times 3} \div 2x^5$
 $= 64x^6 \div 2x^5$
 $= 32x^{6-5}$
 $= 32x$

(d) $= 4 \times 3 \times b^{2+3+4}$
 $= 12b^9$

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Algebra and functions

Exercise I, Question 2

Question:

Expand the brackets:

(a) $3(5y + 4)$

(b) $5x^2(3 - 5x + 2x^2)$

(c) $5x(2x + 3) - 2x(1 - 3x)$

(d) $3x^2(1 + 3x) - 2x(3x - 2)$

Solution:

(a) $= 15y + 12$

(b) $= 15x^2 - 25x^3 + 10x^4$

(c) $= 10x^2 + 15x - 2x + 6x^2$
 $= 16x^2 + 13x$

(d) $= 3x^2 + 9x^3 - 6x^2 + 4x$
 $= 9x^3 - 3x^2 + 4x$

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Algebra and functions

Exercise I, Question 3

Question:

Factorise these expressions completely:

(a) $3x^2 + 4x$

(b) $4y^2 + 10y$

(c) $x^2 + xy + xy^2$

(d) $8xy^2 + 10x^2y$

Solution:

(a) $= x (3x + 4)$

(b) $= 2y (2y + 5)$

(c) $= x (x + y + y^2)$

(d) $= 2xy (4y + 5x)$

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Algebra and functions

Exercise I, Question 4

Question:

Factorise:

(a) $x^2 + 3x + 2$

(b) $3x^2 + 6x$

(c) $x^2 - 2x - 35$

(d) $2x^2 - x - 3$

(e) $5x^2 - 13x - 6$

(f) $6 - 5x - x^2$

Solution:

$$\begin{aligned} \text{(a)} &= x^2 + x + 2x + 2 \\ &= x(x + 1) + 2(x + 1) \\ &= (x + 1)(x + 2) \end{aligned}$$

$$\text{(b)} = 3x(x + 2)$$

$$\begin{aligned} \text{(c)} &= x^2 - 7x + 5x - 35 \\ &= x(x - 7) + 5(x - 7) \\ &= (x - 7)(x + 5) \end{aligned}$$

$$\begin{aligned} \text{(d)} &= 2x^2 - 3x + 2x - 3 \\ &= x(2x - 3) + (2x - 3) \\ &= (2x - 3)(x + 1) \end{aligned}$$

$$\begin{aligned} \text{(e)} &= 5x^2 + 2x - 15x - 6 \\ &= x(5x + 2) - 3(5x + 2) \\ &= (5x + 2)(x - 3) \end{aligned}$$

$$\begin{aligned} \text{(f)} &= 6 + x - 6x - x^2 \\ &= (6 + x) - x(6 + x) \\ &= (1 - x)(6 + x) \end{aligned}$$

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Exercise I, Question 5

Question:

Simplify:

(a) $9x^3 \div 3x^{-3}$

(b) $\left(4\frac{3}{2}\right)^{\frac{1}{3}}$

(c) $3x^{-2} \times 2x^4$

(d) $3x^{\frac{1}{3}} \div 6x^{\frac{2}{3}}$

Solution:

(a) $= 3x^{3 - -3}$
 $= 3x^6$

(b) $[(\sqrt{4})^3]^{\frac{1}{3}}$
 $= (\sqrt{4})^{3 \times \frac{1}{3}}$
 $= \sqrt{4}$
 $= \pm 2$

(c) $= 6x^{-2+4}$
 $= 6x^2$

(d) $= \frac{1}{2}x^{\frac{1}{3} - \frac{2}{3}}$
 $= \frac{1}{2}x^{-\frac{1}{3}}$ or
 $= \frac{1}{2(\sqrt[3]{x})}$

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Algebra and functions

Exercise I, Question 6

Question:

Evaluate:

$$(a) \left(\frac{8}{27} \right)^{\frac{2}{3}}$$

$$(b) \left(\frac{225}{289} \right)^{\frac{3}{2}}$$

Solution:

$$\begin{aligned}(a) &= \left(\frac{\sqrt[3]{8}}{\sqrt[3]{27}} \right)^2 \\ &= \left(\frac{2}{3} \right)^2 \\ &= \frac{4}{9}\end{aligned}$$

$$\begin{aligned}(b) &= \left(\frac{\sqrt{225}}{\sqrt{289}} \right)^3 \\ &= \frac{15^3}{17^3} \\ &= \frac{3375}{4913}\end{aligned}$$

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Exercise I, Question 7

Question:

Simplify:

(a) $\frac{3}{\sqrt{63}}$

(b) $\sqrt{20} + 2\sqrt{45} - \sqrt{80}$

Solution:

(a) $= \frac{3}{\sqrt{9 \times 7}}$

$= \frac{3}{3\sqrt{7}}$

$= \frac{1}{\sqrt{7}}$

$= \frac{\sqrt{7}}{7}$ (If you rationalise)

(b) $= 2\sqrt{5} + 2 \times 3\sqrt{5} - 4\sqrt{5}$
 $= 4\sqrt{5}$

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Exercise I, Question 8

Question:

Rationalise:

(a) $\frac{1}{\sqrt{3}}$

(b) $\frac{1}{\sqrt{2}-1}$

(c) $\frac{3}{\sqrt{3}-2}$

(d) $\frac{\sqrt{23}-\sqrt{37}}{\sqrt{23}+\sqrt{37}}$

Solution:

$$\begin{aligned} \text{(a)} &= \frac{1 \times \sqrt{3}}{\sqrt{3} \times \sqrt{3}} \\ &= \frac{\sqrt{3}}{3} \end{aligned}$$

$$\begin{aligned} \text{(b)} &= \frac{\sqrt{2+1}}{(\sqrt{2}-1)(\sqrt{2}+1)} \\ &= \frac{\sqrt{2+1}}{2-1} \\ &= \sqrt{2+1} \end{aligned}$$

$$\begin{aligned} \text{(c)} &= \frac{3(\sqrt{3}+2)}{(\sqrt{3}-2)(\sqrt{3}+2)} \\ &= \frac{3\sqrt{3}+6}{3-4} \\ &= -3\sqrt{3}-6 \end{aligned}$$

$$\begin{aligned} \text{(d)} &= \frac{(\sqrt{23}-\sqrt{37})(\sqrt{23}-\sqrt{37})}{(\sqrt{23}+\sqrt{37})(\sqrt{23}-\sqrt{37})} \\ &= \frac{23-2\sqrt{23}\sqrt{37}+37}{23-37} \\ &= \frac{60-2\sqrt{851}}{-14} \\ &= \frac{30-\sqrt{851}}{-7} \end{aligned}$$