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Algebra and functions
Exercise A, Question 1

Question:

Simplify this expression:

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

Solution:

$4x - 5y + 3x + 6y$
$= 4x + 3x - 5y + 6y$
$= 7x + y$

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Algebra and functions
Exercise A, Question 2

Question:

Simplify this expression:

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

Solution:

$3r + 7t - 5r + 3t$
$= 3r - 5r + 7t + 3t$
$= -2r + 10t$

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Algebra and functions
Exercise A, Question 3

Question:

Simplify this expression:

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

Solution:

$3m - 2n - p + 5m + 3n - 6p$
$= 3m + 5m - 2n + 3n - p - 6p$
$= 8m + n - 7p$

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Algebra and functions
Exercise A, Question 4

Question:

Simplify this expression:

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

Solution:

$3ab - 3ac + 3a - 7ab + 5ac$
$= 3ab - 7ab - 3ac + 5ac + 3a$
$= 3a - 4ab + 2ac$

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Algebra and functions
Exercise A, Question 5

Question:

Simplify this expression:

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

Solution:

$7x^2 - 2x^2 + 5x^2 - 4x^2$
$= 6x^2$

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Algebra and functions
Exercise A, Question 6

Question:

Simplify this expression:

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

Solution:

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

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Algebra and functions
Exercise A, Question 7

Question:

Simplify this expression:

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

Solution:

$5x^2 + 4x + 1 - 3x^2 + 2x + 7$
$= 5x^2 - 3x^2 + 4x + 2x + 1 + 7$
$= 2x^2 + 6x + 8$

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Algebra and functions
Exercise A, Question 8

Question:

Simplify this expression:

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

Solution:

$6x^2 + 5x - 12 + 3x^2 - 7x + 11$
$= 6x^2 + 3x^2 + 5x - 7x - 12 + 11$
$= 9x^2 - 2x - 1$

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Algebra and functions
Exercise A, Question 9

Question:

Simplify this expression:

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

Solution:

$3x^2 - 5x + 2 + 3x^2 - 7x - 12$
$= 3x^2 + 3x^2 - 5x - 7x + 2 - 12$
$= 6x^2 - 12x - 10$

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Algebra and functions
Exercise A, Question 10

Question:

Simplify this expression:

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

Solution:

$4c^2d + 5cd^2 - c^2d + 3cd^2 + 7c^2d$
$= 4c^2d - c^2d + 7c^2d + 5cd^2 + 3cd^2$
$= 10c^2d + 8cd^2$

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Algebra and functions
Exercise A, Question 11

Question:

Simplify this expression:

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

Solution:

$2x^2 + 3x + 1 + 2 (3x^2 + 6)$
$= 2x^2 + 3x + 1 + 6x^2 + 12$
$= 8x^2 + 3x + 13$

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Algebra and functions
Exercise A, Question 12

Question:

Simplify this expression:

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

Solution:

$4 (a + a^2b) - 3 (2a + a^2b)$
$= 4a + 4a^2b - 6a - 3a^2b$
$= a^2b - 2a$

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Algebra and functions
Exercise A, Question 13

Question:

Simplify this expression:

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

Solution:

$2 (3x^2 + 4x + 5) - 3 (x^2 - 2x - 3)$
$= 6x^2 + 8x + 10 - 3x^2 + 6x + 9$
$= 3x^2 + 14x + 19$

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Algebra and functions
Exercise A, Question 14

Question:

Simplify this expression:

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

Solution:

$7 (1 - x^2) + 3 (2 - 3x + 5x^2)$
$= 7 - 7x^2 + 6 - 9x + 15x^2$
$= 8x^2 - 9x + 13$

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Algebra and functions
Exercise A, Question 15

Question:

Simplify this expression:

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

Solution:

$4 (a + b + 3c) - 3a + 2c$
$= 4a + 4b + 12c - 3a + 2c$
$= a + 4b + 14c$

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Algebra and functions
Exercise A, Question 16

Question:

Simplify this expression:

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

Solution:

$4 (c + 3d^2) - 3 (2c + d^2)$
$= 4c + 12d^2 - 6c - 3d^2$
$= -2c + 9d^2$

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Algebra and functions
Exercise A, Question 17

Question:

Simplify this expression:

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

Solution:

$5 - 3 (x^2 + 2x - 5) + 3x^2$
$= 5 - 3x^2 - 6x + 15 + 3x^2$
$= 20 - 6x$

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Algebra and functions
Exercise A, Question 18

Question:

Simplify this expression:

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

Solution:

$(r^2 + 3t^2 + 9) - (2r^2 + 3t^2 - 4)$
$= r^2 + 3t^2 + 9 - 2r^2 - 3t^2 + 4$
$= 13 - r^2$

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Algebra and functions
Exercise B, Question 1

Question:

Simplify this expression:

$x^3 \times x^4$

Solution:

$= x^{3+4}$
$= x^7$

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Algebra and functions
Exercise B, Question 2

Question:

Simplify this expression:

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

Solution:

$= 2 \times 3 \times x^{3+2}$
$= 6x^5$

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Algebra and functions
Exercise B, Question 3

Question:

Simplify this expression:

$4p^3 \div 2p$

Solution:

$= 4 \div 2 \times p^3 \div p$
$= 2 \times p^{3-1}$
$= 2p^2$

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Algebra and functions
Exercise B, Question 4

Question:

Simplify this expression:

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

Solution:

$= 3x^{-4--2}$
$= 3x^{-2}$

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Algebra and functions
Exercise B, Question 5

Question:

Simplify this expression:

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

Solution:

$= k^{3--2}$
$= k^5$

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Algebra and functions
Exercise B, Question 6

Question:

Simplify this expression:

$(y^2)^5$

Solution:

$= y^{2 \times 5}$
$= y^{10}$

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Algebra and functions
Exercise B, Question 7

Question:

Simplify this expression:

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

Solution:

$= 5x^{5--3}$
$= 5x^8$

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Algebra and functions
Exercise B, Question 8

Question:

Simplify this expression:

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

Solution:

$= p^6 \div p^4$
$= p^{6-4}$
$= p^2$

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Algebra and functions
Exercise B, Question 9

Question:

Simplify this expression:

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

Solution:

$= 4a^6 \div 2a^3$
$= 2a^{6-3}$
$= 2a^3$

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Algebra and functions
Exercise B, Question 10

Question:

Simplify this expression:

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

Solution:

$= 2p^{-4-3}$
$= 2p^{-7}$

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Algebra and functions
Exercise B, Question 11

Question:

Simplify this expression:

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

Solution:

$= 6a^{-4+-5}$
$= 6a^{-9}$

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Algebra and functions
Exercise B, Question 12

Question:

Simplify this expression:

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

Solution:

$= 3a^{3-1}b^{2-4}$
$= 3a^2b^{-2}$

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Algebra and functions
Exercise B, Question 13

Question:

Simplify this expression:

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

Solution:

$= 27x^2 \times x^{2 \times 3}$
$= 27x^{2 + 6}$
$= 27x^8$

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Algebra and functions
Exercise B, Question 14

Question:

Simplify this expression:

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

Solution:

$= 24 \times x^{3 + 2 + 6}$
$= 24x^{11}$

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Algebra and functions
Exercise B, Question 15

Question:

Simplify this expression:

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

Solution:

$= 7a^4 \times 9a^8$
$= 63a^{12}$

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Algebra and functions
Exercise B, Question 16

Question:

Simplify this expression:

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

Solution:

$= 64y^9 \div 2y^3$
$= 32y^6$

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Algebra and functions
Exercise B, Question 17

Question:

Simplify this expression:

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

Solution:

$= 4a^{3-2+5}$
$= 4a^6$

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Algebra and functions
Exercise B, Question 18

Question:

Simplify this expression:

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

Solution:

$= 6a^{4 + 5 + 3}$
$= 6a^{12}$

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Algebra and functions

Exercise C, Question 1

Question:

Expand and simplify if possible:

$9(x-2)$

Solution:

$= 9x - 18$

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Algebra and functions
Exercise C, Question 2

Question:

Expand and simplify if possible:

$x (x + 9)$

Solution:

$= x^2 + 9x$

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Algebra and functions
Exercise C, Question 3

Question:

Expand and simplify if possible:

$-3y\,(4-3y)$

Solution:

$= -12y + 9y^2$

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Algebra and functions
Exercise C, Question 4

Question:

Expand and simplify if possible:

$x (y + 5)$

Solution:

$= xy + 5x$

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Algebra and functions
Exercise C, Question 5

Question:

Expand and simplify if possible:

$-x(3x + 5)$

Solution:

$= -3x^2 - 5x$

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Algebra and functions
Exercise C, Question 6

Question:

Expand and simplify if possible:

$-5x(4x+1)$

Solution:

$= -20x^2 - 5x$

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Algebra and functions

Exercise C, Question 7

Question:

Expand and simplify if possible:

$(4x + 5) x$

Solution:

$= 4x^2 + 5x$

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Algebra and functions
Exercise C, Question 8

Question:

Expand and simplify if possible:

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

Solution:

$= -15y + 6y^3$

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Algebra and functions

Exercise C, Question 9

Question:

Expand and simplify if possible:

$-2x(5x-4)$

Solution:

$= -10x^2 + 8x$

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Algebra and functions

Exercise C, Question 10

Question:

Expand and simplify if possible:

$(3x - 5)x^2$

Solution:

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

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Algebra and functions
Exercise C, Question 11

Question:

Expand and simplify if possible:

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

Solution:

$= 3x + 6 + x - 7$
$= 4x - 1$

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Algebra and functions
Exercise C, Question 12

Question:

Expand and simplify if possible:

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

Solution:

$= 5x - 6 - 3x + 2$
$= 2x - 4$

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Algebra and functions
Exercise C, Question 13

Question:

Expand and simplify if possible:

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

Solution:

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

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Algebra and functions
Exercise C, Question 14

Question:

Expand and simplify if possible:

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

Solution:

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

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Algebra and functions
Exercise C, Question 15

Question:

Expand and simplify if possible:

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

Solution:

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

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Algebra and functions
Exercise C, Question 16

Question:

Expand and simplify if possible:

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

Solution:

$= 7x - 14 + 3x + 12 - 6x + 12$
$= 4x + 10$

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Algebra and functions
Exercise C, Question 17

Question:

Expand and simplify if possible:

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

Solution:

$= 5x - 12 + 6x + 6$
$= 11x - 6$

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Algebra and functions
Exercise C, Question 18

Question:

Expand and simplify if possible:

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

Solution:

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

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Algebra and functions
Exercise C, Question 19

Question:

Expand and simplify if possible:

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

Solution:

$= 4x^2 + 12x - 6x^2 + 14x$
$= 26x - 2x^2$

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Algebra and functions
Exercise C, Question 20

Question:

Expand and simplify if possible:

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

Solution:

$= 6x^3 + 3x^2 - 15x^3 + 20x^2$
$= 23x^2 - 9x^3$

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Algebra and functions
Exercise D, Question 1

Question:

Factorise this expression completely:

$4x + 8$

Solution:

$= 4 (x + 2)$

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Algebra and functions
Exercise D, Question 2

Question:

Factorise this expression completely:

$6x - 24$

Solution:

$= 6(x - 4)$

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Algebra and functions
Exercise D, Question 3

Question:

Factorise this expression completely:

$20x + 15$

Solution:

$= 5 (4x + 3)$

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Algebra and functions
Exercise D, Question 4

Question:

Factorise this expression completely:

$2x^2 + 4$

Solution:

$= 2 (x^2 + 2)$

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Algebra and functions
Exercise D, Question 5

Question:

Factorise this expression completely:

$4x^2 + 20$

Solution:

$= 4 (x^2 + 5)$

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Algebra and functions

Exercise D, Question 6

Question:

Factorise this expression completely:

$6x^2 - 18x$

Solution:

$= 6x (x - 3)$

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Algebra and functions

Exercise D, Question 7

Question:

Factorise this expression completely:

$x^2 - 7x$

Solution:

$= x (x - 7)$

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Algebra and functions
Exercise D, Question 8

Question:

Factorise this expression completely:

$2x^2 + 4x$

Solution:

$= 2x (x + 2)$

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Algebra and functions
Exercise D, Question 9

Question:

Factorise this expression completely:

$3x^2 - x$

Solution:

$= x (3x - 1)$

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Algebra and functions

Exercise D, Question 10

Question:

Factorise this expression completely:

$6x^2 - 2x$

Solution:

$= 2x (3x - 1)$

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Algebra and functions

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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Algebra and functions
Exercise D, Question 13

Question:

Factorise this expression completely:

$x^2 + 2x$

Solution:

$= x (x + 2)$

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Algebra and functions
Exercise D, Question 14

Question:

Factorise this expression completely:

$3y^2 + 2y$

Solution:

$= y (3y + 2)$

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Algebra and functions
Exercise D, Question 15

Question:

Factorise this expression completely:

$4x^2 + 12x$

Solution:

$= 4x (x + 3)$

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Algebra and functions
Exercise D, Question 16

Question:

Factorise this expression completely:

$5y^2 - 20y$

Solution:

$= 5y (y - 4)$

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Algebra and functions
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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Algebra and functions

Exercise D, Question 19

Question:

Factorise this expression completely:

$5x^2 - 25xy$

Solution:

$= 5x (x - 5y)$

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Algebra and functions
Exercise D, Question 20

Question:

Factorise this expression completely:

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

Solution:

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

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Algebra and functions

Exercise D, Question 21

Question:

Factorise this expression completely:

$15y - 20yz^2$

Solution:

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

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Algebra and functions

Exercise D, Question 22

Question:

Factorise this expression completely:

$12x^2 - 30$

Solution:

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

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Algebra and functions

Exercise D, Question 23

Question:

Factorise this expression completely:

$xy^2 - x^2y$

Solution:

$= xy\,(\,y - x\,)$

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Algebra and functions

Exercise D, Question 24

Question:

Factorise this expression completely:

$12y^2 - 4yx$

Solution:

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

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Algebra and functions

Exercise E, Question 1

Question:

Factorise:

$x^2 + 4x$

Solution:

$= x (x + 4)$

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Algebra and functions

Exercise E, Question 2

Question:

Factorise:

$2x^2 + 6x$

Solution:

$= 2x (x + 3)$

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Algebra and functions
Exercise E, Question 3

Question:

Factorise:

$x^2 + 11x + 24$

Solution:

$= x^2 + 8x + 3x + 24$
$= x(x + 8) + 3(x + 8)$
$= (x + 8)(x + 3)$

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Algebra and functions
Exercise E, Question 4

Question:

Factorise:

$x^2 + 8x + 12$

Solution:

$= x^2 + 2x + 6x + 12$
$= x(x + 2) + 6(x + 2)$
$= (x + 2)(x + 6)$

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Algebra and functions
Exercise E, Question 5

Question:

Factorise:

$x^2 + 3x - 40$

Solution:

$= x^2 + 8x - 5x - 40$
$= x(x + 8) - 5(x + 8)$
$= (x + 8)(x - 5)$

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Algebra and functions

Exercise E, Question 6

Question:

Factorise:

$x^2 - 8x + 12$

Solution:

$= x^2 - 2x - 6x + 12$
$= x(x - 2) - 6(x - 2)$
$= (x - 2)(x - 6)$

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Algebra and functions
Exercise E, Question 7

Question:

Factorise:

$x^2 + 5x + 6$

Solution:

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

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Algebra and functions
Exercise E, Question 8

Question:

Factorise:

$x^2 - 2x - 24$

Solution:

$= x^2 - 6x + 4x - 24$
$= x(x - 6) + 4(x - 6)$
$= (x - 6)(x + 4)$

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Algebra and functions
Exercise E, Question 9

Question:

Factorise:

$x^2 - 3x - 10$

Solution:

$= x^2 - 5x + 2x - 10$
$= x(x - 5) + 2(x - 5)$
$= (x - 5)(x + 2)$

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Algebra and functions
Exercise E, Question 10

Question:

Factorise:

$x^2 + x - 20$

Solution:

$= x^2 - 4x + 5x - 20$
$= x(x - 4) + 5(x - 4)$
$= (x - 4)(x + 5)$

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Algebra and functions
Exercise E, Question 11

Question:

Factorise:

$2x^2 + 5x + 2$

Solution:

$= 2x^2 + x + 4x + 2$
$= x(2x + 1) + 2(2x + 1)$
$= (2x + 1)(x + 2)$

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Edexcel Modular Mathematics for AS and A-Level

Algebra and functions
Exercise E, Question 12

Question:

Factorise:

$3x^2 + 10x - 8$

Solution:

$= 3x^2 - 2x + 12x - 8$
$= x(3x - 2) + 4(3x - 2)$
$= (3x - 2)(x + 4)$

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Algebra and functions
Exercise E, Question 13

Question:

Factorise:

$5x^2 - 16x + 3$

Solution:

$= 5x^2 - 15x - x + 3$
$= 5x(x - 3) - (x - 3)$
$= (x - 3)(5x - 1)$

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Algebra and functions
Exercise E, Question 14

Question:

Factorise:

$6x^2 - 8x - 8$

Solution:

$= 6x^2 - 12x + 4x - 8$
$= 6x(x - 2) + 4(x - 2)$
$= (x - 2)(6x + 4) = 2(x - 2)(3x + 2)$

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Algebra and functions
Exercise E, Question 15

Question:

Factorise:

$2x^2 + 7x - 15$

Solution:

$= 2x^2 + 10x - 3x - 15$
$= 2x(x + 5) - 3(x + 5)$
$= (x + 5)(2x - 3)$

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Algebra and functions
Exercise E, Question 16

Question:

Factorise:

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

Solution:

$= 2y^2 + 14y + 24$
$= 2y^2 + 6y + 8y + 24$
$= 2y (y + 3) + 8 (y + 3)$
$= (y + 3) (2y + 8)$
$= (x^2 + 3) (2x^2 + 8) = 2 (x^2 + 3) (x^2 + 4)$

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Algebra and functions
Exercise E, Question 17

Question:

Factorise:

$x^2 - 4$

Solution:

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

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Algebra and functions
Exercise E, Question 18

Question:

Factorise:

$x^2 - 49$

Solution:

$= x^2 - 7^2$
$= (x + 7)(x - 7)$

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Algebra and functions
Exercise E, Question 19

Question:

Factorise:

$4x^2 - 25$

Solution:

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

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Algebra and functions
Exercise E, Question 20

Question:

Factorise:

$9x^2 - 25y^2$

Solution:

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

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Algebra and functions

Exercise E, Question 21

Question:

Factorise:

$36x^2 - 4$

Solution:

$= 4 (9x^2 - 1)$
$= 4 [(3x) ^2 - 1]$
$= 4 (3x + 1) (3x - 1)$

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Algebra and functions
Exercise E, Question 22

Question:

Factorise:

$2x^2 - 50$

Solution:

$= 2 (x^2 - 25)$
$= 2 (x^2 - 5^2)$
$= 2 (x + 5) (x - 5)$

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Algebra and functions
Exercise E, Question 23

Question:

Factorise:

$6x^2 - 10x + 4$

Solution:

$= 2 (3x^2 - 5x + 2)$
$= 2 (3x^2 - 3x - 2x + 2)$
$= 2 [3x (x - 1) - 2 (x - 1)]$
$= 2 (x - 1) (3x - 2)$

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Algebra and functions
Exercise E, Question 24

Question:

Factorise:

$15x^2 + 42x - 9$

Solution:

$= 3 (5x^2 + 14x - 3)$
$= 3 (5x^2 - x + 15x - 3)$
$= 3 [x (5x - 1) + 3 (5x - 1)]$
$= 3 (5x - 1) (x + 3)$

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

$= 12$

(g) $= 3x^{\frac{2}{3} - \frac{1}{6}}$

$= 3x^{\frac{1}{2}}$

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

$= 5x$

(i) $= 6x^{4 + -5}$

$= 6x^{-1}$

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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) $= \sqrt{81}$

$= \pm 9$

(c) $= \sqrt[3]{27}$
$= 3$

(d) $= \frac{1}{4^2}$

$= \frac{1}{16}$

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

$= \frac{1}{\sqrt{9}}$

$= \pm \frac{1}{3}$

(f) $= \frac{1}{(-5)^3}$

$= \frac{1}{-125}$

(g) $= 1$

(h) $= \sqrt[4]{1296}$
$= \pm 6$

(i) $= \left(\frac{25}{16}\right)^{\frac{3}{2}}$

$= \frac{(\sqrt{25})^3}{(\sqrt{16})^3}$

$= \frac{5^3}{4^3}$

$= \frac{125}{64}$

(j) $= \frac{(\sqrt[3]{27})^2}{(\sqrt[3]{8})^2}$

$= \frac{(3)^2}{(2)^2}$

$= \frac{9}{4}$

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

$= \frac{5}{6}$

(l) $\frac{(\sqrt[3]{512})^2}{(\sqrt[3]{343})^2}$

$= \frac{(8)^2}{(7)^2}$

$= \frac{64}{49}$

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Algebra and functions
Exercise G, Question 1

Question:

Simplify:

$\sqrt{28}$

Solution:

$= \sqrt{4} \times \sqrt{7}$
$= 2\sqrt{7}$

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Algebra and functions
Exercise G, Question 2

Question:

Simplify:

$\sqrt{72}$

Solution:

$= \sqrt{8} \times \sqrt{9}$
$= \sqrt{2} \times \sqrt{4} \times \sqrt{9}$
$= \sqrt{2} \times 2 \times 3$
$= 6\sqrt{2}$

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Algebra and functions

Exercise G, Question 3

Question:

Simplify:

$\sqrt{50}$

Solution:

$= \sqrt{25} \times \sqrt{2}$
$= 5\sqrt{2}$

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Algebra and functions
Exercise G, Question 4

Question:

Simplify:

$\sqrt{32}$

Solution:

$= \sqrt{16} \times \sqrt{2}$
$= 4\sqrt{2}$

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Algebra and functions
Exercise G, Question 5

Question:

Simplify:

$\sqrt{90}$

Solution:

$= \sqrt{9} \times \sqrt{10}$
$= 3\sqrt{10}$

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Algebra and functions
Exercise G, Question 6

Question:

Simplify:

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

Solution:

$$= \frac{\sqrt{4} \times \sqrt{3}}{2}$$

$$= \frac{2 \times \sqrt{3}}{2}$$

$$= \sqrt{3}$$

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Algebra and functions
Exercise G, Question 7

Question:

Simplify:

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

Solution:

$$= \frac{\sqrt{9} \times \sqrt{3}}{3}$$

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

$$= \sqrt{3}$$

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Algebra and functions
Exercise G, Question 8

Question:

Simplify:

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

Solution:

$= \sqrt{4}\sqrt{5} + \sqrt{16}\sqrt{5}$
$= 2\sqrt{5} + 4\sqrt{5}$
$= 6\sqrt{5}$

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Algebra and functions
Exercise G, Question 9

Question:

Simplify:

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

Solution:

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

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Algebra and functions
Exercise G, Question 10

Question:

Simplify:

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

Solution:

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

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Algebra and functions
Exercise G, Question 11

Question:

Simplify:

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

Solution:

$= \sqrt{4}\sqrt{7} - 2\sqrt{9}\sqrt{7} + \sqrt{7}$
$= 2\sqrt{7} - 6\sqrt{7} + \sqrt{7}$
$= -3\sqrt{7}$

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Algebra and functions
Exercise G, Question 12

Question:

Simplify:

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

Solution:

$= \sqrt{16}\sqrt{5} - 2\sqrt{4}\sqrt{5} + 3\sqrt{9}\sqrt{5}$
$= 4\sqrt{5} - 4\sqrt{5} + 9\sqrt{5}$
$= 9\sqrt{5}$

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Algebra and functions
Exercise G, Question 13

Question:

Simplify:

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

Solution:

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

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Algebra and functions
Exercise G, Question 14

Question:

Simplify:

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

Solution:

$$= \frac{\sqrt{4}\sqrt{11}}{\sqrt{11}}$$

$$= 2$$

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Algebra and functions
Exercise G, Question 15

Question:

Simplify:

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

Solution:

$= \sqrt{4}\sqrt{3} + 3\sqrt{16}\sqrt{3} + \sqrt{25}\sqrt{3}$
$= 2\sqrt{3} + 12\sqrt{3} + 5\sqrt{3}$
$= 19\sqrt{3}$

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Algebra and functions
Exercise H, Question 1

Question:

Rationalise the denominator:

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

Solution:

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

$$= \frac{\sqrt{5}}{5}$$

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Algebra and functions
Exercise H, Question 2

Question:

Rationalise the denominator:

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

Solution:

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

$$= \frac{\sqrt{11}}{11}$$

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Algebra and functions
Exercise H, Question 3

Question:

Rationalise the denominator:

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

Solution:

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

$$= \frac{\sqrt{2}}{2}$$

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Algebra and functions
Exercise H, Question 4

Question:

Rationalise the denominator:

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

Solution:

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

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

$$= \frac{\sqrt{45}}{15}$$

$$= \frac{\sqrt{9 \times 5}}{15}$$

$$= \frac{\sqrt{9} \times \sqrt{5}}{15}$$

$$= \frac{3 \times \sqrt{5}}{15}$$

$$= \frac{\sqrt{5}}{5}$$

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Algebra and functions
Exercise H, Question 5

Question:

Rationalise the denominator:

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

Solution:

$$= \frac{\sqrt{12}}{\sqrt{12} \times \sqrt{4}}$$

$$= \frac{1}{\sqrt{4}}$$

$$= \frac{1}{2}$$

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Algebra and functions
Exercise H, Question 6

Question:

Rationalise the denominator:

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

Solution:

$$= \frac{\sqrt{5}}{\sqrt{5} \times \sqrt{16}}$$

$$= \frac{1}{\sqrt{16}}$$

$$= \frac{1}{4}$$

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Algebra and functions
Exercise H, Question 7

Question:

Rationalise the denominator:

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

Solution:

$$= \frac{\sqrt{12}}{\sqrt{12} \times \sqrt{13}}$$

$$= \frac{1}{\sqrt{13}}$$

$$= \frac{1 \times \sqrt{13}}{\sqrt{13} \times \sqrt{13}}$$

$$= \frac{\sqrt{13}}{13}$$

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Algebra and functions
Exercise H, Question 8

Question:

Rationalise the denominator:

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

Solution:

$$\frac{\sqrt{7}}{\sqrt{7} \times \sqrt{9}}$$

$$= \frac{1}{\sqrt{9}}$$

$$= \frac{1}{3}$$

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Algebra and functions
Exercise H, Question 9

Question:

Rationalise the denominator:

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

Solution:

$$= \frac{1\times(1-\sqrt{3})}{(1+\sqrt{3})(1-\sqrt{3})}$$

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

$$= \frac{1-\sqrt{3}}{-2} \text{ or}$$

$$= \frac{-1+\sqrt{3}}{2}$$

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Algebra and functions
Exercise H, Question 10

Question:

Rationalise the denominator:

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

Solution:

$$= \frac{1 \times (2-\sqrt{5})}{(2+\sqrt{5})(2-\sqrt{5})}$$

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

$$= \frac{2-\sqrt{5}}{-1}$$

$$= -2+\sqrt{5}$$

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Algebra and functions
Exercise H, Question 11

Question:

Rationalise the denominator:

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

Solution:

$$= \frac{3+\sqrt{7}}{(3-\sqrt{7})(3+\sqrt{7})}$$

$$= \frac{3+\sqrt{7}}{9-7}$$

$$= \frac{3+\sqrt{7}}{2}$$

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Algebra and functions
Exercise H, Question 12

Question:

Rationalise the denominator:

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

Solution:

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

$$= \frac{12+4\sqrt{5}}{9-5}$$

$$= \frac{12+4\sqrt{5}}{4}$$

$$= 3+\sqrt{5}$$

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Algebra and functions

Exercise H, Question 13

Question:

Rationalise the denominator:

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

Solution:

$$= \frac{\sqrt{5} + \sqrt{3}}{(\sqrt{5} - \sqrt{3})(\sqrt{5} + \sqrt{3})}$$

$$= \frac{\sqrt{5} + \sqrt{3}}{5 - 3}$$

$$= \frac{\sqrt{5} + \sqrt{3}}{2}$$

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Algebra and functions
Exercise H, Question 14

Question:

Rationalise the denominator:

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

Solution:

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

$$= \frac{(3-\sqrt{2})(4+\sqrt{5})}{16-5}$$

$$= \frac{(3-\sqrt{2})(4+\sqrt{5})}{11}$$

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Algebra and functions
Exercise H, Question 15

Question:

Rationalise the denominator:

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

Solution:

$$= \frac{5\times(2-\sqrt{5})}{(2+\sqrt{5})(2-\sqrt{5})}$$

$$= \frac{5(2-\sqrt{5})}{4-5}$$

$$= \frac{5(2-\sqrt{5})}{-1}$$

$$= 5(\sqrt{5}-2)$$

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Algebra and functions
Exercise H, Question 16

Question:

Rationalise the denominator:

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

Solution:

$$= \frac{5\sqrt{2}(\sqrt{8}+\sqrt{7})}{(\sqrt{8}-\sqrt{7})(\sqrt{8}+\sqrt{7})}$$

$$= \frac{5(\sqrt{8\times 2}+\sqrt{2}\sqrt{7})}{8-7}$$

$$= \frac{5(\sqrt{16}+\sqrt{14})}{1}$$

$$= 5(4+\sqrt{14})$$

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Algebra and functions
Exercise H, Question 17

Question:

Rationalise the denominator:

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

Solution:

$$= \frac{11(3-\sqrt{11})}{(3+\sqrt{11})(3-\sqrt{11})}$$

$$= \frac{11(3-\sqrt{11})}{9-11}$$

$$= \frac{11(3-\sqrt{11})}{-2}$$

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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:

$$= \frac{(\sqrt{3} - \sqrt{7})(\sqrt{3} - \sqrt{7})}{(\sqrt{3} + \sqrt{7})(\sqrt{3} - \sqrt{7})}$$

$$= \frac{3 - \sqrt{21} - \sqrt{21} + 7}{3 - 7}$$

$$= \frac{10 - 2\sqrt{21}}{-4}$$

$$= \frac{5 - \sqrt{21}}{-2}$$

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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:

$$= \frac{(\sqrt{17} - \sqrt{11})(\sqrt{17} - \sqrt{11})}{(\sqrt{17} + \sqrt{11})(\sqrt{17} - \sqrt{11})}$$

$$= \frac{17 - \sqrt{187} - \sqrt{187} + 11}{17 - 11}$$

$$= \frac{28 - 2\sqrt{187}}{6}$$

$$= \frac{14 - \sqrt{187}}{3}$$

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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:

$$= \frac{(\sqrt{41} + \sqrt{29})(\sqrt{41} + \sqrt{29})}{(\sqrt{41} - \sqrt{29})(\sqrt{41} + \sqrt{29})}$$

$$= \frac{41 + 2\sqrt{41}\sqrt{29} + 29}{41 - 29}$$

$$= \frac{70 + 2\sqrt{1189}}{12}$$

$$= \frac{35 + \sqrt{1189}}{6}$$

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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:

$$= \frac{(\sqrt{2} - \sqrt{3})(\sqrt{3} + \sqrt{2})}{(\sqrt{3} - \sqrt{2})(\sqrt{3} + \sqrt{2})}$$

$$= \frac{\sqrt{6} - 3 + 2 - \sqrt{6}}{3 - 2}$$

$$= \frac{-1}{1}$$

$$= -1$$

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

(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:

(a) $= x^2 + x + 2x + 2$
$= x(x + 1) + 2(x + 1)$
$= (x + 1)(x + 2)$

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

(c) $= x^2 - 7x + 5x - 35$
$= x(x - 7) + 5(x - 7)$
$= (x - 7)(x + 5)$

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

(e) $= 5x^2 + 2x - 15x - 6$
$= x(5x + 2) - 3(5x + 2)$
$= (5x + 2)(x - 3)$

(f) $= 6 + x - 6x - x^2$
$= (6 + x) - x(6 + x)$
$= (1 - x)(6 + x)$

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Edexcel Modular Mathematics for AS and A-Level

Algebra and functions
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
$= \frac{1}{2(\sqrt[3]{x})}$

Solutionbank C1
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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:

(a) $= \left(\frac{\sqrt[3]{8}}{\sqrt[3]{27}}\right)^2$

$= \left(\frac{2}{3}\right)^2$

$= \frac{4}{9}$

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

$= \frac{15^3}{17^3}$

$= \frac{3375}{4913}$

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

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

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

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

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

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Algebra and functions

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:

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

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

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

$= \frac{\sqrt{2}+1}{2-1}$

$= \sqrt{2}+1$

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

$= \frac{3\sqrt{3}+6}{3-4}$

$= -3\sqrt{3}-6$

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

$= \frac{23-2\sqrt{23}\sqrt{37}+37}{23-37}$

$= \frac{60-2\sqrt{851}}{-14}$

$= \frac{30-\sqrt{851}}{-7}$