2 ALGEBRA 1

TASK 2.1

In Questions **1** to **20** find the value of each expression
when $f = -1$
$g = 5$
$h = -4$

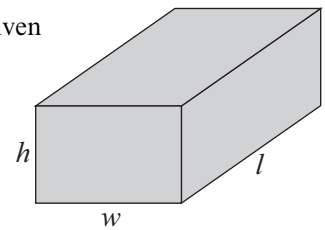
1. $2h$	**2.** $3f$	**3.** fg	**4.** fh	**5.** $2g - h$
6. $3f + 4g$	**7.** $4f + 3g$	**8.** h^2	**9.** $g^2 + h^2$	**10.** $16 - h$
11. $f + g + h$	**12.** $5g + 6f$	**13.** $6h + 10$	**14.** $3(f + g)$	**15.** $7(g - f)$
16. $(4f)^2$	**17.** $4g - 3f + 3h$	**18.** $\frac{6h}{2f}$	**19.** $\frac{7(f+g)}{h}$	**20.** $2h^2$

In Questions **21** to **40** find the value of each expression
when $a = -2$
$b = -5$
$c = 3$

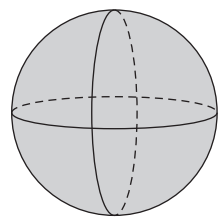
21. $a^2(c - b)$	**22.** $3a^2$	**23.** $(2b)^2 - 3b^2$	**24.** $(4c)^2 + (5a)^2$
25. b^3	**26.** $a(bc - a^2)$	**27.** $\frac{2b + 4a}{3c}$	**28.** a^2b^2
29. $b^2 + 6ab$	**30.** $\frac{4c - 9a}{2b}$	**31.** $a^2 + ac - b$	**32.** $\frac{4b}{a} - \frac{10c}{b}$
33. $\frac{b(c^2 - a)}{a - c}$	**34.** $a^3 + c^3$	**35.** $(a - 2b)(2c - b)$	**36.** $2c^3 - 2b^2$
37. $(a^2 - b)(a^2 + b)$	**38.** abc	**39.** $4a^2bc$	**40.** $\frac{b^2 + 5a^2}{c^2}$

TASK 2.2

1. The total surface area A of this cuboid is given by the formula
$A = 2lw + 2lh + 2hw$
Find the value of A when
a $l = 5$, $w = 3$ and $h = 1$
b $l = 10$, $w = 2{\cdot}5$ and $h = 4$



2. The total surface area A of a sphere is given by the formula
$A = 12r^2$
Find the value of A when
a $r = 3$ **b** $r = 5$ **c** $r = 8$

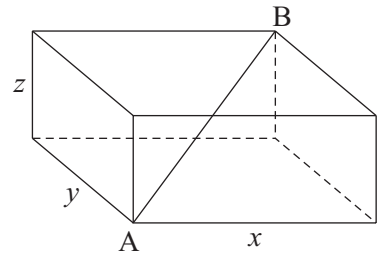


3. Energy E is given by the formula $E = mc^2$ where m is the mass and c is the speed of light.
Find the value of E when $m = 15$ and $c = 300\,000\,000$.

4. The formula $s = ut + \frac{1}{2}at^2$ gives the displacement s of a particle after time t. The acceleration is a and the initial velocity is u.
Find s (to 3 significant figures if necessary) when
a $u = 3$, $t = 12$ and $a = 6{\cdot}4$ **b** $u = -8{\cdot}17$, $a = -9{\cdot}81$, $t = 4{\cdot}5$

5. The area A of a trapezium is given by the formula
$A = \frac{1}{2}h(a + b)$
Find the value of A when
a $a = 6$, $b = 13$, $h = 12$ **b** $h = 3{\cdot}26$, $a = 4{\cdot}9$, $b = 7{\cdot}48$

6. The length of the diagonal AB is given by the formula
$\text{AB} = \sqrt{(x^2 + y^2 + z^2)}$
Find the value of AB when $x = 13\,\text{cm}$, $y = 8\,\text{cm}$ and $z = 5\,\text{cm}$. (give your answer to 1 d.p.)



7. The mass m of a radioactive substance present at time t is given by the formula
$m = 100(2^{-t})$
Find the value of m when
a $t = 0$ **b** $t = 1$ **c** $t = 4$

8. If $\frac{1}{f} = \frac{1}{u} + \frac{1}{v}$, find the value of f when $u = 8$ and $v = 17$.

TASK **2.3**

In Questions **1** to **6** answer true or false.

1. $a + a = a^2$ **2.** $5m + m = 6m$ **3.** $6n^2 - n^2 = 6$

4. $4y \times y = 4y^2$ **5.** $a \times 5 \times b = 5ab$ **6.** $16x \div 4 = 12x$

Simplify

7. $4a \times -6b$ **8.** $-3m \times -2p$ **9.** $-15x \div 5$

10. $-3p \times 7q$ **11.** $-a \times 3a$ **12.** $-42a^2 \div -2$

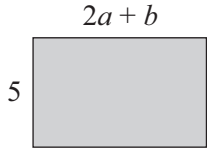
Multiply out

13. $2(3y + 5)$ **14.** $6(2a - b)$ **15.** $7(2x + 5)$

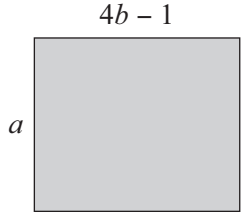
16. $x(x - y)$ **17.** $m(m - 3p)$ **18.** $c(2d + 1)$

Write down and *simplify* an expression for the area of each shape below:

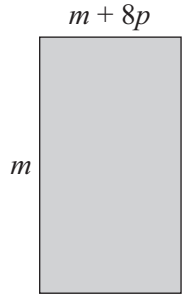
19.



20.



21.



Expand

22. $-5(x - 3)$ **23.** $-2(3m - 4)$ **24.** $-m(2 - p)$

25. $-y(x + z)$ **26.** $-x(x + 3y)$ **27.** $-(a - b)$

28. $-q(q - 8r)$ **29.** $3a(3a + 4b)$ **30.** $-8x(4x - 3y)$

31. $-y(y^2 + 3x)$ **32.** $4n^2(3n - 7)$ **33.** $5xy(4x + 2y^2)$

34. $6ab(2a - 3b)$ **35.** $8p^2q(3q - p)$ **36.** $7m^2n^2(3n + 4mn^2)$

TASK **2.4**

Expand and simplify

1. $3(a + 4) + 7$ **2.** $9(2b + 4) + 4b$ **3.** $7(5a + 6) - 10a$

Simplify

4. $3(8y + 6) + 2(2y - 5)$ **5.** $5n + 9 + 6(2n + 3)$

6. $4b + 9(3b + 6) - 24$ **7.** $7(4c + 7) + 3(2c - 8)$

Copy and complete

8. $6(3a + 2) - 4(2a + 2) = \square + 12 - \square - 8 = \square + 4$

9. $7(4x + 3) - 5(3x - 6) = 28x + \square - 15x + \square = 13x + \square$

Expand and simplify

10. $5(a + 4) - 3(a + 2)$ **11.** $6(2m + 3) - 5(m + 3)$

12. $4(5y + 6) - 2(4y + 3)$ **13.** $2(8b + 9) - 4(4b - 6)$

14. $8a - 3(2a - 5) + 6$ **15.** $7x - 4(x - 1) - 3$

16. $9(4n + 7) - 5(2n + 4)$ **17.** $10q + 3(5 - 2q) + 4(7q + 4)$

18. $3x(2x + 3) + 5x(x - 2)$ **19.** $5n(3n - 4) - 2n(4n + 5)$

20. $4m(2m - n) - 3n(4m + n)$ **21.** $3a(4a + 2b - 3c) - 4b(5a - 2c)$

TASK **2.5**

Multiply out

1. $(x + 3)(x + 2)$ **2.** $(m + 4)(m + 7)$ **3.** $(c - 4)(c - 2)$

4. $(y - 8)(y + 2)$ **5.** $(y - 7)(y + 3)$ **6.** $(n - 9)(n - 4)$

7. Explain why $(x + 6)^2$ is *not* equal to $x^2 + 36$.

Expand

8. $(n + 7)^2$ **9.** $(y - 4)^2$ **10.** $(x - 8)^2$

Multiply out

11. $(3x + 2)(5x + 4)$ **12.** $(5a + 4)(2a + 1)$ **13.** $(2n - 4)(3n + 7)$

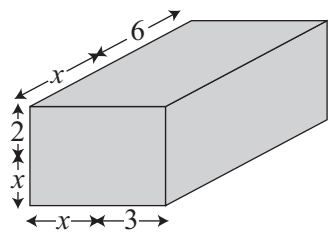
14. $(7y - 6)(3y - 2)$ **15.** $(4a + 6)^2$ **16.** $(5m - 9)^2$

17. $(6 + 5y)(6 + y)$ **18.** $(9 - 4c)(7 + 2c)$ **19.** $(4x - 2y)(8x + 3y)$

Expand and simplify

20. $(m + 4)^2 + (m + 7)^2$ **21.** $(c + 6)^2 - (c - 1)^2$

22. Find the volume of this cuboid, simplifying your answer as far as possible.



TASK **2.6**

Solve

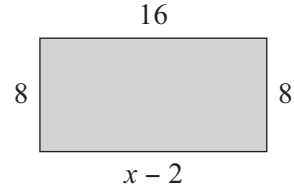
1. $\frac{n}{4} = 2$ **2.** $\frac{x}{10} = 6$ **3.** $n + 3 = 1$ **4.** $y + 2 = 1$

5. $p - 3 = -6$ **6.** $3a = -6$ **7.** $-5x = -20$ **8.** $n \div 3 = -4$

9. $\frac{b}{5} = -5$ **10.** $\frac{m}{7} = -3$ **11.** $2y = 1$ **12.** $7f = 2$

13. $2n = -3$ **14.** $5x = 7$ **15.** $7a = -4$ **16.** $3m = -11$

17. Find the value of x in this rectangle.



18. Adrianna thinks of a number and then adds 10. If the answer is 5, what number did she think of?

Solve the following equations

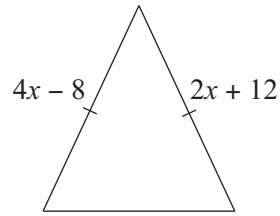
19. $6n + 4 = 16$ **20.** $3a - 8 = 19$ **21.** $34 = 5y - 6$

22. $4m + 7 = 10$ **23.** $9w - 5 = 2$ **24.** $8y - 2 = -5$

25. $5x - 3 = 2x + 18$ **26.** $9p - 6 = 6p + 18$ **27.** $5n + 3 = 27 - n$

28. $3a + 9 = 44 - 2a$ **29.** $5w + 19 = 11 - 3w$ **30.** $17 - 2x = 29 - 6x$

31. This is an *isosceles* triangle. Find the value of x.



Solve

32. $\frac{8}{x} = 12$ **33.** $\frac{n}{4} + 2 = 8$ **34.** $\frac{m}{7} - 3 = 4$

35. $\frac{4a}{5} = 12$ **36.** $\frac{6w}{5} = -12$ **37.** $\frac{48}{c} = -4$

TASK **2.7**

Solve

1. $2(2x + 3) = 14$ **2.** $4(n - 3) = 24$ **3.** $5(2a - 1) = 25$

4. $5(2w - 6) = 40$ **5.** $5(2a + 3) = 18$ **6.** $70 = 10(2 - 5y)$

7. I think of a number. I add 9 onto the number then multiply the answer by 3. This gives 36. What was the number I started with?

Solve the following equations

8. $4(2x + 1) = 2(3x + 5)$ **9.** $5(3a + 4) = 4(3a + 20)$

10. $2(4y - 3) = 5(y + 6)$ **11.** $4(3m - 1) = 2(5m + 7)$

12. $5(2n + 4) = 2(4n + 3)$ **13.** $3(3w + 2) + 5(w + 4) = 54$

14. $8(3q + 4) + 1 = 3(12q - 1)$ **15.** $5(2x + 1) - 5 = 2(6x + 5)$

16. $7 - 3(2 - 3x) = 10$ **17.** $3(h - 2) + 2(h - 3) = 28$

18. $4(2p + 7) - 5(p - 1) = 12$ **19.** $6(2a + 3) - 4 = 4(a + 6) + 6$

20. $3(2w + 7) - 5 = 4(3w - 6) + 35$ **21.** $2(5x + 3) - 6(2x - 1) = 3(x + 14)$

TASK **2.8**

Solve

1. $\frac{x}{7} - 4 = 4$ **2.** $\frac{y - 4}{7} = 4$ **3.** $\frac{a + 9}{4} = 6$ **4.** $\frac{c}{5} - 3 = 2$ **5.** $\frac{x - 8}{6} = 5$

6. $\frac{3n + 5}{2} = 3$ **7.** $\frac{30}{x} = 5$ **8.** $\frac{7}{a} = 2$ **9.** $3 = \frac{11}{m}$

Copy and complete:

10. $\frac{20}{x+3} = 5$

$20 = \square(x + 3)$

$20 = \square + \square$

$20 - \square = \square$

$\square = \square$

$x = \square$

11. $\frac{6-7n}{2n+4} = -3$

$6 - 7n = -3(\square + \square)$

$6 - 7n = \square - \square$

$6 + \square = \square + 7n$

$\square = \square$

$n = \square$

Solve the following equations

12. $\frac{15}{a+1} = 3$

13. $\frac{21}{n-2} = 7$

14. $\frac{10}{2y+1} = 5$

15. $\frac{1-2m}{3} = 5$

16. $\frac{8}{w} + 3 = 7$

17. $\frac{5x+7}{2x-2} = 3$

18. $\frac{7f-2}{3f-1} = 5$

19. $\frac{3n+2}{2n-3} = 7$

20. $\frac{11z-1}{5z-2} = 3$

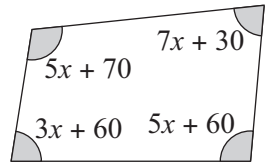
21. $\frac{6a-1}{5a-4} = 2$

22. $4 = \frac{6x+5}{2x-1}$

23. $\frac{7v+3}{6v+1} = 2$

TASK **2.9**

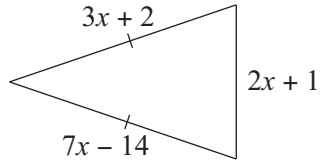
1. **a** Write down an equation using the angles.
b Find x.
c Write down the actual value of each angle in this quadrilateral.



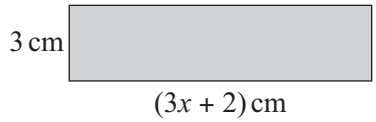
2. The length of a rectangle is 8 cm more than its width. If its perimeter is 44 cm, find its width.

3. Hahana has 3 times as much money as Jurgi. Hahana spends \$24 and has \$30 left. How much money has Jurgi got?

4. This is an *isosceles* triangle.
a Find the value of x.
b Find the perimeter of the triangle.

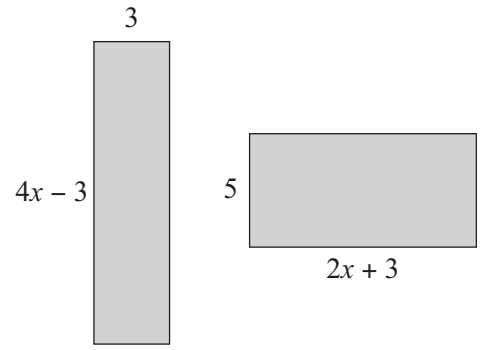


5. The area of this rectangle is 60 cm^2.
a Write down an equation involving x.
b Find x.

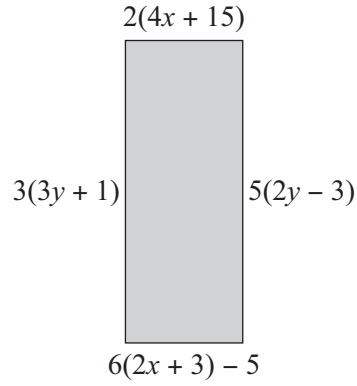


6. Three consecutive whole numbers add up to 144. If the lowest number is n,
- **a** Write down an expression for the other two numbers in terms of n.
- **b** Write down an equation involving n.
- **c** Find n then write down the three consecutive whole numbers.

7. The area of each rectangle is equal (all lengths are measured in cm).
- **a** Find the value of x.
- **b** Find the area of one of the rectangles.



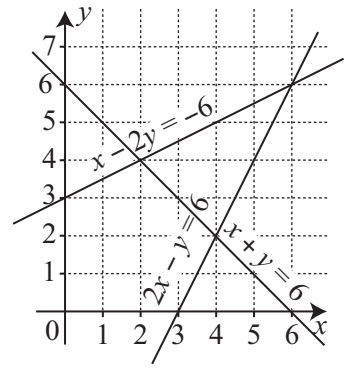
8. Find the actual length and width of this rectangle.



TASK **2.10**

1. Use the graph to solve the simultaneous equations below:

- **a** $x + y = 6$, $2x - y = 6$
- **b** $x - 2y = -6$, $2x - y = 6$
- **c** $x + y = 6$, $x - 2y = -6$



2. **a** Draw an x-axis from 0 to 7.
Draw a y-axis from -5 to 5.
b Use the cover-up method to draw the line $2x + 3y = 12$.
c Use the cover-up method to draw the line $4x - 2y = 8$.
d Use your graph to solve the simultaneous equations $2x + 3y = 12$
$4x - 2y = 8$

3. By drawing graphs, solve the following pairs of simultaneous equations:
a $x + y = 4$, $y = x + 2$ **b** $5x + 2y = 20$, $x - 2y = -8$ **c** $2x + y = 7$, $y = 2x - 5$

TASK **2.11**

1. Add together the simultaneous equations $3x + 2y = 7$
and $7x - 2y = 3$
Use your answer to find the value of x.
Use this value of x to find the value of y.

Solve the simultaneous equations

2. $2x + 3y = 12$, $5x + 3y = 21$

3. $4x + y = 13$, $4x + 3y = 23$

4. $3x + y = 16$, $2x - y = 9$

5. $4x - 3y = 0$, $7x + 3y = 33$

6. $5x + 4y = 24$, $3x - 4y = -24$

7. $2x - 5y = -12$, $3x - 5y = -13$

8. $4x + 2y = 10$, $7x - 2y = 34$

9. $3x + 5y = -11$, $3x - 4y = -2$

10. $2x - 2y = -16$, $3x - 2y = -21$

TASK **2.12**

Solve the simultaneous equations

1. $3x + 4y = 17$, $6x + y = 20$

2. $2a + 3b = 14$, $3a + 2b = 11$

3. $4m + 3n = 26$, $3m - 5n = -24$

4. $5c - 4d = 21$, $2c - 3d = 7$

5. $2p - 3q = -11$, $p + 4q = 11$

6. $7a + 3b = 22$, $5a - 2b = 24$

7. $3m + 4n = 11$, $2m + 6n = 9$

8. $4x - 3y = 2$, $5x + 7y = -19$

9. $10x - 3y = -14$, $4x - 5y = -17$

10. $3p - 2q + 18 = 0$, $5p + 7q = 32$

11. $8c + 3d = -35$, $5c = -22 - 2d$

12. $6x - 8y = 1$, $4x + 12y - 5 = 0$

TASK **2.13**

Solve the following simultaneous equations

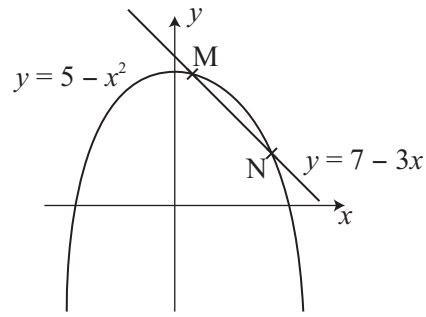
1. $y = x^2 + 4$
$y = 3x + 2$

2. $x^2 + y^2 = 40$
$y = x + 4$

3. $xy = 12$
$y = 2x - 2$

4. $x^2 + y^2 = 20$
$y = 5x - 6$

5. Find the co-ordinates of M and N by solving the simultaneous equations
$y = 7 - 3x$
$y = 5 - x^2$



TASK **2.14**

Answer these questions by forming a pair of simultaneous equations then solving them.

1. Xing buys 3 pairs of socks and 2 pairs of underpants for \$25. Romolo buys 2 pairs of socks and 7 pairs of underpants for \$62. What is the cost of a pair of socks and a pair of underpants?

2. The sum of two numbers is 19. The difference between four times one number and the other number is 41. Find the values of the two numbers.

3. A school buy 10 solar calculators and 30 battery calculators for \$210. Another school buy 15 solar calculators and 8 battery calculators for \$130. Find the cost of one solar calculator and one battery calculator.

4. Lican buys 5 adult tickets and 3 child tickets for the theatre. The tickets cost her a total of \$164. Dimitar buys 4 adult tickets and 4 child tickets at a total cost of \$152. Find the cost of one adult ticket and one child ticket.

5. A straight line passes through the points $(2, 11)$ and $(-1, 2)$. The equation of a straight line is $y = mx + c$. Find the values of m and c.

6. A woman buys 7 books and 5 magazines for \$61·40. A man buys 11 books and 7 magazines for \$93·10. Find the price of one book and one magazine.

7. A meal in a restaurant is normally \$11 but the price for a senior citizen is \$8. One day the restaurant sells three times as many senior citizen meals as normal priced meals and takes \$420. How many senior citizen meals and normal priced meals did the restaurant sell on that day?

8. Meli has four times as many sweets as Kaiona. Meli eats 14 sweets and Kaiona eats 2 sweets. If Meli now has three times as many sweets as Kaiona, how many sweets have Meli and Kaiona each got *now*?

TASK **2.15**

Copy and complete

1. $n^2 + 7n = n(n + \square)$ **2.** $4mp - 10m = 2m(2p - \square)$

3. $4ab + 18bc = 2b(\square + \square)$ **4.** $x^2y - 3xy^2 = xy(\square - \square)$

Factorise these expressions completely

5. $xy + yz$ **6.** $a^2 - 6a$ **7.** $b^2 + 4b$

8. $c^2 + 9c$ **9.** $mp - pq$ **10.** $3xy + 9xz$

11. $10ab - 15ac$ **12.** $18wz - 15wy$ **13.** $12fg + 21f$

14. $4a^2 - 6a$ **15.** $5p^2 - 30pq$ **16.** $18mp + 30m$

17. $8pq - 20q^2$ **18.** $16xyz - 28y^2$ **19.** $33a^2 + 55abc$

Factorise completely

20. $12m^2n - 9mn^2$ **21.** $25a^2b + 15abc$

22. $6x^2y + 15x^3$ **23.** $21m^3 - 28mn^2$

24. $48pq^2r - 36p^2qr$ **25.** $8xy^2 + 20xyz + 6yz^2$

26. $40a^3b - 56ab^2 + 32a^2b^3$ **27.** $36m^2n^3p^2 - 54mn^3p^3 - 27m^2n^2p^2$

TASK **2.16**

Factorise the following

1. $x^2 + 12x + 35$ **2.** $m^2 + 12m + 27$ **3.** $y^2 - 4y + 3$

4. $n^2 - 2n - 24$ **5.** $a^2 - 6a - 27$ **6.** $c^2 - 8c - 20$

7. $n^2 - 11n + 24$ **8.** $y^2 - 14y + 45$ **9.** $a^2 + a - 30$

10. $x^2 - x - 72$ **11.** $p^2 + 15p + 44$ **12.** $m^2 + 4m - 60$

13. $a^2 - 15a + 56$ **14.** $q^2 + 4q - 96$ **15.** $b^2 - 5b - 150$

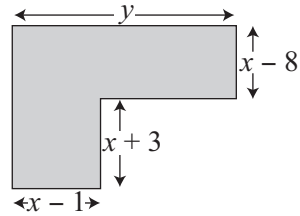
16. Write $x^2 + 2x + 1$ in the form $(x + a)^2$. Write down the value of a.

17. Write $x^2 + 8x + 16$ in the form $(x + b)^2$. Write down the value of b.

18. Write $x^2 - 6x + 9$ in the form $(x - c)^2$. Write down the value of c.

19. Write $x^2 - 14x + 49$ in the form $(x - d)^2$. Write down the value of d.

20. The total area of this shape is $2x^2 - 10x + 29$
Find an expression for y in terms of x.



TASK **2.17**

Factorise

1. $x^2 - y^2$ **2.** $b^2 - 3^2$ **3.** $y^2 - 5^2$ **4.** $a^2 - 64$

5. $n^2 - 4$ **6.** $p^2 - 1$ **7.** $36 - x^2$ **8.** $9y^2 - z^2$

9. $49 - 4a^2$ **10.** $49x^2 - 81y^2$ **11.** $144m^2 - 25$ **12.** $16b^2 - \frac{1}{9}$

Copy and complete

13. $5x^2 - 20$
$= \square(x^2 - 4)$
$= \square(x + \square)(x - \square)$

14. $12a^2 - 27b^2$
$= 3(\square - \square)$
$= 3(\square + \square)(\square - \square)$

15. $4m^2 - 8m - 60$
$= 4(m^2 - \square - \square)$
$= 4(m + \square)(m - \square)$

Factorise completely

16. $3n^2 - 48$ **17.** $50 - 2b^2$ **18.** $5t^2 + 15t + 10$

19. $6n^2 - 42n + 60$ **20.** $12p^2 - 147$ **21.** $4x^2 - 16x - 48$

22. $7y^2 + 42y - 49$ **23.** $80 - 45a^2$ **24.** $32x^2 - 162y^2$

25. $9a^2 - 9a - 180$ **26.** $10m^2 - 80m + 160$ **27.** $72y^2 - 338$

TASK **2.18**

Copy and complete

1. $mp + mq - np - nq$
$= m(\square + \square) - n(\square + \square)$
$= (\square + \square)(m - n)$

2. $a^2 - ac - ab + bc$
$= a(\square - \square) - b(\square - \square)$
$= (\square - \square)(a - b)$

Factorise

3. $mx + nx + my + ny$ **4.** $ac - bc - ad + bd$

5. $pr + ps - qr - qs$ **6.** $p^2 + pr - pq - qr$

7. $m^2 - mn - mk + kn$ **8.** $ab - 3c + 3b - ac$

9. $8ac + 10ad + 4bc + 5bd$ **10.** $20x^2 - 15xy + 16xz - 12yz$

TASK **2.19**

Copy and complete

1. $5x^2 + 13x - 6$
$= 5x^2 + 15x - \square - 6$
$= 5x(\square + \square) - 2(\square + \square)$
$= (\square + \square)(5x - 2)$

2. $6x^2 - 19x + 10$
$= 6x^2 - 15x - \square + 10$
$= 3x(\square - \square) - \square(\square - \square)$
$= (\square - \square)(3x - \square)$

Factorise each expression below

3. $5x^2 + 21x + 4$
4. $3a^2 + 20a + 12$
5. $10y^2 - 17y + 3$
6. $6n^2 - 13n - 5$
7. $14c^2 + 15c - 9$
8. $4x^2 - 81$
9. $20m^2 - 31m + 12$
10. $36a^2 + 19a - 6$
11. $200n^2 + 30n + 1$
12. $18p^2 - 25p - 3$
13. $100x^2 + 44x - 3$
14. $35m^2 - 69m + 28$

TASK **2.20**

Copy and complete

1. $x^2 - 3x - 18 = 0$
$(x - 6)(x + \square) = 0$
$x - 6 = 0$ or $x + \square = 0$
$x = \square$ or $x = \square$

2. $n^2 + 3n = 0$
$n(\square + \square) = 0$
$n = 0$ or $\square + \square = 0$
$n = 0$ or $n = \square$

3. $a^2 - 4a = 5$
$a^2 - 4a - \square = 0$
$(a + 1)(a - \square) = 0$
$a + 1 = 0$ or $a - \square = 0$
$a = \square$ or $a = \square$

Solve these equations

4. $x^2 - 3x + 2 = 0$
5. $a^2 + 4a + 3 = 0$
6. $m^2 + 7m + 10 = 0$
7. $y^2 + y - 12 = 0$
8. $n^2 + 3n - 10 = 0$
9. $x^2 - 8x + 12 = 0$
10. $c^2 + 2c - 15 = 0$
11. $(m - 6)(m + 4) = 0$
12. $(a - 3)(a - 7) = 0$
13. $n^2 - 5n = 0$
14. $x^2 + 7x = 0$
15. $y^2 = 6y$
16. $p^2 + 5p = 14$
17. $n^2 + 32 = 12n$
18. $b^2 - 3b = 0$
19. $x^2 - 13x + 30 = 0$
20. $a^2 + 36 = 13a$
21. $m(m + 2) = 24 - 3m$

Solve the following equations

22. $3p^2 - 11p + 6 = 0$
23. $10a^2 - 3a - 1 = 0$
24. $8y^2 + 10y + 3 = 0$
25. $21m^2 - 41m + 10 = 0$
26. $4m^2 = m$
27. $4h^2 + 4h - 15 = 0$
28. $(9x - 1)(5x - 1) = 0$
29. $15w^2 - 14w = 8$
30. $4y^2 - 25 = 0$
31. $4h^2 - 12h + 8 = 0$
32. $5n^2 - 14 = 33n$
33. $n^3 - 3n^2 - 10n = 0$

TASK **2.21**

1. $(x + 3)^2 = (x + 3)(x + 3) = x^2 + 6x + 9$
Express $x^2 + 6x + 13$ in the form $(x + a)^2 + b$, giving the values of a and b.

2. $(x - 5)^2 = (x - 5)(x - 5) = x^2 - 10x + 25$
Express $x^2 - 10x + 18$ in the form $(x + c)^2 + d$, giving the values of c and d.

3. Write the following in the form $(x + a)^2 + b$ where a and b are numbers to be determined:
a $x^2 + 16x + 30$ **b** $x^2 - 4x + 1$ **c** $x^2 - 3x + 2$

4. Copy and complete:

$$x^2 - 8x + 3 = 0$$
$$(x - 4)^2 - \square + 3 = 0$$
$$(x - 4)^2 = \square$$
$$x - 4 = \sqrt{\square} \text{ or } -\sqrt{\square}$$
$$x = 4 + \sqrt{\square} \text{ or } 4 - \sqrt{\square}$$

5. Solve the following quadratic equations by completing the square (leaving your answers in the form $a \pm \sqrt{b}$ where appropriate):
a $x^2 + 6x + 4 = 0$ **b** $x^2 - 12x + 21 = 0$
c $x^2 - 20x + 90 = 0$ **d** $x^2 + 5x + 2 = 0$

6. $3x^2 + 18x + 42 = a((x + b)^2 + c)$. Find the values of a, b and c.

7. $4x^2 - 16x + 44 = p((x - q)^2 + r)$. Find the values of p, q and r.

8. Solve $x^2 + 8x + 13 = 0$ by completing the square, giving your answer to 3 significant figures.

9. By completing the square, find the minimum y-value of the curve $y = x^2 - 4x + 7$.

10. By completing the square on the denominator, find the maximum value of the function $f(x) = \frac{6}{x^2 + 6x + 11}$. What value of x gives this maximum value?

TASK **2.22**

Remember If $ax^2 + bx + c = 0$ then $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

Use the formula to solve the following quadratic equations, giving each answer to 3 significant figures.

1. $x^2 + 9x + 4 = 0$ **2.** $x^2 + 4x - 1 = 0$ **3.** $x^2 - 6x - 2 = 0$

4. $x^2 + 8x + 3 = 0$ **5.** $2x^2 + 3x - 7 = 0$ **6.** $5x^2 + 9x + 1 = 0$

7. $2x(2x - 3) = 1$ **8.** $9x^2 + 5x - 2 = 0$ **9.** $3x + \frac{3}{x} = 7$

Use the formula to solve the following quadratic equations, leaving each answer in the form $\frac{p \pm \sqrt{q}}{r}$.

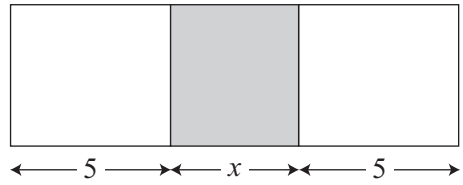
10. $x^2 + 5x + 3 = 0$ **11.** $5x^2 - 2x - 4 = 0$ **12.** $x + 7 + \frac{11}{x} = 0$

TASK **2.23**

1. The base of a triangle is 4 cm longer than its height. Let the height of the triangle be x.
- **a** If the area of the triangle is 30 cm^2, show that $x^2 + 4x - 60 = 0$
- **b** Find the base of the triangle.

2. A square piece of paper is trimmed to form a rectangle. One of its sides is reduced by 3 cm and the other side is reduced by 4 cm. The resulting rectangle has an area of 20 cm^2. If the side length of the initial square was s,
- **a** write down a quadratic equation involving s
- **b** solve this equation to find s

3. A square is adjoined by two rectangles, each of length 5 units. If the total area is then 39 square units, what is the length of the square?

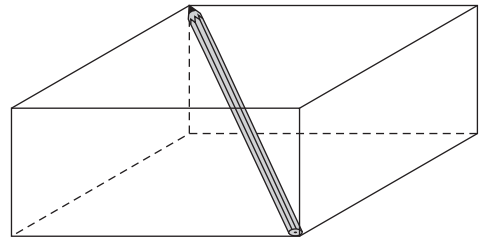


4. A rectangular garden measures 10 m by 15 m. Its width and length are then both increased by x metres. If its area is now 266 m^2, find x.

5. A small rectangular field is 5 m longer than it is wide. The diagonal of the field is 25 m.
- **a** If the width of the field is x, show that $x^2 + 5x - 300 = 0$
- **b** Find the dimensions of the field.

6. Two numbers differ by $\frac{1}{2}$. Their product is 68.
- **a** If the smaller number is x, show that $2x^2 + x - 136 = 0$
- **b** Write down the value of each number if they are positive.

7. A pencil box (in the shape of a cuboid) is 9 cm longer than it is wide and 1 cm higher than it is wide. The longest pencil which can be fitted into the case is 13 cm long. Find the dimensions of the pencil case.



TASK **2.24**

In this task give answers to 3 significant figures when appropriate.

1. A rectangle is such that its length is 2 metres longer than its width.
- **a** If the width of rectangle is x metres then find expressions for the length and the area of the rectangle in terms of x.
- **b** If the area is 5 m^2, show that $x^2 + 2x - 5 = 0$.
- **c** Solve this equation to find the value of x.

2. A rectangle is 34 m longer than it is wide. If the diagonal of the rectangle is 50 m then:
- **a** By letting the width be x, prove that $x^2 + 34x - 672 = 0$
- **b** Solve this equation to find the dimensions of the rectangle.

3. A triangle whose area is 76 cm^2 is such that the base is 3 cm longer than twice the height. If the height of the triangle is h then:
- **a** Write down an expression for the base of the triangle in terms of h.
- **b** Write down a quadratic equation involving h.
- **c** Solve this equation to find h (you may use the fact that $19 \times 16 = 304$).

4. 50 m of fencing is arranged so that it encloses a rectangular area of 154 m^2. If w is the width of the rectangle then:
- **a** Find the length of the rectangle in terms of w.
- **b** Write down a quadratic equation involving w.
- **c** Solve this equation to find w.

5. Two positive numbers are such that the bigger one is 3 less than twice the smaller one. Their product is 35. If the smaller of the two numbers is x then:
- **a** Write down an expression for the larger number in terms of x.
- **b** Write down a quadratic equation involving x.
- **c** Solve this equation to find x.

6. Two circles are cut out of a rectangular sheet of metal. The larger circle has a radius r and the smaller circle has a radius 5 cm less than the larger circle. If the shaded area is 250 cm^2, find the radius of the smaller circle.