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ANSWER KEY

Chapter 4 · Exploring Algebraic Identities

Class IX · As per New Curriculum **Ganita Manjari**

Reviewed by Deepika Bhati, Maths Passionate Since 2009
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Topic 1: Identities for Squares

1. (i) $49x^2 + 56xy + 16y^2$ *[$(a + b)^2$]*

(ii) $\frac{49}{25}x^2 + \frac{21}{5}xy + \frac{9}{4}y^2$ *[$2 \times \frac{7}{5} \times \frac{3}{2} = \frac{21}{5}$]*

(iii) $6.25p^2 + 7.5pq + 2.25q^2$

(iv) $\frac{9}{16}s^2 + 12st + 64t^2$

(v) $\frac{1}{4}x^2 + 2xy + 4y^2$

(vi) $\frac{1}{x^2} + \frac{2}{xy} + \frac{1}{y^2}$

Answer: As above

2. $64^2 = (60 + 4)^2 = 3600 + 480 + 16 = 4096$

$105^2 = 10000 + 1000 + 25 = 11025$; $205^2 = 40000 + 2000 + 25 = 42025$

$79^2 = (80 - 1)^2 = 6400 - 160 + 1 = 6241$

$193^2 = (200 - 7)^2 = 40000 - 2800 + 49 = 37249$

$299^2 = (300 - 1)^2 = 90000 - 600 + 1 = 89401$

Answer: 4096, 11025, 42025, 6241, 37249, 89401

3. (i) $p^2 + 9q^2 + 49r^2 + 6pq + 42qr + 14rp$

(ii) $a \to 2a$, $b \to -b$, $c \to -3c$: $4a^2 + b^2 + 9c^2 - 4ab + 6bc - 12ca$

(iii) $9m^2 + 16k^2 + l^2 - 24mk - 8kl + 6lm$

Answer: As above

4. $117^2 = (100 + 17)^2 = 10000 + 3400 + 289 = 13689$

$78^2 = (80 - 2)^2 = 6400 - 320 + 4 = 6084$

$198^2 = (200 - 2)^2 = 40000 - 800 + 4 = 39204$

$214^2 = (200 + 14)^2 = 40000 + 5600 + 196 = 45796$

$1104^2 = (1100 + 4)^2 = 1210000 + 8800 + 16 = 1218816$

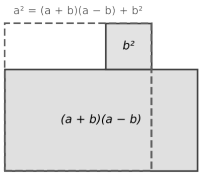
$1120^2 = 1210000 + 44000 + 400 = 1254400$

Answer: 13689, 6084, 39204, 45796, 1218816, 1254400

5. $35^2 = 40 \times 30 + 25 = 1225$; $65^2 = 70 \times 60 + 25 = 4225$ *[b = 5]*

$85^2 = 90 \times 80 + 25 = 7225$; $95^2 = 100 \times 90 + 25 = 9025$

Pattern: $(10n + 5)^2 = 100n(n + 1) + 25$ — write $n(n + 1)$ followed by 25.



Answer: 1225, 4225, 7225, 9025

6. $104 \times 96 = 100^2 - 4^2 = 9984$; $23 \times 17 = 20^2 - 3^2 = 391$

$24 \times 16 = 20^2 - 4^2 = 384$; $17 \times 21 = 19^2 - 2^2 = 357$

$0.98 \times 1.02 = 1 - 0.02^2 = 0.9996$

Answer: 9984, 391, 384, 357, 0.9996

7. (i) $a^2 + b^2 = (a + b)^2 - 2ab = 49 - 20 = 29$

$(a - b)^2 = (a + b)^2 - 4ab = 49 - 40 = 9$

(ii) $(x - \frac{1}{x})^2 = x^2 - 2 + \frac{1}{x^2} = 9 \Rightarrow x^2 + \frac{1}{x^2} = 11$

Answer: 29, 9; 11

8. $a = 1, b = c = 0$: LHS $= 1 + 1 + 1 = 3$, RHS $= 2$ *[one counter-example is enough]*

Expanding: LHS $= 3a^2 + 3b^2 + 3c^2 - 2ab - 2bc - 2ca$ *[add the three expansions]*

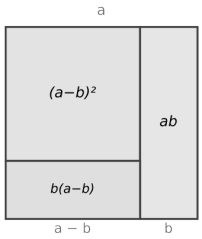
Answer: Not an identity

9. From the $a \times a$ square remove a strip $a \times b$ along the top and a strip $b \times a$ along the side.

The $b \times b$ corner square lies in both strips, so it has been removed twice; add it back once.

$(a - b)^2 = a^2 - ab - ab + b^2 = a^2 - 2ab + b^2$

Hence proved.



10. $= (n^2 + 6n + 9) - 3(n^2 + 4n + 4) + 3(n^2 + 2n + 1) - n^2$

n^2: $1 - 3 + 3 - 1 = 0$; n: $6 - 12 + 6 = 0$; constants: $9 - 12 + 3 = 0$

Answer: Always 0

11. $(a + b)^2 - (a^2 + b^2) = 2ab$

Greater if $ab > 0$ ($a = 2, b = 3$: $25 > 13$); less if $ab < 0$ ($a = 2, b = -3$: $1 < 13$); equal if $ab = 0$ ($a = 0, b = 5$).

Answer: Decided by the sign of ab

Topic 2: Factorisation Using Identities and Algebra Tiles

1. (i) $(3x + 4y)^2$ (ii) $(2s + 5t)^2$ (iii) $(7x + 2y)^2$ *[$a^2 + 2ab + b^2$]*

(iv) $(4y - 3)^2$ *[$a^2 - 2ab + b^2$]*

(v) $(8p + \frac{2}{3}q)^2$ *[$2 \times 8p \times \frac{2}{3}q = \frac{32}{3}pq$]*

Answer: As above

2. (i) $3(a^2 + \frac{4}{3}ab + \frac{4}{9}b^2) = 3(a + \frac{2}{3}b)^2$

(ii) $\frac{1}{5}(9s^2 + 30sv + 25v^2) = \frac{1}{5}(3s + 5v)^2$

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

Answer: As above

3. (i) $(6s + 7t)(6s - 7t)$ (ii) $(2x + 5)(2x - 5)$

(iii) $(p^2 + 4)(p^2 - 4) = (p^2 + 4)(p + 2)(p - 2)$

(iv) $(3m + m - 2)(3m - m + 2) = (4m - 2)(2m + 2) = 4(2m - 1)(m + 1)$

Answer: As above

4. (i) $-3, -8 \Rightarrow (s - 3)(s - 8)$ (ii) $-7, 6 \Rightarrow (r - 7)(r + 6)$

(iii) pn = −21: $-7, 3 \Rightarrow x(3x - 7) + 1(3x - 7) = (3x - 7)(x + 1)$

(iv) pn = 12: $3, 4 \Rightarrow 3x(2x + 1) + 2(2x + 1) = (2x + 1)(3x + 2)$

(v) pn = 6: $1, 6 \Rightarrow x(2x + 1) + 3(2x + 1) = (2x + 1)(x + 3)$

Answer: As above

5. (i) $(3a - b + 2c)^2$ *[check 2ab-type terms: −6ab, −4bc, 12ca]*

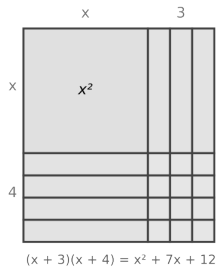
(ii) $(8u - 11v - 2w)^2$ *[−176uv, 44vw, −32uw]*

Answer: $(3a - b + 2c)^2$; $(8u - 11v - 2w)^2$

6. (i) One x^2-tile, 2 strips on one side, 3 strips on the other and 6 unit squares fill the corner: sides $x + 2$, $x + 3$.

(ii) 5 strips along one side, 6 along the other, $5 \times 6 = 30$ unit squares $\Rightarrow (x + 5)(x + 6)$.

(iii) No: 2 and 5 strips need $2 \times 5 = 10$ unit squares to fill the corner, but there are 12. Only 3 + 4 works.



$(x + 3)(x + 4) = x^2 + 7x + 12$

Answer: As above

7. (i) pq, (pb + qa), ab

(ii) $12x^2 + (3 \times 5 + 4 \times (-2))x - 10 = 12x^2 + 7x - 10$

(iii) $(2x - 3)(5x + 2)$ *[$-15x + 4x = -11x$]*

Answer: $12x^2 + 7x - 10$; $(2x - 3)(5x + 2)$

8. (i) $10000 + 7 \times 100 + 12 = 10712$ *[$x = 100, a = 3, b = 4$]*

(ii) $6x^2 + (2(-1) + 3(-2))x + 2 = 600 - 80 + 2 = 522$ *[$x = 10$]*

(iii) $(100 - 3)(100 - 5) = 10000 - 800 + 15 = 9215$

Answer: 10712, 522, 9215

9. (i) $(5a - 3b)^2 \Rightarrow$ a square of side $5a - 3b$

(ii) length $6s + 7t$, breadth $6s - 7t$

Answer: As above

10. $x^2 + 13x + 42 = (x + 6)(x + 7)$; $x^2 + 13x + 40 = (x + 5)(x + 8)$

Both pairs add to 13, but the products 42 and 40 differ, so a different pair of numbers is needed.

Answer: As above

Topic 3: Identities for Cubes

1. (i) $8x^3 + 36x^2 + 54x + 27$ (ii) $x^3 - 6x^2y + 12xy^2 - 8y^3$

(iii) $\frac{1}{8}x^3 + \frac{3}{4}x^2y + \frac{3}{2}xy^2 + y^3$

(iv) $27a^3 - 9a^2 + a - \frac{1}{27}$

Answer: As above

2. $147^3 = (150 - 3)^3 = 3375000 - 202500 + 4050 - 27 = 3176523$

$199^3 = (200 - 1)^3 = 8000000 - 120000 + 600 - 1 = 7880599$

$127^3 = (130 - 3)^3 = 2197000 - 152100 + 3510 - 27 = 2048383$

$(-107)^3 = -(1000000 + 210000 + 14700 + 343) = -1225043$

$(-299)^3 = -(27000000 - 270000 + 900 - 1) = -26730899$

Answer: As above

3. (i) $(x + 2y)^3$ (ii) $(2p - 3)^3$ *[$3(2p)^2(3) = 36p^2$]*

(iii) $(3u - \frac{1}{5})^3$

Answer: As above

4. (i) $(3b - 4)(9b^2 + 12b + 16)$ (ii) $(2x + 5)(4x^2 - 10x + 25)$

(iii) $(4y + \frac{z}{5})(16y^2 - \frac{4yz}{5} + \frac{z^2}{25})$

(iv) $(a - 3b)(a^2 + 3ab + 9b^2)$

Answer: As above

5. (i) $x = p, y = 3q, z = r$: $(p + 3q + r)(p^2 + 9q^2 + r^2 - 3pq - 3qr - rp)$

(ii) $(2x + y + 3z)(4x^2 + y^2 + 9z^2 - 2xy - 3yz - 6zx)$

Answer: As above

6. $a^2 + b^2 + c^2 = 25 - 2 \times 10 = 5$ *[$(a + b + c)^2$]*

$a^3 + b^3 + c^3 - 3abc = 5(5 - 10) = -25$

Hence proved.

7. (i) $-12 + 7 + 5 = 0 \Rightarrow 3(-12)(7)(5) = -1260$; check $-1728 + 343 + 125 = -1260$

(ii) $28 - 15 - 13 = 0 \Rightarrow 3(28)(-15)(-13) = 16380$

(iii) $0.2 - 0.3 + 0.1 = 0 \Rightarrow 3(0.2)(-0.3)(0.1) = -0.018$

Answer: -1260, 16380, -0.018

8. (i) $x + y + 4 = 0 \Rightarrow x^3 + y^3 + 4^3 = 3 \cdot x \cdot y \cdot 4 = 12xy$

(ii) $x + (-2y) + (-6) = 0 \Rightarrow x^3 - 8y^3 - 216 = 3x(-2y)(-6) = 36xy$

Answer: 0 in both cases

9. (i) $x^4 - y^4 = (x^2 - y^2)(x^2 + y^2) = (x - y)(x + y)(x^2 + y^2)$

(ii) the inner terms cancel in pairs

Answer: $x^5 - y^5$

10. $(a - b)^2(a + b) = (a - b)(a - b)(a + b) = (a - b)(a^2 - b^2)$

Both expand to $a^3 - a^2b - ab^2 + b^3$

Answer: Both are correct

11. $n^3 - n = n(n^2 - 1) = (n - 1)n(n + 1)$

Of three consecutive integers one is even and one is a multiple of 3, so the product is divisible by $2 \times 3 = 6$.

Hence proved.

Topic 4: Rational Expressions and Applications

1. (i) $\frac{3(p-3q)(p+2q)}{(p-3q)(p+3q)} = \frac{3(p+2q)}{p+3q}$

(ii) $\frac{(n-m)^3}{5(n-m)^2} = \frac{n-m}{5}$ *[$(m-n)^2 = (n-m)^2$]*

(iii) $\frac{(5z-2y)^2}{(5z-2y)(5z+2y)} = \frac{5z-2y}{5z+2y}$

Answer: As above

2. (i) $\frac{(x+3)(x-2)(x-3)(x-4)}{(x-2)(x-4)(x-3)(x+3)} = 1$

(ii) $\frac{(2x+1)^2}{(2x+1)(2x-1)} = \frac{2x+1}{2x-1}$

Answer: 1; $\frac{2x+1}{2x-1}$

3. (i) $\frac{3(a-2b)(a^2+2ab+4b^2)}{9(a-2b)(a+2b)} = \frac{a^2+2ab+4b^2}{3(a+2b)}$

(ii) $\frac{(s+5t)(s^2-5st+25t^2)}{(s-7t)(s+5t)} = \frac{s^2-5st+25t^2}{s-7t}$

(iii) $\frac{(p^2+4)(p+2)(p-2)}{(p-2)^2} = \frac{(p^2+4)(p+2)}{p-2}$

Answer: As above

4. (i) $(5a - 3b)^2$: $5a - 3b$ by $5a - 3b$ (ii) $6s + 7t$ by $6s - 7t$
(iii) $(2x + 1)(x + 3)$

Answer: As above

5. (i) $6(a + 2b)(a - 2b)$: 6, $a + 2b$, $a - 2b$
(ii) $3p(s - 1)(s - 4)$: $3p$, $s - 1$, $s - 4$
(iii) $x(x - 1)(x + 1)$

Answer: As above

6. $2x^2 + 7x + 3 = (2x + 1)(x + 3)$
Length = $x + 3$; $x = 4$: $9 \times 7 = 63$

Answer: $x + 3$ hastas; 63 square hastas

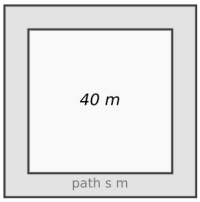
7. $x(x + 3) = 108 \Rightarrow x^2 + 3x - 108 = 0 \Rightarrow (x + 12)(x - 9) = 0$
$x = 9$ *[$x = -12$ rejected]*

Answer: 12 m × 9 m

8. (i) $5x^2 - 26x + 5 = 0 \Rightarrow (5x - 1)(x - 5) = 0$
(ii) $n^2 + n - 132 = 0 \Rightarrow (n + 12)(n - 11) = 0$

Answer: (i) 5 or $\frac{1}{5}$ (ii) 11 and 12

9. (i) Inner side = $40 - 2s \Rightarrow$ path = $1600 - (40 - 2s)^2 = 160s - 4s^2$
(ii) $160s - 4s^2 = 156 \Rightarrow s^2 - 40s + 39 = 0 \Rightarrow (s - 1)(s - 39) = 0$
$s = 1$ *[$s = 39$ is impossible as $2s < 40$]*



Answer: $(160s - 4s^2)$ m^2; $s = 1$ m

10. $\frac{(a+b)^2}{(a+b)(a-b)} \times \frac{a-b}{a+b} = 1$ *[dividing = multiplying by reciprocal]*

Hence proved.

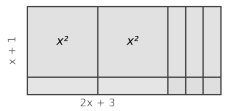
11. $x = 1$: $\frac{7}{4} \neq 2$

x is a term, not a factor, of the numerator and denominator; only common factors may be cancelled.

Answer: Wrong cancellation

Miscellaneous Questions

1. $(2x + 3)(x + 1) = 2x^2 + 2x + 3x + 3 = 2x^2 + 5x + 3$ *[2 big, 5 strips, 3 units]*



$pq = 2$, $pb + qa = 2 + 3 = 5$, $ab = 3$ ✓

Perimeter $= 2(3x + 4) = 6x + 8$

Answer: $(x + 2)(3x + 1) = 3x^2 + 7x + 2$

2. (i) $3 + 2 + 2\sqrt{6} = 5 + 2\sqrt{6}$ — irrational

(ii) $5 - 3 = 2$ — rational *[$a^2 - b^2$]*

(iii) $4 - 3 = 1$ — rational

(iv) $4 \times \sqrt{7} \times \sqrt{3} = 4\sqrt{21}$ — irrational *[$(a + b)^2 - (a - b)^2 = 4ab$]*

Answer: Irrational, rational, rational, irrational

3. $OP^2 = (m^2 - n^2)^2 + 4m^2n^2 = (m^2 + n^2)^2$ *[$(a - b)^2 + 4ab = (a + b)^2$]*

(2, 1): (3, 4), 5; (3, 2): (5, 12), 13; (4, 1): (15, 8), 17

Answer: Pythagorean triples 3-4-5, 5-12-13, 8-15-17

4. (i) $12x \Rightarrow$ zero 0

(ii) $3x + 1 \Rightarrow$ zero $-\frac{1}{3}$

(iii) $(x^2 + 7x + 10) - (x^2 + 5x + 4) = 2x + 6 \Rightarrow$ zero -3

Answer: 0, $-\frac{1}{3}$, -3

5. $1003^2 = 1000000 + 6000 + 9 = 1006009$

$997 \times 1003 = 1000^2 - 3^2 = 999991$

$5.02 \times 4.98 = 25 - 0.0004 = 24.9996$

$101^3 = 1000000 + 30000 + 300 + 1 = 1030301$

$98^3 = 1000000 - 60000 + 1200 - 8 = 941192$

Answer: As above

6. (i) $25 - 2 = 23$

(ii) $125 - 3 \times 5 = 110$ *[$(a + b)^3 = a^3 + b^3 + 3ab(a + b)$]*

(iii) $4 + 2 = 6$

(iv) $8 + 3 \times 2 = 14$

Answer: 23, 110, 6, 14

7. (i) $(x^2 + 9)(x + 3)(x - 3)$

(ii) $2(x - 2)(x^2 + 2x + 4)$

(iii) $(a + b + 3c)(a + b - 3c)$

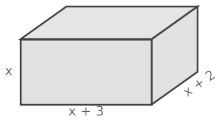
(iv) $(2x - 3 + y)(2x - 3 - y)$

Answer: As above

8. $V = x(x + 2)(x + 3) = x^3 + 5x^2 + 6x$

$x = 4$: $4 \times 6 \times 7 = 168$ cm^3

$TSA = 2[x(x + 2) + (x + 2)(x + 3) + x(x + 3)] = 6x^2 + 20x + 12$



Answer: 168 cm^3; $6x^2 + 20x + 12$

9. $\text{LHS} = \dfrac{a^3 + b^3 + c^3}{abc}$

$a + b + c = 0 \Rightarrow a^3 + b^3 + c^3 = 3abc$

∴ LHS = 3

Check: $\dfrac{1}{-6} + \dfrac{4}{-3} + \dfrac{9}{2} = 3$ ✓

Hence proved.

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10. $(x - y) + (y - z) + (z - x) = 0$

∴ sum of cubes = 3(x − y)(y − z)(z − x) *[$a + b + c = 0 \Rightarrow a^3 + b^3 + c^3 = 3abc$]*

$x = 5, y = 2, z = 1$: $27 + 1 - 64 = -36 = 3 \times 3 \times 1 \times (-4)$ ✓

Hence proved.

11. $n(n + 3) = n^2 + 3n = t$; $(n + 1)(n + 2) = t + 2$

$t(t + 2) + 1 = (t + 1)^2$

$n = 1$: $25 = 5^2$; $n = 2$: $121 = 11^2$; $n = 5$: $1681 = 41^2$

Hence proved.

Competency Based Question Bank

1. $(a + b)^2 - (a - b)^2 = 4ab$.

Answer: (b) 4ab

2. True for all x, y.

Answer: (c) $(x + y)^2 = x^2 + 2xy + y^2$

3. $1600 + 240 + 9$.

Answer: (c) 1849

4. $a^2 - 2ab + b^2$ with $a = 3x$, $b = 2y$.

Answer: (a) $9x^2 - 12xy + 4y^2$

5. $100^2 - 4^2$.

Answer: (a) 9984

6. $49 - 20$.

Answer: (b) 29

7. $2 \times b \times c$.

Answer: (d) $2bc$

8. $(65 + 5)(65 - 5) + 5^2$.

Answer: (d) $70 \times 60 + 25$

9. Difference is $2ab$.

Answer: (b) $ab > 0$

10. $(x)^2 + 2(x)(2) + 2^2$.

Answer: (c) $(x + 2)^2$

11. $(6s)^2 - (7t)^2$.

Answer: (d) $(6s + 7t)(6s - 7t)$

12. $5 + 6 = 11$, $5 \times 6 = 30$.

Answer: (d) $(x + 5)(x + 6)$

13. $(-2) + (-3) = -5$, product 6.

Answer: (b) $(x - 2)(x - 3)$

14. $-7 + 6 = -1$, product -42.

Answer: (b) $(r - 7)(r + 6)$

15. Split $-11x$ as $-15x + 4x$.

Answer: (c) $(2x - 3)(5x + 2)$

16. $pb + qa = 2 + 9 = 11$.

Answer: (d) $6x^2 + 11x + 3$

17. $2(25p^2 + 30pq + 9q^2)$.

Answer: (a) $2(5p + 3q)^2$

18. Cube identity.

Answer: (c) $a^3 + 3a^2b + 3ab^2 + b^3$

19. $(p + 2q)^3$.

Answer: (c) $p + 2q$

20. Difference of cubes.

Answer: (d) $(x - y)(x^2 + xy + y^2)$

21. $(2x)^3 + 5^3$.

Answer: (a) $(2x + 5)(4x^2 - 10x + 25)$

22. From $x^3 + y^3 + z^3 - 3xyz$ identity.

Answer: (d) $3xyz$

23. $-12 + 7 + 5 = 0 \Rightarrow 3(-12)(7)(5)$.

Answer: (c) -1260

24. $(100 - 1)^3$.

Answer: (d) 970 299

25. $(x^2 - y^2)(x^2 + y^2)$.

Answer: (b) $x^4 - y^4$

26. $x + y + 4 = 0 \Rightarrow$ value 0.

Answer: (c) 0

27. Cancel $(x - 3)$.

Answer: (c) $\frac{x-4}{x+3}$

28. Cancel $(2x + 1)$.

Answer: (d) $\frac{2x+1}{2x-1}$

29. $x(x - 4) = 96 \Rightarrow x = 12$.

Answer: (b) 12 m

30. $(40 + 2s)^2 - 40^2$.

Answer: (d) $160s + 4s^2$

31. $(n - 1)n(n + 1)$.

Answer: (a) 6

32. $a^2 + b^2 + c^2 = 5 \Rightarrow 5(5 - 10)$.

Answer: (a) -25

33. A true; R true and is the definition of an identity.

Answer: (a)

34. A false (fails for $a = b = 1$); R true.

Answer: (d)

35. $28 - 15 - 13 = 0$, so A follows from R.

Answer: (a)

36. A true; R gives the numbers used in splitting.

Answer: (a)

37. A false ($x = 1$ gives $\frac{7}{4}$); R true.

Answer: (d)

38. A true with a = 2n, b = 5m; R explains it.

Answer: (a)

Story Time: Case Studies

Case 1 · Mental Maths Club

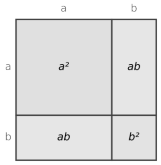
(i) $103^2 = 10000 + 600 + 9 = 10609$.

(ii) $97^2 = 10000 - 600 + 9 = 9409$.

(iii) $50 \times 40 + 25 = 2025$.

(iv) $50^2 - 1^2 = 2499$.

Case 2 · Tiling a Courtyard



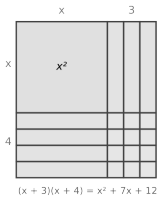
(i) $(a + b)^2$ m^2.

(ii) $(a + b)^2 - a^2 = 2ab + b^2$.

(iii) 32 + 4 = 36 m^2.

(iv) $2ab + b^2 = b(2a + b)$.

Case 3 · Saira’s Tiles



(i) (x + 3) and (x + 4).

(ii) (x + 3) and (x + 5).

(iii) No: no two whole numbers have sum 5 and product 7.

(iv) 13 cm × 14 cm.

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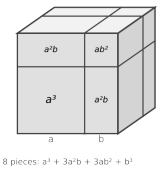
Case 4 · The Cube Puzzle



8 pieces: $a^3 + 3a^2b + 3ab^2 + b^3$

(i) 2 cubes: a^3 and b^3.

(ii) 3 of a^2b and 3 of ab^2.

(iii) $(a + b)^3 = a^3 + 3a^2b + 3ab^2 + b^3$.

(iv) $4^3 = 64 = 27 + 27 + 9 + 1$.

Case 5 · The Swimming Pool

(i) $x(x - 4) = 96$.

(ii) 12 m × 8 m.

(iii) $14 \times 10 - 96 = 44$ m^2.

(iv) $2(14 + 10) = 48$ m.

Case 6 · Packing Boxes

(i) $x(x + 3)(x + 4)$.

(ii) x cm, (x + 3) cm, (x + 4) cm.

(iii) $5 \times 8 \times 9 = 360$ cm^3.

(iv) $x = 5$ cm.

Case 7 · The Sum of Cubes Trick

(i) 0.

(ii) $x + y + z = 0 \Rightarrow x^3 + y^3 + z^3 = 3xyz$.

(iii) $3 \times 25 \times (-17) \times (-8) = 10200$.

(iv) $3 \times 1 \times 2 \times (-3) = -18$.

Case 8 · Three Numbers

(i) $(81 - 29) \div 2 = 26$.

(ii) $3 \times 24 + 9(29 - 26) = 99$.

(iii) 2, 3, 4 ($8 + 27 + 64 = 99$).

(iv) $81 = 29 + 2 \times 26$ ✓

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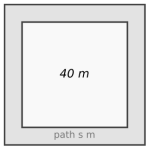
Case 9 · Garden Path



(i) (40 + 2s) m.

(ii) $4s^2 + 160s$.

(iii) $16 + 320 = 336\ m^2$.

(iv) $s^2 + 40s - 176 = 0 \Rightarrow (s - 4)(s + 44) = 0 \Rightarrow s = 4$.

Case 10 · Divisibility Detective

(i) $(n - 1)n(n + 1)$.

(ii) Two consecutive integers include an even one.

(iii) Three consecutive integers include a multiple of 3.

(iv) Always by 6; not always by 12 (n = 2 gives 6).

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