Chapter 2: Arithmetic Expressions

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Exercise 2.1 — Simple Expressions — Fill Blanks and Arrange (Page 25)

Q1 Fill in the blanks to make the expressions equal on both sides of the = sign:

(a) 13 + 4 = ___ + 6

(b) 22 + ___ = 6 × 5

(c) 8 × ___ = 64 ÷ 2

(d) 34 − ___ = 25

SOLUTION

(a) LHS: 13 + 4 = 17. We need 17 = ___ + 6, so ___ = 17 − 6 = 11.
Answer: 13 + 4 = 11 + 6

(b) RHS: 6 × 5 = 30. We need 22 + ___ = 30, so ___ = 30 − 22 = 8.
Answer: 22 + 8 = 6 × 5

(c) RHS: 64 ÷ 2 = 32. We need 8 × ___ = 32, so ___ = 32 ÷ 8 = 4.
Answer: 8 × 4 = 64 ÷ 2

(d) We need 34 − ___ = 25, so ___ = 34 − 25 = 9.
Answer: 34 − 9 = 25

Answer: (a) 11 (b) 8 (c) 4 (d) 9

Q2 Arrange the following expressions in ascending (increasing) order of their values.

(a) 67 − 19 (b) 67 − 20 (c) 35 + 25 (d) 5 × 11 (e) 120 ÷ 3

SOLUTION

Evaluate each expression:

(a) 67 − 19 = 48

(b) 67 − 20 = 47

(c) 35 + 25 = 60

(d) 5 × 11 = 55

(e) 120 ÷ 3 = 40

Arranging 40 < 47 < 48 < 55 < 60 in ascending order:

120 ÷ 3 < 67 − 20 < 67 − 19 < 5 × 11 < 35 + 25

Answer: 120 ÷ 3 < 67 − 20 < 67 − 19 < 5 × 11 < 35 + 25

Exercise 2.2 — Comparing Expressions Without Full Calculation (Page 26)

Q1 Use '>' or '<' or '=' in each of the following expressions to compare them. Can you do it without complicated calculations?

(a) 245 + 289 ___ 246 + 285
(b) 273 − 145 ___ 272 − 144
(c) 364 + 587 ___ 363 + 589
(d) 124 + 245 ___ 129 + 245
(e) 213 − 77 ___ 214 − 76

SOLUTION

(a) 245 + 289 vs 246 + 285:
Compare term by term: 246 is 1 more than 245, but 285 is 4 less than 289.
So the right side changes by +1 − 4 = −3, i.e. it is 3 less than the left side.
Therefore 245 + 289 > 246 + 285. (Check: 534 > 531.)

(b) 273 − 145 vs 272 − 144:
273 is one more than 272, but 145 is one more than 144.
Both the starting number and the amount subtracted increase by 1, so the result is the same.
273 − 145 = 272 − 144

(c) 364 + 587 vs 363 + 589:
364 − 363 = +1 (LHS starts 1 more); 589 − 587 = +2 (RHS adds 2 more).
Net: LHS is 1 − 2 = 1 less than RHS.
364 + 587 < 363 + 589

(d) 124 + 245 vs 129 + 245:
Same second term (245). 124 < 129, so LHS < RHS.
124 + 245 < 129 + 245

(e) 213 − 77 vs 214 − 76:
214 is one more than 213; 76 is one less than 77 (we subtract one less).
RHS = (213 + 1) − (77 − 1) = 213 − 77 + 2, which is 2 more than LHS.
213 − 77 < 214 − 76

Answer: (a) > (b) = (c) < (d) < (e) <

Exercise 2.3 — Terms, Values, and Situations (Pages 34–35)

Q1 Find the values of the following expressions by writing the terms in each case.

(a) 28 − 7 + 8

(b) 39 − 2 × 6 + 11

(c) 40 − 10 + 10 + 10

(d) 48 − 10 × 2 + 16 ÷ 2

(e) 6 × 3 − 4 × 8 × 5

SOLUTION

(a) 28 − 7 + 8

Terms: 28, −7, 8

Value: 28 + (−7) + 8 = 21 + 8 = 29

(b) 39 − 2 × 6 + 11

Terms: 39, −(2 × 6), 11 → 39, −12, 11

Evaluate term: 2 × 6 = 12

Value: 39 − 12 + 11 = 27 + 11 = 38

(c) 40 − 10 + 10 + 10

Terms: 40, −10, 10, 10

Value: 40 − 10 + 10 + 10 = 50

(d) 48 − 10 × 2 + 16 ÷ 2

Terms: 48, −(10 × 2), (16 ÷ 2) → 48, −20, 8

Evaluate terms: 10 × 2 = 20; 16 ÷ 2 = 8

Value: 48 − 20 + 8 = 28 + 8 = 36

(e) 6 × 3 − 4 × 8 × 5

Terms: (6 × 3), −(4 × 8 × 5) → 18, −160

Evaluate terms: 6 × 3 = 18; 4 × 8 × 5 = 160

Value: 18 − 160 = −142

Answer: (a) 29 (b) 38 (c) 50 (d) 36 (e) −142

Q2 Write a story/situation for each of the following expressions and find their values.
(a) 89 + 21 − 10
(b) 5 × 12 − 6
(c) 4 × 9 + 2 × 6

SOLUTION

(a) 89 + 21 − 10
Story: A library had 89 books. The librarian added 21 new books, and then 10 books were borrowed by students. How many books are on the shelf?
Value: 89 + 21 − 10 = 110 − 10 = 100

(b) 5 × 12 − 6
Story: A shopkeeper had 5 boxes each containing 12 pens. He sold 6 pens. How many pens remain?
Value: 5 × 12 − 6 = 60 − 6 = 54

(c) 4 × 9 + 2 × 6
Story: Riya bought 4 packets with 9 biscuits each and 2 packets with 6 biscuits each. How many biscuits does she have in all?
Terms: 4 × 9, 2 × 6 → 36, 12
Value: 36 + 12 = 48

Answer: (a) 100 (b) 54 (c) 48

Q3 For each of the following situations, write the expression describing the situation, identify its terms and find the value of the expression.
(a) Queen Alia gave 100 gold coins to Princess Elsa and 100 gold coins to Princess Anna last year. Princess Elsa doubled her coins. Princess Anna has only half left. Write an expression for how many gold coins they together have.
(b) A metro train ticket is 40 for an adult and 20 for a child. Find the total cost:
(i) for four adults and three children, (ii) for two groups having three adults each.
(c) Find the total height of the window from the picture (Border = 3 cm, Grill = 2 cm, Gap = 5 cm; 2 borders, 6 grills, 7 gaps).

SOLUTION

(a) Princess Elsa started with 100 coins and doubled them: 2 × 100 = 200.
Princess Anna started with 100 coins and has half left: 100 ÷ 2 = 50.
Expression: 2 × 100 + 100 ÷ 2

Terms: 2×100, $100 \div 2 \rightarrow 200, 50$
Value: $200 + 50 = 250$ gold coins

(b-i) 4 adults and 3 children:
Expression: $4 \times 40 + 3 \times 20$
Terms: 4×40, $3 \times 20 \rightarrow 160, 60$
Value: $160 + 60 = 220$

(b-ii) Two groups of three adults each:
Expression: $2 \times (3 \times 40)$
Term: $2 \times (3 \times 40) \rightarrow 2 \times 120 = 240$
Value: 240

(c) From the picture: 2 borders (3 cm each) + 6 grills (2 cm each) + 7 gaps (5 cm each).
Expression: $2 \times 3 + 6 \times 2 + 7 \times 5$
Terms: 2×3, 6×2, $7 \times 5 \rightarrow 6, 12, 35$
Value: $6 + 12 + 35 = 53$ cm

Answer: (a) 250 gold coins (b-i) 220 (b-ii) 240 (c) 53 cm

Exercise 2.4 — Removing Brackets — I (Pages 37–38)

Q1 Fill in the blanks with numbers, and boxes with operation signs such that the expressions on both sides are equal.

(a) 24 + (6 − 4) = 24 + 6 [box] ___

(b) 38 + (___ [box] __) = 38 + 9 − 4

(c) 24 − (6 + 4) = 24 [box] 6 − 4

(d) 24 − 6 − 4 = 24 − 6 [box] ___

(e) 27 − (8 + 3) = 27 [box] 8 [box] 3

(f) 27 − (___ [box] __) = 27 − 8 + 3

SOLUTION

(a) 24 + (6 − 4): removing bracket preceded by '+', signs inside do not change.
24 + (6 − 4) = 24 + 6 − 4. Box = '−', blank = 4.

(b) RHS is 38 + 9 − 4, so inside the bracket on LHS we need 9 − 4.
38 + (9 − 4) = 38 + 9 − 4. Blank = 9, box = '−', blank = 4.

(c) 24 − (6 + 4): removing bracket preceded by '−', signs of 6 and +4 change to −6 and −4.
24 − (6 + 4) = 24 − 6 − 4. Box = '−'.

(d) 24 − 6 − 4 = 24 − 6 [box] 4. Box = '−', blank = 4.

(e) 27 − (8 + 3): sign of 8 changes to −8 and sign of +3 changes to −3.
27 − (8 + 3) = 27 − 8 − 3. First box = '−', second box = '−'.

(f) We want 27 − (___ [box] __) = 27 − 8 + 3.
Removing a bracket with '−' in front changes signs: −a becomes +a.
So we need − (8 − 3) because −8 and −(−3) = +3.
27 − (8 − 3) = 27 − 8 + 3. Blanks: 8, '−', 3.

Answer: (a) −4 (b) 9 − 4 (c) − (d) −4 (e) −8 −3 (f) 8 − 3

Q2 Remove the brackets and write the expression having the same value.

(a) 14 + (12 + 10)

(b) 14 − (12 + 10)

(c) 14 + (12 − 10)

(d) 14 − (12 − 10)

(e) −14 + (12 − 10)

(f) 14 − (−12 − 10)

SOLUTION

(a) 14 + (12 + 10): bracket has '+' in front — signs unchanged.
= 14 + 12 + 10 = 36

(b) 14 − (12 + 10): bracket has '−' in front — both signs change.
+12 becomes −12; +10 becomes −10.
= 14 − 12 − 10 = −8

(c) 14 + (12 − 10): bracket has '+' in front — signs unchanged.
= 14 + 12 − 10 = 16

(d) 14 − (12 − 10): bracket has '−' in front — signs change.
+12 becomes −12; −10 becomes +10.
= 14 − 12 + 10 = 12

(e) −14 + (12 − 10): bracket has '+' in front — signs unchanged.
= −14 + 12 − 10 = −12

(f) 14 − (−12 − 10): bracket has '−' in front — signs change.
−12 becomes +12; −10 becomes +10.
= 14 + 12 + 10 = 36

Answer: (a) 14 + 12 + 10 = 36 (b) 14 − 12 − 10 = −8 (c) 14 + 12 − 10 = 16 (d) 14 − 12 + 10 = 12 (e) −14 + 12 − 10 = −12 (f) 14 + 12 + 10 = 36

Q3 Find the values of the following expressions. For each pair, first try to guess whether they have the same value. When are the two expressions equal?
(a) (6 + 10) − 2 and 6 + (10 − 2)
(b) 16 − (8 − 3) and (16 − 8) − 3
(c) 27 − (18 + 4) and 27 + (−18 − 4)

SOLUTION

(a) (6 + 10) − 2 = 16 − 2 = 14
6 + (10 − 2) = 6 + 8 = 14
Both equal 14. They are equal.

(b) 16 − (8 − 3) = 16 − 5 = 11
(16 − 8) − 3 = 8 − 3 = 5
They are not equal. (16 − (8 − 3) = 11, but (16 − 8) − 3 = 5.)
Moving the bracket changes the meaning: in the first case we subtract 5 from 16; in the second we subtract 3 more.

(c) 27 − (18 + 4) = 27 − 22 = 5
27 + (−18 − 4) = 27 − 18 − 4 = 5
Both equal 5. They are equal.
Reason: −(18 + 4) = −18 − 4, so the two expressions are identical once brackets are removed.

Answer: (a) Both = 14 (equal) (b) 11 ≠ 5 (not equal) (c) Both = 5 (equal)

Q4 In each of the sets of expressions below, identify those that have the same value. Do not evaluate them; use your understanding of terms.
(a) 319 + 537, 319 − 537, −537 + 319, 537 − 319
(b) 87 + 46 − 109, 87 + 46 − 109, 87 + 46 − 109, 87 − 46 + 109, 87 − (46 + 109), (87 − 46) + 109

SOLUTION

(a) Write each as a sum of terms and compare:
319 + 537: terms are +319 and +537.
319 − 537: terms are +319 and −537.
−537 + 319: terms are −537 and +319 — same as 319 − 537.
537 − 319: terms are +537 and −319 — different from all above.
Same value: 319 − 537 = −537 + 319.

(b) Identify the terms of each:
87 + 46 − 109: terms +87, +46, −109. (Appears three times — all equal.)
87 − 46 + 109: terms +87, −46, +109. Different.
87 − (46 + 109) = 87 − 46 − 109: terms +87, −46, −109. Different from above.
(87 − 46) + 109 = 87 − 46 + 109: terms +87, −46, +109. Same as 87 − 46 + 109.
Same value: the three expressions '87 + 46 − 109' (×3) have equal values.
Also: '87 − 46 + 109' and '(87 − 46) + 109' have equal values.

Answer: (a) 319 − 537 and −537 + 319 are equal. (b) The first three (87 + 46 − 109) are equal to each other; 87 − 46 + 109 and (87 − 46) + 109 are equal to each other.

Q5 Add brackets at appropriate places in the expressions such that they lead to the values indicated.
(a) 34 − 9 + 12 = 13
(b) 56 − 14 − 8 = 34
(c) −22 − 12 + 10 + 22 = −22

SOLUTION

(a) Without brackets: 34 − 9 + 12 = 25 + 12 = 37 ≠ 13.
To get 13, we need to subtract (9 + 12) from 34.
34 − (9 + 12) = 34 − 21 = 13. ✓

(b) Without brackets: 56 − 14 − 8 = 42 − 8 = 34. This already equals 34!
So brackets can be placed as (56 − 14) − 8 = 42 − 8 = 34. ✓

(c) Without brackets: −22 − 12 + 10 + 22 = 0 + 10 − 12 = −2 ≠ −22.
We need to group (12 + 10) inside a subtraction: −22 − (12 + 10) + 22.
= −22 − 22 + 22 = −22. ✓
Bracket: −22 − (12 + 10) + 22 = −22.

Answer: (a) 34 − (9 + 12) = 13 (b) (56 − 14) − 8 = 34 (c) −22 − (12 + 10) + 22 = −22

Q6 Using only reasoning of how terms change their values, fill the blanks to make the expressions on either side of the equality (=) equal.
(a) 423 + ___ = 419 + ___
(b) 207 − 68 = 210 − ___

SOLUTION

(a) 423 + ___ = 419 + ___
The LHS starts with 423; the RHS starts with 419, which is 4 less.
To balance, the RHS blank must be 4 more than the LHS blank.
One solution using the commutative property: 423 + 419 = 419 + 423.
(Any pair where the RHS blank = LHS blank + 4 works, e.g. 423 + 0 = 419 + 4.)

(b) 207 − 68 = 210 − ___
207 − 68 = 139.
The RHS has 210, which is 3 more than 207. To keep the value the same, we must subtract 3 more: ___ = 68 + 3 = 71.
Check: 210 − 71 = 139. ✓

Answer: (a) e.g. 423 + 419 = 419 + 423 (or any pair differing by 4) (b) 71

Q7 Using the numbers 2, 3, and 5, and the operators '+' and '−', and brackets as necessary, generate expressions to give as many different values as possible. (Example: 2 − 3 + 5 = 4 and 3 − (5 − 2) = 0.)

SOLUTION

Listing distinct arrangements:

2 + 3 + 5 = 10

2 + 3 − 5 = 0

2 − 3 + 5 = 4

2 − 3 − 5 = −6

3 − 2 − 5 = −4

5 − 3 + 2 = 4 (same as 2 − 3 + 5)

5 + 3 − 2 = 6

3 − (5 − 2) = 3 − 3 = 0 (same value as 2 + 3 − 5)

2 − (3 + 5) = 2 − 8 = −6 (same as 2 − 3 − 5)

2 − (3 − 5) = 2 + 2 = 4 (same as 2 − 3 + 5)

5 − (3 + 2) = 0

5 − (2 − 3) = 5 + 1 = 6

3 + (5 − 2) = 6

Distinct values obtained: −6, −4, 0, 4, 6, 10.

Answer: Distinct values: −6, −4, 0, 4, 6, 10

Q8 Consider the two expressions: (A) 73 − 14 + 1 and (B) 73 − 14 − 1. For each, identify which of the following are equal to it:
(a) 73 − (14 + 1) (b) 73 − (14 − 1) (c) 73 + (−14 + 1) (d) 73 + (−14 − 1)

SOLUTION

Expression A: 73 − 14 + 1 = 60. Terms: +73, −14, +1.

Expression B: 73 − 14 − 1 = 58. Terms: +73, −14, −1.

Evaluate each option:

(a) 73 − (14 + 1) = 73 − 15 = 58 → equals Expression B.

(b) 73 − (14 − 1) = 73 − 13 = 60 → equals Expression A.

(c) 73 + (−14 + 1) = 73 − 14 + 1 = 60 → equals Expression A.

(d) 73 + (−14 − 1) = 73 − 14 − 1 = 58 → equals Expression B.

Equal to A (value 60): (b) and (c).
Equal to B (value 58): (a) and (d).

Answer: Equal to 73 − 14 + 1: options (b) and (c). Equal to 73 − 14 − 1: options (a) and (d).

Exercise 2.5 — Distributive Property — Removing Brackets II (Pages 41–42)

Q1 Fill in the blanks with numbers, and boxes by signs, so that the expressions on both sides are equal.

(a) 3 × (6 + 7) = 3 × 6 + 3 × 7

(b) (8 + 3) × 4 = 8 × 4 + 3 × 4

(c) 3 × (5 + 8) = 3 × 5 [box] 3 × ___

(d) (9 + 2) × 4 = 9 × 4 [box] 2 × ___

(e) 3 × (___ + 4) = 3 × ___ + ___

(f) (___ + 6) × 4 = 13 × 4 + ___

(g) 3 × (___ + __) = 3 × 5 + 3 × 2

(h) (___ + __) × ___ = 2 × 4 + 3 × 4

(i) 5 × (9 − 2) = 5 × 9 − 5 × ___

(j) (5 − 2) × 7 = 5 × 7 − 2 × ___

(k) 5 × (8 − 3) = 5 × 8 [box] 5 × ___

(l) (8 − 3) × 7 = 8 × 7 [box] 3 × 7

(m) 5 × (12 − __) = ___ [box] 5 × ___

(n) (15 − __) × 7 = ___ [box] 6 × 7

(o) 5 × (___ − __) = 5 × 9 − 5 × 4

(p) (___ − __) × ___ = 17 × 7 − 9 × 7

SOLUTION

(a) and (b) are given examples — both verified by distributive property.

(c) 3 × (5 + 8) = 3 × 5 + 3 × 8. Box = '+', blank = 8.

(d) (9 + 2) × 4 = 9 × 4 + 2 × 4. Box = '+', blank = 4.

(e) 3 × (10 + 4) = 3 × 10 + 3 × 4. Blank = 10; RHS blanks = 10, 3 × 4.
(Any number works for the first blank; 10 is the standard choice.)

(f) (13 + 6) × 4 = 13 × 4 + 6 × 4. Blank = 13; last blank = 6 × 4.

(g) 3 × (5 + 2) = 3 × 5 + 3 × 2. Blanks = 5 and 2.

(h) (2 + 3) × 4 = 2 × 4 + 3 × 4. Blanks = 2, 3, 4.

(i) 5 × (9 − 2) = 5 × 9 − 5 × 2. Blank = 2.

(j) (5 − 2) × 7 = 5 × 7 − 2 × 7. Blank = 7.

(k) 5 × (8 − 3) = 5 × 8 − 5 × 3. Box = '−', blank = 3.

(l) (8 − 3) × 7 = 8 × 7 − 3 × 7. Box = '−'.

(m) 5 × (12 − 3) = 5 × 12 − 5 × 3 = 60 − 15 = 45. Blank = 3; RHS = 60 '−' 5 × 3. (Any number works; 3 is the standard choice.)

(n) (15 − 6) × 7 = 15 × 7 − 6 × 7 = 105 − 42 = 63. Blank = 6; RHS = 15 × 7 '−' 6 × 7.

(o) 5 × (9 − 4) = 5 × 9 − 5 × 4. Blanks = 9 and 4.

(p) (17 − 9) × 7 = 17 × 7 − 9 × 7. Blanks = 17, 9, 7.

Answer: (c) +, 8 (d) +, 4 (e) 10, 10, 3×4 (f) 13, 6×4 (g) 5, 2 (h) 2, 3, 4 (i) 2 (j) 7 (k) −, 3 (l) − (m) 3, 60, −, 3 (n) 6, 15×7, − (o) 9, 4 (p) 17, 9, 7

Q2 In the boxes below, fill '<', '>' or '=' after analysing the expressions on the LHS and RHS. Use reasoning and understanding of terms and brackets — not by evaluating.

(a) (8 − 3) × 29 ___ (3 − 8) × 29
(b) 15 + 9 × 18 ___ (15 + 9) × 18
(c) 23 × (17 − 9) ___ 23 × 17 + 23 × 9
(d) (34 − 28) × 42 ___ 34 × 42 − 28 × 42

SOLUTION

(a) (8 − 3) = 5; (3 − 8) = −5. Both are multiplied by the same positive 29.
Since 5 > −5, we have (8 − 3) × 29 > (3 − 8) × 29.

(b) LHS: 15 + 9 × 18. By order of operations, 9 × 18 is evaluated first, then 15 is added.
RHS: (15 + 9) × 18 = 24 × 18. By distributive property, 24 × 18 = 15 × 18 + 9 × 18.
So RHS = 15 × 18 + 9 × 18, which is larger than LHS = 15 + 9 × 18 (since 15 × 18 > 15).
15 + 9 × 18 < (15 + 9) × 18.

(c) LHS: 23 × (17 − 9) = 23 × 17 − 23 × 9 (by distributive property).
RHS: 23 × 17 + 23 × 9.
LHS subtracts 23 × 9; RHS adds 23 × 9. So LHS < RHS.
23 × (17 − 9) < 23 × 17 + 23 × 9.

(d) LHS: (34 − 28) × 42 = 34 × 42 − 28 × 42 (by distributive property).
This is exactly the RHS. So (34 − 28) × 42 = 34 × 42 − 28 × 42.

Answer: (a) > (b) < (c) < (d) =

Q3 Here is one way to make 14: 2 × (1 + 6) = 14. Find four other ways of getting 14 in the form ___ × (___ + __) = 14.

SOLUTION

We need a × (b + c) = 14 where a, b, c are whole numbers.
Factor pairs of 14: 1×14, 2×7, 7×2, 14×1.

(a) 2 × (5 + 2) = 2 × 7 = 14
(b) 2 × (3 + 4) = 2 × 7 = 14
(c) 7 × (1 + 1) = 7 × 2 = 14
(d) 2 × (6 + 1) = 2 × 7 = 14

Many other answers are possible, e.g. 14 × (1 + 0) = 14.

Answer: (a) 2 × (5 + 2) (b) 2 × (3 + 4) (c) 7 × (1 + 1) (d) 2 × (6 + 1)

Q4 Find out the sum of the numbers given in each picture below in at least two different ways. Describe how you solved it through expressions.
Picture I: a 3 × 3 grid with alternating values — corners and centre = 4, edges = 8 (5 fours and 4 eights).
Picture II: a 4 × 4 grid with values 5 and 6 alternating — 8 fives and 8 sixes.

SOLUTION

Picture I (3 × 3 grid: 5 fours, 4 eights):
Way 1: Count separately. Sum = 5 × 4 + 4 × 8 = 20 + 32 = 52.
Way 2: Row sums. Row 1 = 4 + 8 + 4 = 16; Row 2 = 8 + 4 + 8 = 20; Row 3 = 4 + 8 + 4 = 16.
Expression: (4 + 8 + 4) + (8 + 4 + 8) + (4 + 8 + 4) = 16 + 20 + 16 = 52.

Picture II (4 × 4 grid: 8 fives, 8 sixes):
Way 1: 8 × 5 + 8 × 6 = 40 + 48 = 88.
Way 2: By distributive property, 8 × (5 + 6) = 8 × 11 = 88.
(Each row has two 5s and two 6s; 4 rows: 4 × 2 × (5 + 6) = 8 × 11 = 88.)

Answer: Picture I: 52 Picture II: 88

Exercise 2.6 — Mixed Problems — Expressions and Reasoning (Pages 42–44)

Q1 Read the situations given below. Write appropriate expressions for each of them and find their values.
(a) The district market in Begur operates all seven days. Rahim supplies 9 kg and Shyam supplies 11 kg of mangoes each day. Find the total mangoes supplied in a week.
(b) Binu earns 20,000 per month. She spends 5,000 on rent, 5,000 on food, and 2,000 on other expenses every month. What will she save in a year?
(c) During the daytime a snail climbs 3 cm up a post, and during the night accidentally slips down by 2 cm. The post is 10 cm high and a delicious treat is on top. In how many days will the snail get the treat?

SOLUTION

(a) Each day, total mangoes = 9 + 11 = 20 kg. Over 7 days:
Expression: 7 × (9 + 11)
= 7 × 20 = 140 kg

(b) Monthly savings = 20,000 − (5,000 + 5,000 + 2,000) = 20,000 − 12,000 = 8,000.
Annual savings: Expression: 12 × (20,000 − 5,000 − 5,000 − 2,000)
= 12 × 8,000 = 96,000

(c) Each full day (daytime + night), the snail climbs a net of 3 − 2 = 1 cm.
After 7 full days, the snail is at 7 × (3 − 2) = 7 cm.
On the 8th day's daytime, it climbs 3 cm: 7 + 3 = 10 cm — it reaches the top!
Expression for the 8th day: 7 × (3 − 2) + 3 = 10 cm.
The snail gets the treat in 8 days.

Answer: (a) 7 × (9 + 11) = 140 kg (b) 12 × 8,000 = 96,000 (c) 8 days

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Q2 Melvin reads a two-page story every day except on Tuesdays and Saturdays. How many stories would he complete reading in 8 weeks? Which of the following expressions describes this scenario?
(a) 5 × 2 × 8 (b) (7 − 2) × 8 (c) 8 × 7 (d) 7 × 2 × 8 (e) 7 × 5 − 2 (f) (7 + 2) × 8
(g) 7 × 8 − 2 × 8 (h) (7 − 5) × 8

SOLUTION

Melvin reads every day except Tuesday and Saturday — that is 7 − 2 = 5 days per week.

One story = 2 pages, so he reads 1 story per day.
In 8 weeks: 5 days/week × 8 weeks = 40 stories.

Check each expression:
(a) 5 × 2 × 8 = 80 — wrong (this counts 2 stories per day).
(b) (7 − 2) × 8 = 5 × 8 = 40 ✓ — correct.
(c) 8 × 7 = 56 — wrong (all 7 days).
(d) 7 × 2 × 8 = 112 — wrong.
(e) 7 × 5 − 2 = 33 — wrong.
(f) (7 + 2) × 8 = 72 — wrong.
(g) 7 × 8 − 2 × 8 = 56 − 16 = 40 ✓ — correct (by distributive property, = (7 − 2) × 8).
(h) (7 − 5) × 8 = 16 — wrong.

Answer: 40 stories. Expressions that describe the scenario: (b) and (g).

Q3 Find different ways of evaluating the following expressions:
(a) 1 − 2 + 3 − 4 + 5 − 6 + 7 − 8 + 9 − 10
(b) 1 − 1 + 1 − 1 + 1 − 1 + 1 − 1 + 1 − 1

SOLUTION

(a) 1 − 2 + 3 − 4 + 5 − 6 + 7 − 8 + 9 − 10

Way 1 — group into consecutive pairs:
(1 − 2) + (3 − 4) + (5 − 6) + (7 − 8) + (9 − 10)
= (−1) + (−1) + (−1) + (−1) + (−1) = −5

Way 2 — group odd-position and even-position terms:
(1 + 3 + 5 + 7 + 9) + (−2 − 4 − 6 − 8 − 10)
= 25 + (−30) = −5

Value: −5

(b) 1 − 1 + 1 − 1 + 1 − 1 + 1 − 1 + 1 − 1

Way 1 — consecutive pairs:
(1 − 1) + (1 − 1) + (1 − 1) + (1 − 1) + (1 − 1) = 0 + 0 + 0 + 0 + 0 = 0

Way 2 — group all positives and negatives:
(1 + 1 + 1 + 1 + 1) + (−1 − 1 − 1 − 1 − 1) = 5 − 5 = 0

Value: 0

Answer: (a) −5 (b) 0

Q4 Compare the following pairs of expressions using '<', '>' or '=' or by reasoning.
(a) 49 − 7 + 8 ___ 49 − 7 + 8
(b) 83 × 42 − 18 ___ 83 × 40 − 18
(c) 145 − 17 × 8 ___ 145 − 17 × 6
(d) 23 × 48 − 35 ___ 23 × (48 − 35)
(e) (16 − 11) × 12 ___ −11 × 12 + 16 × 12
(f) (76 − 53) × 88 ___ 88 × (53 − 76)
(g) 25 × (42 + 16) ___ 25 × (43 + 15)
(h) 36 × (28 − 16) ___ 35 × (27 − 15)

SOLUTION

(a) Both expressions are identical: 49 − 7 + 8 = 49 − 7 + 8.
49 − 7 + 8 = 50. Result: =

(b) LHS has 83 × 42; RHS has 83 × 40. Since 42 > 40, LHS term is larger. Same −18 on both.
83 × 42 − 18 > 83 × 40 − 18. Result: >

(c) LHS has −17 × 8 = −136; RHS has −17 × 6 = −102. A larger negative term means smaller value.
145 − 17 × 8 < 145 − 17 × 6. Result: <

(d) LHS: 23 × 48 − 35. By order of operations, term 23 × 48 is large then 35 is subtracted.
RHS: 23 × (48 − 35) = 23 × 13 = 299.
LHS = 23 × 48 − 35 = 1104 − 35 = 1069 > 299. Result: >

(e) LHS: (16 − 11) × 12 = 5 × 12 = 60.
RHS: −11 × 12 + 16 × 12 = (16 − 11) × 12 = 5 × 12 = 60 (distributive property).
Result: =

(f) LHS: (76 − 53) × 88 = 23 × 88 (positive).
RHS: 88 × (53 − 76) = 88 × (−23) = −23 × 88 (negative).
Positive > Negative. Result: >

(g) LHS: 25 × (42 + 16) = 25 × 58.
RHS: 25 × (43 + 15) = 25 × 58.
Same multiplier, same bracket sum. Result: =

(h) LHS: 36 × (28 − 16) = 36 × 12 = 432.

RHS: 35 × (27 − 15) = 35 × 12 = 420.
432 > 420. Result: >

Answer: (a) = (b) > (c) < (d) > (e) = (f) > (g) = (h) >

Q5 Identify which of the following expressions are equal to the given expression without computation. There can be more than one.
(a) Given: 83 − 37 − 12
(i) 84 − 38 − 12 (ii) 84 − (37 + 12) (iii) 83 − 38 − 13 (iv) −37 + 83 − 12
(b) Given: 93 + 37 × 44 + 76
(i) 37 + 93 × 44 + 76 (ii) 93 + 37 × 76 + 44 (iii) (93 + 37) × (44 + 76) (iv) 37 × 44 + 93 + 76

SOLUTION

(a) Given: 83 − 37 − 12. Terms: +83, −37, −12.

(i) 84 − 38 − 12: terms +84, −38, −12.
Compare: +84 = +83 + 1; −38 = −37 − 1. The +1 and −1 cancel. Terms effectively same.
84 − 38 − 12 = 83 − 37 − 12. Equal ✓

(ii) 84 − (37 + 12) = 84 − 37 − 12: terms +84, −37, −12.
Given has +83, not +84. These differ. Not equal ✗

(iii) 83 − 38 − 13: terms +83, −38, −13.
Given has −37 and −12; this has −38 and −13. Sum of negative terms: −37 − 12 = −49; −38 − 13 = −51. Not equal ✗

(iv) −37 + 83 − 12: terms +83, −37, −12. Same terms as given (commutative). Equal ✓

Equal to (a): options (i) and (iv).

(b) Given: 93 + 37 × 44 + 76. Terms: +93, +(37 × 44), +76.

(i) 37 + 93 × 44 + 76: terms +37, +(93 × 44), +76. The product term is 93 × 44, not 37 × 44. Not equal ✗

(ii) 93 + 37 × 76 + 44: terms +93, +(37 × 76), +44. Product term is 37 × 76 ≠ 37 × 44. Not equal ✗

(iii) (93 + 37) × (44 + 76): this is a product of two sums, not a sum of terms. Not equal ✗

(iv) 37 × 44 + 93 + 76: terms +(37 × 44), +93, +76. Same three terms as given (commutative). Equal ✓

Equal to (b): option (iv) only.

Answer: (a) Equal: (i) and (iv) (b) Equal: (iv) only