# Chapter 10: Operations with Integers

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## Exercise 10.1 — A Quick Recap of Integers — Sum and Difference Pairs (Page 25)

**Q1** Find the pair of numbers with: (a) Sum = 27, Difference = 9

SOLUTION

If the two numbers are x and y, then x + y = 27 and x – y = 9.
Adding both equations: 2x = 27 + 9 = 36, so x = 18.
Subtracting: 2y = 27 – 9 = 18, so y = 9.
Check: 18 + 9 = 27 ✓ and 18 – 9 = 9 ✓

Answer: First number = 18, Second number = 9

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**Q2** Find the pair of numbers with: (b) Sum = 4, Difference = 12

SOLUTION

x + y = 4 and x – y = 12.
Adding: 2x = 16, so x = 8.
Subtracting: 2y = 4 – 12 = –8, so y = –4.
Check: 8 + (–4) = 4 ✓ and 8 – (–4) = 12 ✓

Answer: First number = 8, Second number = –4

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**Q3** Find the pair of numbers with: (c) Sum = 0, Difference = 10

SOLUTION

x + y = 0 and x – y = 10.
Adding: 2x = 10, so x = 5.
From x + y = 0: y = –5.

Check: 5 + (–5) = 0 ✓ and 5 – (–5) = 10 ✓

Answer: First number = 5, Second number = –5

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Q4 Find the pair of numbers with: (d) Sum = 0, Difference = –10

SOLUTION

x + y = 0 and x – y = –10.
Adding: 2x = –10, so x = –5.
From x + y = 0: y = 5.
Check: (–5) + 5 = 0 ✓ and (–5) – 5 = –10 ✓

Answer: First number = –5, Second number = 5

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Q5 Find the pair of numbers with: (e) Sum = –7, Difference = –1

SOLUTION

x + y = –7 and x – y = –1.
Adding: 2x = –8, so x = –4.
From x + y = –7: y = –7 – (–4) = –7 + 4 = –3.
Check: (–4) + (–3) = –7 ✓ and (–4) – (–3) = –4 + 3 = –1 ✓

Answer: First number = –4, Second number = –3

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Q6 Find the pair of numbers with: (f) Sum = –7, Difference = –13

SOLUTION

x + y = –7 and x – y = –13.
Adding: 2x = –20, so x = –10.
From x + y = –7: y = –7 – (–10) = –7 + 10 = 3.
Check: (–10) + 3 = –7 ✓ and (–10) – 3 = –13 ✓

Answer: First number = –10, Second number = 3

## Exercise 10.2 — Multiplication of Integers — Token Model (Page 31)

**Q1** Using the token interpretation, find the values of: (a) 3 × (–2)

SOLUTION

The multiplier 3 is positive, so we place tokens into the bag.
We place 2 negative (red) tokens into the bag 3 times.
Total: 6 negative tokens in the bag.

Answer: 3 × (–2) = –6

---

**Q2** Using the token interpretation, find the values of: (b) (–5) × (–2)

SOLUTION

The multiplier –5 is negative, so we remove tokens from the bag.
We remove 2 negative (red) tokens from the bag 5 times.
Start with empty bag: add 5 zero pairs (5 green + 5 red), then remove 2 red tokens 5 times.
Removing 10 red tokens leaves 10 green (positive) tokens.

Answer: (–5) × (–2) = 10

---

**Q3** Using the token interpretation, find the values of: (c) (–4) × (–1)

SOLUTION

The multiplier –4 is negative, so we remove tokens from the bag.
We remove 1 negative (red) token from the bag 4 times.
Start with empty bag: add 4 zero pairs, then remove 1 red token 4 times.
Removing 4 red tokens leaves 4 green (positive) tokens.

Answer: (–4) × (–1) = 4

---

**Q4** Using the token interpretation, find the values of: (d) (–7) × 3

SOLUTION

The multiplier –7 is negative, so we remove tokens from the bag.
We remove 3 positive (green) tokens from the bag 7 times.
Start with empty bag: add 7 zero pairs, then remove 3 green tokens 7 times.
Removing 21 green tokens leaves 21 red (negative) tokens.

Answer: (–7) × 3 = –21

---

Q5 If 123 × 456 = 56088, without calculating, find the value of: (a) (–123) × 456

SOLUTION

When one factor is positive and the other is negative, the product is negative.
(–123) × 456 has opposite sign to 123 × 456.
So (–123) × 456 = –56088.

Answer: (–123) × 456 = –56088

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Q6 If 123 × 456 = 56088, without calculating, find the value of: (b) (–123) × (–456)

SOLUTION

When both factors are negative, the product is positive.
The magnitude stays the same: 123 × 456 = 56088.
So (–123) × (–456) = +56088.

Answer: (–123) × (–456) = 56088

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Q7 If 123 × 456 = 56088, without calculating, find the value of: (c) (123) × (–456)

SOLUTION

When one factor is positive and the other is negative, the product is negative.
The magnitude stays the same: 123 × 456 = 56088.
So 123 × (–456) = –56088.

Answer: 123 × (–456) = –56088

## Exercise 10.3 — Patterns in Integer Multiplication — Find Products (Page 33)

**Q1** Find the following product: (a) 4 × (–3)

SOLUTION

One factor is positive (4), one is negative (–3).
Product is negative, with magnitude 4 × 3 = 12.

Answer: 4 × (–3) = –12

**Q2** Find the following product: (b) (–6) × (–3)

SOLUTION

Both factors are negative.
Product is positive, with magnitude 6 × 3 = 18.

Answer: (–6) × (–3) = 18

**Q3** Find the following product: (c) (–5) × (–1)

SOLUTION

Both factors are negative.
Product is positive, with magnitude 5 × 1 = 5.

Answer: (–5) × (–1) = 5

**Q4** Find the following product: (d) (–8) × 4

SOLUTION

One factor is negative (–8), one is positive (4).
Product is negative, with magnitude 8 × 4 = 32.

Answer: (–8) × 4 = –32

**Q5** Find the following product: (e) (–9) × 10

SOLUTION

One factor is negative (–9), one is positive (10).
Product is negative, with magnitude 9 × 10 = 90.

Answer: (–9) × 10 = –90

## Q6 Find the following product: (f) 10 × (–17)

SOLUTION

One factor is positive (10), one is negative (–17).

Product is negative, with magnitude 10 × 17 = 170.

Answer: 10 × (–17) = –170

## Exercise 10.4 — Division of Integers — Multiplication, Division and Word Problems (Pag

**Q1** Find the value of: (a) 14 × (–15)

SOLUTION

One factor positive, one negative → product is negative.
14 × 15 = 210, so 14 × (–15) = –210.

Answer: 14 × (–15) = –210

---

**Q2** Find the value of: (b) –16 × (–5)

SOLUTION

Both factors are negative → product is positive.
16 × 5 = 80, so (–16) × (–5) = 80.

Answer: (–16) × (–5) = 80

---

**Q3** Find the value of: (c) 36 ÷ (–18)

SOLUTION

Dividend positive, divisor negative → quotient is negative.
36 ÷ 18 = 2, so 36 ÷ (–18) = –2.

Answer: 36 ÷ (–18) = –2

---

**Q4** Find the value of: (d) (–46) ÷ (–23)

SOLUTION

Both dividend and divisor are negative → quotient is positive.
46 ÷ 23 = 2, so (–46) ÷ (–23) = 2.

Answer: (–46) ÷ (–23) = 2

Q5 A freezing process requires that the room temperature be lowered from 32°C at the rate of 5°C every hour. What will be the room temperature 10 hours after the process begins?

SOLUTION

Rate of change = –5°C per hour (negative because temperature is decreasing).
Starting temperature = 32°C.
Temperature change in 10 hours = 10 × (–5) = –50°C.
Final temperature = 32 + (–50) = 32 – 50 = –18°C.

Answer: The room temperature after 10 hours will be –18°C

Q6 A cement company earns a profit of 8 per bag of white cement sold and a loss of 5 per bag of grey cement sold. The company sells 3,000 bags of white cement and 5,000 bags of grey cement in a month. What is its profit or loss?

SOLUTION

Profit per bag of white cement = +8.
Loss per bag of grey cement = –5.

Profit from white cement = 3000 × 8 = 24,000.
Loss from grey cement = 5000 × (–5) = –25,000.

Total = 24,000 + (–25,000) = –1,000.

Answer: The company has a loss of 1,000

Q7 If the number of bags of grey cement sold is 6,400 bags, what is the number of bags of white cement the company must sell to have neither profit nor loss?

SOLUTION

For no profit or loss, total earnings must equal zero.
Loss from grey cement = 6400 × (–5) = –32,000.

Let the number of white cement bags = n.
Profit from white cement = n × 8.

For break-even: 8n + (–32,000) = 0.
8n = 32,000.
n = 32,000 ÷ 8 = 4,000.

Answer: The company must sell 4,000 bags of white cement

Q8 Replace the blank with an integer to make a true statement: (a) (–3) × _____ = 27

SOLUTION

We need (–3) × ? = 27.

The product is positive (27) and one factor is negative (–3), so the missing factor must be negative.

? = 27 ÷ (–3) = –9.

Check: (–3) × (–9) = 27 ✓

Answer: (–3) × (–9) = 27

---

Q9 Replace the blank with an integer to make a true statement: (b) 5 × _____ = (–35)

SOLUTION

We need 5 × ? = –35.

The product is negative and one factor is positive (5), so the missing factor must be negative.

? = (–35) ÷ 5 = –7.

Check: 5 × (–7) = –35 ✓

Answer: 5 × (–7) = (–35)

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Q10 Replace the blank with an integer to make a true statement: (c) _____ × (–8) = (–56)

SOLUTION

We need ? × (–8) = –56.

The product is negative and one factor is negative (–8), so the missing factor must be positive.

? = (–56) ÷ (–8) = 7.

Check: 7 × (–8) = –56 ✓

Answer: 7 × (–8) = (–56)

Q11 Replace the blank with an integer to make a true statement: (d) _____ × (–12) = 132

SOLUTION

We need ? × (–12) = 132.

The product is positive (132) and one factor is negative (–12), so the missing factor must be negative.

? = 132 ÷ (–12) = –11.

Check: (–11) × (–12) = 132 ✓

Answer: (–11) × (–12) = 132

---

Q12 Replace the blank with an integer to make a true statement: (e) _____ ÷ (–8) = 7

SOLUTION

We need ? ÷ (–8) = 7.

? = 7 × (–8) = –56.

Check: (–56) ÷ (–8) = 7 ✓

Answer: (–56) ÷ (–8) = 7

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Q13 Replace the blank with an integer to make a true statement: (f) _____ ÷ 12 = –11

SOLUTION

We need ? ÷ 12 = –11.

? = (–11) × 12 = –132.

Check: (–132) ÷ 12 = –11 ✓

Answer: (–132) ÷ 12 = –11

## Exercise 10.5 — Expressions Using Integers — Properties and Applications (Pages 42–4

**Q1** Find the value of: (a) (–5) × (18 + (–3))

SOLUTION

First evaluate the expression inside the brackets: 18 + (–3) = 15.
Then: (–5) × 15 = –75.

Answer: (–5) × (18 + (–3)) = –75

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**Q2** Find the value of: (b) (–7) × 4 × (–1)

SOLUTION

First: (–7) × 4 = –28.
Then: (–28) × (–1) = 28.
(Negative × negative = positive.)

Answer: (–7) × 4 × (–1) = 28

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**Q3** Find the value of: (c) (–2) × (–1) × (–5) × (–3)

SOLUTION

Count the negative factors: there are 4 negative factors.
An even number of negative factors gives a positive product.
Magnitude: 2 × 1 × 5 × 3 = 30.
Sign: positive (4 negatives = even = positive).

Answer: (–2) × (–1) × (–5) × (–3) = 30

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**Q4** Find the value of: (a) (–27) ÷ 9

SOLUTION

Dividend is negative, divisor is positive → quotient is negative.
27 ÷ 9 = 3, so (–27) ÷ 9 = –3.

Answer: (–27) ÷ 9 = –3

Q5 Find the value of: (b) 84 ÷ (–4)

SOLUTION

Dividend is positive, divisor is negative → quotient is negative.
84 ÷ 4 = 21, so 84 ÷ (–4) = –21.

Answer: 84 ÷ (–4) = –21

Q6 Find the value of: (c) (–56) ÷ (–2)

SOLUTION

Both dividend and divisor are negative → quotient is positive.
56 ÷ 2 = 28, so (–56) ÷ (–2) = 28.

Answer: (–56) ÷ (–2) = 28

Q7 Find the integer whose product with (–1) is: (a) 27

SOLUTION

We need x such that (–1) × x = 27.
Since (–1) × x = –x, we need –x = 27, so x = –27.
Check: (–1) × (–27) = 27 ✓

Answer: –27

Q8 Find the integer whose product with (–1) is: (b) –31

SOLUTION

We need x such that (–1) × x = –31.
–x = –31, so x = 31.
Check: (–1) × 31 = –31 ✓

Answer: 31

Q9 Find the integer whose product with (–1) is: (c) –1

SOLUTION

We need x such that (–1) × x = –1.
–x = –1, so x = 1.
Check: (–1) × 1 = –1 ✓

Answer: 1

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Q10 Find the integer whose product with (–1) is: (d) 1

SOLUTION

We need x such that (–1) × x = 1.
–x = 1, so x = –1.
Check: (–1) × (–1) = 1 ✓

Answer: –1

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Q11 Find the integer whose product with (–1) is: (e) 0

SOLUTION

We need x such that (–1) × x = 0.
–x = 0, so x = 0.
Check: (–1) × 0 = 0 ✓

Answer: 0

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Q12 If 47 – 56 + 14 – 8 + 2 – 8 + 5 = –4, then find the value of –47 + 56 – 14 + 8 – 2 + 8 – 5 without calculating the full expression.

SOLUTION

The expression –47 + 56 – 14 + 8 – 2 + 8 – 5 is the exact negative of the given expression.
Every term has its sign flipped compared to 47 – 56 + 14 – 8 + 2 – 8 + 5.
So –47 + 56 – 14 + 8 – 2 + 8 – 5 = –(47 – 56 + 14 – 8 + 2 – 8 + 5) = –(–4) = 4.

Answer: –47 + 56 – 14 + 8 – 2 + 8 – 5 = 4

Q13 In a test, (+4) marks are given for every correct answer and (–2) marks for every incorrect answer. (a) Anita answered all the questions. She scored 40 marks even though 15 of her answers were correct. How many of her answers were incorrect? How many questions are in the test?

SOLUTION

Let the number of incorrect answers = w.
Marks from correct answers = 15 × 4 = 60.
Marks from incorrect answers = w × (–2) = –2w.

Total marks: 60 + (–2w) = 40.
–2w = 40 – 60 = –20.
w = 10.

Total questions = correct + incorrect = 15 + 10 = 25.

Answer: Anita had 10 incorrect answers; the test had 25 questions

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Q14 In a test, (+4) marks are given for every correct answer and (–2) marks for every incorrect answer. (b) Anil scored (–10) marks even though he had 5 correct answers. How many of his answers were incorrect? Did he leave any questions unanswered?

SOLUTION

Let the number of incorrect answers = w.
Marks from correct answers = 5 × 4 = 20.
Marks from incorrect answers = w × (–2) = –2w.

Total marks: 20 + (–2w) = –10.
–2w = –10 – 20 = –30.
w = 15.

Total questions Anil answered = 5 + 15 = 20.
We cannot determine if he left any unanswered without knowing the total number of questions in the test.

Answer: Anil had 15 incorrect answers; whether he left any unanswered cannot be determined without knowing the total questions

Q15 Pick the pattern — find the operations done by the machine shown. The machine takes 3 inputs (a, b, c) and gives outputs: (4, 8, –3) → 28; (6, 9, 6) → –48; (2, 3, –2) → 8; (–9, 5, –8) → 31; (7, –4, –6) → –17; (–16, –6, –9) → ?

SOLUTION

Test pattern a – (b × c):

4 – (8 × (–3)) = 4 – (–24) = 4 + 24 = 28 ✓

6 – (9 × 6) = 6 – 54 = –48 ✓

2 – (3 × (–2)) = 2 – (–6) = 2 + 6 = 8 ✓

(–9) – (5 × (–8)) = –9 – (–40) = –9 + 40 = 31 ✓

7 – ((–4) × (–6)) = 7 – 24 = –17 ✓

The operation is: first – (second × third).

Last row: (–16) – ((–6) × (–9)) = (–16) – 54 = –70.

Answer: Operation: a – (b × c); last row answer = –70

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Q16 Imagine you're in a place where the temperature drops by 5°C each hour. If the temperature is currently at 8°C, write an expression which denotes the temperature after 4 hours.

SOLUTION

Temperature drop per hour = –5°C.

After 4 hours, total change = 4 × (–5) = –20°C.

Temperature after 4 hours = 8 + 4 × (–5) = 8 + (–20) = –12°C.

Answer: Temperature after 4 hours = 8 + 4 × (–5) = –12°C

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Q17 Find 3 consecutive numbers with a product of (a) –6

SOLUTION

Let the three consecutive numbers be n–1, n, n+1.

Try n = –2: (–3) × (–2) × (–1) = 6 × (–1) = –6 ✓

Answer: The three consecutive numbers are –3, –2, –1

**Q18** Find 3 consecutive numbers with a product of (b) 120

SOLUTION

Let the three consecutive numbers be n–1, n, n+1.
Try n = 5: 4 × 5 × 6 = 120 ✓

Answer: The three consecutive numbers are 4, 5, 6

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**Q19** An alien society uses a peculiar currency called 'pibs' with two denominations — a +13 pibs coin and a –9 pibs coin. Using the two denominations, try to get the following totals: (a) +20

SOLUTION

We need: (number of +13 coins) × 13 + (number of –9 coins) × (–9) = 20.
Try 5 coins of +13 and 5 coins of –9:
5 × 13 + 5 × (–9) = 65 – 45 = 20 ✓

Answer: 5 coins of +13 pibs and 5 coins of –9 pibs

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**Q20** Using +13 and –9 pib coins, get a total of: (b) +40

SOLUTION

Try 10 coins of +13 and 10 coins of –9:
10 × 13 + 10 × (–9) = 130 – 90 = 40 ✓

Answer: 10 coins of +13 pibs and 10 coins of –9 pibs

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**Q21** Using +13 and –9 pib coins, get a total of: (c) –50

SOLUTION

Try 1 coin of +13 and 7 coins of –9:
1 × 13 + 7 × (–9) = 13 – 63 = –50 ✓

Answer: 1 coin of +13 pibs and 7 coins of –9 pibs

Q22 Using +13 and –9 pib coins, get a total of: (d) +8

SOLUTION

Try 2 coins of +13 and 2 coins of –9:
2 × 13 + 2 × (–9) = 26 – 18 = 8 ✓

Answer: 2 coins of +13 pibs and 2 coins of –9 pibs

Q23 Using +13 and –9 pib coins, get a total of: (e) +10

SOLUTION

Try 7 coins of +13 and 9 coins of –9:
7 × 13 + 9 × (–9) = 91 – 81 = 10 ✓

Answer: 7 coins of +13 pibs and 9 coins of –9 pibs

Q24 Using +13 and –9 pib coins, get a total of: (f) –2

SOLUTION

Try 4 coins of +13 and 6 coins of –9:
4 × 13 + 6 × (–9) = 52 – 54 = –2 ✓

Answer: 4 coins of +13 pibs and 6 coins of –9 pibs

Q25 Using +13 and –9 pib coins, get a total of: (g) +1

SOLUTION

Try 7 coins of +13 and 10 coins of –9:
7 × 13 + 10 × (–9) = 91 – 90 = 1 ✓

Answer: 7 coins of +13 pibs and 10 coins of –9 pibs

Q26 Find the value of: (a) (32 × (–18)) ÷ (–36)

SOLUTION

Step 1: 32 × (–18) = –576.
Step 2: (–576) ÷ (–36) = 16.
(Both dividend and divisor negative → quotient positive.)
576 ÷ 36 = 16.

Answer: (32 × (–18)) ÷ (–36) = 16

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Q27 Find the value of: (b) 32 ÷ ((–36) × (–18))

SOLUTION

Step 1: (–36) × (–18) = 648.
Step 2: 32 ÷ 648 = 4/81.
(Dividend positive, divisor positive → quotient positive.)

Answer: 32 ÷ ((–36) × (–18)) = 4/81

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Q28 Find the value of: (c) (25 × (–12)) ÷ ((45) × (–27))

SOLUTION

Step 1: 25 × (–12) = –300.
Step 2: 45 × (–27) = –1215.
Step 3: (–300) ÷ (–1215) = 300/1215 = 20/81.
(Both negative → quotient positive.)

Answer: (25 × (–12)) ÷ (45 × (–27)) = 20/81

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Q29 Find the value of: (d) (280 × (–7)) ÷ ((–8) × (–35))

SOLUTION

Step 1: 280 × (–7) = –1960.
Step 2: (–8) × (–35) = 280.
Step 3: (–1960) ÷ 280 = –7.
(Dividend negative, divisor positive → quotient negative.)
1960 ÷ 280 = 7.

Answer: (280 × (–7)) ÷ ((–8) × (–35)) = –7

Q30 Arrange the expressions given below in increasing order: (a) (–348) + (–1064), (b) (–348) – (–1064), (c) 348 – (–1064), (d) (–348) × (–1064), (e) 348 × (–1064), (f) 348 × 964

SOLUTION

Evaluate each expression:
(a) (–348) + (–1064) = –1412
(b) (–348) – (–1064) = –348 + 1064 = 716
(c) 348 – (–1064) = 348 + 1064 = 1412
(d) (–348) × (–1064) = 370272
(e) 348 × (–1064) = –370272
(f) 348 × 964 = 335472

Arranging from smallest to largest:
(e) –370272 < (a) –1412 < (b) 716 < (c) 1412 < (f) 335472 < (d) 370272

Answer: (e) < (a) < (b) < (c) < (f) < (d)

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Q31 Given that (–548) × 972 = –532656, write the value of: (a) (–547) × 972

SOLUTION

(–547) = (–548) + 1.
(–547) × 972 = ((–548) + 1) × 972 = (–548) × 972 + 1 × 972.
= –532656 + 972 = –531684.

Answer: (–547) × 972 = –531684

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Q32 Given that (–548) × 972 = –532656, write the value of: (b) (–548) × 971

SOLUTION

971 = 972 – 1.
(–548) × 971 = (–548) × (972 – 1) = (–548) × 972 – (–548) × 1.
= –532656 – (–548) = –532656 + 548 = –532108.

Answer: (–548) × 971 = –532108

Q33 Given that (–548) × 972 = –532656, write the value of: (c) (–547) × 971

SOLUTION

Use the result from (b): (–548) × 971 = –532108.
(–547) × 971 = ((–548) + 1) × 971 = (–548) × 971 + 1 × 971.
= –532108 + 971 = –531137.

Answer: (–547) × 971 = –531137

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Q34 Given that 207 × (–33 + 7) = –5382, write the value of –207 × (33 – 7).

SOLUTION

Note that –33 + 7 = –26 and 33 – 7 = 26.
So 207 × (–26) = –5382, which means 207 × 26 = 5382.

Now: –207 × (33 – 7) = –207 × 26 = –(207 × 26) = –5382.

Alternatively: –207 × (33 – 7) = –207 × 26 = 207 × (–26) = 207 × (–33 + 7) = –5382.

Answer: –207 × (33 – 7) = –5382

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Q35 Use the numbers 3, –2, 5, –6 exactly once and the operations '+', '–', and '×' exactly once and brackets as necessary to write an expression such that (a) the result is the maximum possible.

SOLUTION

To maximise, we want to multiply two numbers whose product is large and positive.
Try: (–2) – (3 + 5) × (–6).
= (–2) – 8 × (–6)

Using brackets so × is applied to (–2)–(3+5) first:
((–2) – (3 + 5)) × (–6) = (–2 – 8) × (–6) = (–10) × (–6) = 60.
This uses each of 3, –2, 5, –6 once and operations +, –, × once.

Answer: Maximum = 60, using expression ((–2) – (3 + 5)) × (–6)

Q36 Use the numbers 3, –2, 5, –6 exactly once and the operations '+', '–', and '×' exactly once and brackets as necessary to write an expression such that (b) the result is the minimum possible.

SOLUTION

To minimise, we want a large negative product.

Try: ((3 – (–2)) + 5) × (–6).

= (3 + 2 + 5) × (–6)

= 10 × (–6) = –60.

This uses 3, –2, 5, –6 once and operations –, +, × once.

Answer: Minimum = –60, using expression ((3 – (–2)) + 5) × (–6)