Infinity Masterclasses
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MTSE 2026 | CLASS 5–6

Detailed Solutions

Step-by-step solutions



Answer Key

Q1 D	Q2 C	Q3 C	Q4 A	Q5 B
Q6 C	Q7 A	Q8 B	Q9 D	Q10 D
Q11 B	Q12 A	Q13 D	Q14 B	Q15 C
Q16 A	Q17 C	Q18 D	Q19 A	Q20 B
Q21 A	Q22 B	Q23 A	Q24 C	Q25 B

Colours follow the case studies: 1 Paper Cutting · 2 Same Perimeter, Different Areas · 3 Balance Puzzle · 4 Gear Train · 5 Matchmaker's Count

How to use this booklet. Each solution has a short title, numbered steps in simple words, and a coloured answer box. A "Watch out" note shows a mistake that children often make.

Scoring. 25 questions × 4 marks = 100 marks. There is no negative marking. Correct options: A × 7, B × 7, C × 6, D × 5.

CASE STUDY 1

Paper Cutting Puzzle



QUESTIONS
1 – 5
5 × 4 = 20 marks

1 Most pieces with 5 cuts

What is the greatest number of pieces that 5 cuts can make?

Step 1. Start with the uncut paper. It is 1 piece.

Step 2. To get the most pieces, follow the key rule. Each new cut adds one more piece than the cut before.

Step 3. Add the new pieces cut by cut:

1st cut: 1 + 1 = 2 | 2nd cut: 2 + 2 = 4 | 3rd cut: 4 + 3 = 7

4th cut: 7 + 4 = 11 | 5th cut: 11 + 5 = 16

Step 4. So 5 cuts can make 16 pieces at most.

ANSWER D **16 pieces**

2 Most pieces with 8 cuts

What is the greatest number of pieces that 8 cuts can make?

Step 1. Carry on with the pattern from Question 1. After 5 cuts there are 16 pieces.

6th cut: 16 + 6 = 22 | 7th cut: 22 + 7 = 29 | 8th cut: 29 + 8 = 37

Step 2. So 8 cuts can make 37 pieces at most.

Watch out. *If you add 1 + 2 + 3 + 4 + 5 + 6 + 7 + 8 = 36 and stop, you forget the starting piece. The uncut paper is already 1 piece. So the answer is 36 + 1 = 37.*

ANSWER C **37 pieces**

3 New pieces from one new cut

A new cut crosses 10 earlier cuts. How many new pieces does it make?

Step 1. The 10 crossings cut the new cut into parts.

Step 2. Think of cutting a rope. 1 cross-cut makes 2 parts. 2 cross-cuts make 3 parts. So 10 cross-cuts make 10 + 1 = 11 parts.

Step 3. Each part cuts one old piece in two. So each part adds 1 new piece.

Step 4. So the new cut makes 11 new pieces.

Step 5. Check with the pictures. The 4th cut crosses 3 earlier cuts. It makes 3 + 1 = 4 parts and adds 4 pieces. This matches.

ANSWER C **11 new pieces**

4 Which cut adds 9 pieces?

Each cut is placed to make the most pieces. Which cut adds 9 new pieces?

Step 1. Look at the pattern. The 1st cut adds 1 piece. The 2nd cut adds 2 pieces. The 3rd cut adds 3 pieces.

Step 2. So the cut with the number 9 adds 9 pieces.

Step 3. The 9th cut adds 9 new pieces.

Watch out. *The 10th cut adds 10 pieces, not 9. The number of the cut and the number of new pieces are the same.*

ANSWER A **9th**

5 Fewest cuts for at least 20 pieces

What is the fewest number of cuts needed to get at least 20 pieces?

Step 1. Use the totals from Questions 1 and 2.

Cuts	4	5	6
Pieces	11	16	22

Step 2. 5 cuts make only 16 pieces. That is less than 20.

Step 3. 6 cuts make 22 pieces. That is more than 20.

Step 4. So the fewest number of cuts is 6.

ANSWER B 6 cuts

CASE STUDY 2

Same Perimeter, Different Areas



QUESTIONS
6 – 10
5 × 4 = 20 marks

6 Greatest area from 34 sticks

A rectangle's border uses 34 sticks. Each side has a whole number of sticks. What is the greatest area?

Step 1. A rectangle has 2 long sides and 2 short sides. So one long side and one short side together use half of the sticks.

34 ÷ 2 = 17 sticks

Step 2. Now try the pairs of sides that add up to 17 sticks. Find the area of each by multiplying.

Sides (sticks)	1 and 16	2 and 15	3 and 14	4 and 13	5 and 12	6 and 11	7 and 10	8 and 9
Area (squares)	16	30	42	52	60	66	70	72

Step 3. The greatest area is 72 squares. It comes from the sides 8 sticks and 9 sticks. These sides are nearly equal.

Watch out. *81 squares would need sides 9 and 9. That needs 9 + 9 + 9 + 9 = 36 sticks, but we have only 34 sticks.*

ANSWER C 72 squares

7 Growing the area step by step

28 sticks. The sides change from 4 and 10, to 5 and 9, to 6 and 8, to 7 and 7. How many more squares after each change?

Step 1. Find the area of each rectangle. Multiply the two sides.

4 × 10 = 40 squares | 5 × 9 = 45 squares | 6 × 8 = 48 squares | 7 × 7 = 49 squares

Step 2. Find how many more squares after each change. Subtract the earlier area from the new area.

45 − 40 = 5 squares | 48 − 45 = 3 squares | 49 − 48 = 1 square

Step 3. So the area grows by 5 squares, then 3 squares, then 1 square.

ANSWER A 5 squares, then 3 squares, then 1 square

8 Find the sides

A rectangle uses 26 sticks. It has 40 squares inside. What are its side lengths?

Step 1. One long side and one short side together use half of the sticks.

26 ÷ 2 = 13 sticks

Step 2. Find two sides that add up to 13 and multiply to 40. Try each option.

Sides	Add up to	Area
4 and 9	13	36
5 and 8	13	40
6 and 7	13	42
3 and 10	13	30

Step 3. Only 5 sticks and 8 sticks give an area of 40 squares.

ANSWER B **5 sticks and 8 sticks**

9 Is this rectangle possible?

Whole-number sides. 24 sticks. 30 squares inside. Is this possible?

Step 1. One long side and one short side together use half of the sticks.

$$24 \div 2 = 12 \text{ sticks}$$

Step 2. List all the pairs of whole numbers that add up to 12 and find each area.

Sides	1, 11	2, 10	3, 9	4, 8	5, 7	6, 6
Area	11	20	27	32	35	36

Step 3. 30 squares is not in the list. So the answer is No.

Step 4. Two sides that add up to 12 sticks never make an area of 30 squares.

Watch out. *The greatest area is 36 squares, not 30. And the sides 3 and 9 make 27 squares, not 30.*

ANSWER D **No. Two sides that add up to 12 sticks never make an area of 30 squares.**

10 The bigger garden

A square garden has a border of 24 sticks. The border is made bigger, with 28 sticks. How many more squares does it cover?

Step 1. A square has 4 equal sides. Share the sticks equally among the 4 sides.

$$24 \div 4 = 6 \text{ sticks on each side} \quad | \quad 28 \div 4 = 7 \text{ sticks on each side}$$

Step 2. Find the area of each square.

$$6 \times 6 = 36 \text{ squares} \quad | \quad 7 \times 7 = 49 \text{ squares}$$

Step 3. Subtract the old area from the new area.

$$49 - 36 = 13 \text{ squares}$$

Step 4. The garden covers 13 more squares.

ANSWER D **13 squares**

CASE STUDY 3

The Balance Puzzle



QUESTIONS **11 – 15**

5 × 4 = 20 marks

11 Two boxes and 6 tiles

One pan has 2 boxes and 6 tiles. The other pan has 22 tiles.

Step 1. Write what we see.

$$2\square + 6 = 22$$

Step 2. Move A: remove 6 tiles from both pans. The scale stays level.

$$2\square = 22 - 6 = 16$$

Step 3. Move B: share 16 tiles equally among the 2 boxes.

$$\square = 16 \div 2 = 8$$

Step 4. Check: 2 × 8 + 6 = 22. This is correct. Each box holds 8 tiles.

ANSWER B **8 tiles**

12 Boxes on both pans

One pan has 1 box and 11 tiles. The other pan has 3 boxes and 3 tiles.

Step 1. Write what we see.

□ + 11 = 3□ + 3

Step 2. Move C: remove 1 box from both pans.

11 = 2□ + 3

Step 3. Move A: remove 3 tiles from both pans.

8 = 2□

Step 4. Move B: share 8 tiles equally among the 2 boxes.

□ = 8 ÷ 2 = 4

Step 5. Check: 4 + 11 = 15 and 3 × 4 + 3 = 15. Both pans are equal. Each box holds 4 tiles.

ANSWER A **4 tiles**

13 Half a box

The left pan has 2 boxes and 5 tiles. The right pan has half a box and 20 tiles.

Step 1. Write what we see. Half a box is ½□.

2□ + 5 = ½□ + 20

Step 2. Move A: remove 5 tiles from both pans.

2□ = ½□ + 15

Step 3. Move C: remove half a box from both pans. The left pan has 1½ boxes left.

1½ □ = 15

Step 4. 1½ boxes is 3 halves of a box. Share 15 tiles equally among the 3 halves.

Half a box = 15 ÷ 3 = 5 tiles

Step 5. A whole box is 2 halves.

1 box = 5 + 5 = 10 tiles

Step 6. Check: 2 × 10 + 5 = 25 and 5 + 20 = 25. The pans are equal.

ANSWER D **10 tiles**

14 Mira moves a box

Left: 3 boxes and 4 tiles. Right: 2 boxes and 13 tiles. Mira moves 1 box from left to right.

Step 1. First find the tiles in 1 box. Write what we see.

3□ + 4 = 2□ + 13

Step 2. Move C: remove 2 boxes from both pans.

□ + 4 = 13

Step 3. Move A: remove 4 tiles from both pans.

□ = 9 tiles

Step 4. Now Mira moves 1 box from the left pan to the right pan. Count each pan.

	Boxes	Tiles	Total tiles
Left pan	2 boxes	4	2 × 9 + 4 = 22
Right pan	3 boxes	13	3 × 9 + 13 = 40

Step 5. The right pan is heavier. Find the difference.

40 − 22 = 18

Step 6. Mira must add 18 tiles to the left pan.

ANSWER B **18 tiles**

15 Two scales

Scale A: 2 boxes and 3 tiles on one pan, 1 box and 12 tiles on the other. Scale B: 3 boxes and some tiles on the left, 5 boxes and 1 tile on the right.

Step 1. Use Scale A to find the tiles in 1 box.

$$2\square + 3 = \square + 12$$

Step 2. Move C: remove 1 box from both pans.

$$\square + 3 = 12$$

Step 3. Move A: remove 3 tiles from both pans.

$$\square = 9 \text{ tiles}$$

Step 4. Now use Scale B. Every box holds 9 tiles. Count the tiles on the right pan.

$$5 \times 9 + 1 = 46 \text{ tiles}$$

Step 5. The left pan has 3 boxes.

$$3 \times 9 = 27 \text{ tiles}$$

Step 6. The left pan needs more tiles to be equal to 46.

$$46 - 27 = 19 \text{ tiles}$$

Step 7. Check: 27 + 19 = 46. The pans are equal.

ANSWER C **19 tiles**

CASE STUDY 4

The Gear Train



QUESTIONS
16 – 20
5 × 4 = 20 marks

16 A small gear drives a bigger gear

A gear with 10 teeth turns 3 times clockwise. It turns a gear with 15 teeth.

Step 1. Use the rule: teeth of Gear 1 × turns of Gear 1 = teeth of Gear 2 × turns of Gear 2.

Step 2. Count the teeth that pass on the first gear.

$$10 \text{ teeth} \times 3 \text{ turns} = 30 \text{ teeth}$$

Step 3. The same 30 teeth pass on the second gear. It has 15 teeth.

$$15 \times (\text{turns}) = 30, \text{ so turns} = 30 \div 15 = 2$$

Step 4. The first gear turns clockwise. Touching gears turn in opposite directions. So the second gear turns anticlockwise.

Watch out. *4½ comes from 15 × 3 ÷ 10. That is the wrong way round. A bigger gear must turn fewer times, not more.*

ANSWER A **2 turns anticlockwise**

17 Half a turn

A gear with 12 teeth makes half a turn. It touches a gear with 8 teeth.

Step 1. Half a turn of the 12-teeth gear passes half of its teeth.

$$12 \div 2 = 6 \text{ teeth}$$

Step 2. The same 6 teeth pass on the 8-teeth gear. Write this as a fraction of its 8 teeth.

$$6 \text{ out of } 8 = 6/8 = 3/4$$

Step 3. The gear with 8 teeth makes ¾ of a turn.

Step 4. Check: ¾ of 8 teeth = 6 teeth. This matches.

ANSWER C **¾**

18 Fastest to slowest

The 12-teeth gear makes 1 full turn while touching gears with 6, 12 and 18 teeth.

Step 1. One full turn of the 12-teeth gear passes 12 teeth.

Step 2. Find the turns of each gear. Divide 12 by its number of teeth.

Gear	Teeth passing	Turns
6 teeth	12	12 ÷ 6 = 2 turns
12 teeth	12	12 ÷ 12 = 1 turn
18 teeth	12	12 ÷ 18 = ⅔ of a turn

Step 3. Now put them in order, from the most turns to the fewest turns: 2 turns, 1 turn, ⅔ of a turn.

Step 4. The order is: 6 teeth, 12 teeth, 18 teeth. A gear with fewer teeth turns more times.

ANSWER D **6 teeth, 12 teeth, 18 teeth**

19 Four gears in a row

Gear A has 6 teeth, B has 12, C has 8 and D has 4. Gear A turns 4 times clockwise.

Step 1. Find the teeth that pass on Gear A.

6 teeth × 4 turns = 24 teeth

Step 2. Gears that touch share the same teeth movement. So 24 teeth pass on every gear in the row.

Step 3. Find the turns of Gear D. It has 4 teeth.

24 ÷ 4 = 6 turns

Step 4. Now find the direction. Touching gears turn in opposite directions.

Gear	A	B	C	D
Direction	clockwise	anticlockwise	clockwise	anticlockwise

Step 5. Gear D turns 6 times anticlockwise.

ANSWER A **6 turns anticlockwise**

20 Marked teeth meet again

An 8-teeth gear and a 12-teeth gear touch. Each has a marked tooth at the meeting place at the start.

Step 1. The marked teeth meet again when the same number of teeth have passed on both gears. This number must be in the 8 times table and in the 12 times table.

Multiples of 8: 8, 16, 24, 32 ...

Multiples of 12: 12, 24, 36 ...

Step 2. The smallest number in both lists is 24. So 24 teeth must pass.

Step 3. Find the turns of each gear.

8-teeth gear: 24 ÷ 8 = 3 turns | 12-teeth gear: 24 ÷ 12 = 2 turns

Step 4. Check with option B: 8 × 3 = 24 and 12 × 2 = 24.

Watch out. *Option D (6 turns and 4 turns) also passes 48 teeth on both gears, and it is a correct meeting. But the marked teeth meet earlier, after 24 teeth. We need the first time.*

ANSWER B **8 teeth: 3 turns; 12 teeth: 2 turns**

CASE STUDY 5

The Matchmaker's Count



QUESTIONS
21 – 25
5 × 4 = 20 marks

21 Seven players

Seven players play a tournament. Every player plays every other player once.

Step 1. Let the players walk in one by one. Count the new matches each player adds.

Player	1st	2nd	3rd	4th	5th	6th	7th
New matches	0	1	2	3	4	5	6

Step 2. Add them up.

$$0 + 1 + 2 + 3 + 4 + 5 + 6 = 21$$

Step 3. So 21 matches are played.

ANSWER A **21 matches**

22 The 8th player

The 8th player walks in. How many new matches does this player add?

Step 1. A new player plays every player who is already there.

Step 2. Before the 8th player walks in, 7 players are there.

Step 3. So the 8th player plays 7 new matches.

Step 4. Look at the pattern: the 2nd player adds 1, the 3rd adds 2, the 4th adds 3. The 8th player adds $8 - 1 = 7$.

ANSWER B **7 matches**

23 A new player joins

Six players have played all their matches. Then 1 new player joins.

Step 1. The new player plays every player who is already there.

Step 2. 6 players are already there.

Step 3. So the new player plays 6 more matches.

Watch out. *You do not need to find the 15 matches that were already played. Count only the new matches.*

ANSWER A **6 matches**

24 How many players?

There are 15 matches in all. How many players are there?

Step 1. Add the new matches player by player, until the total reaches 15.

Players	1	2	3	4	5	6
Total matches	0	1	3	6	10	15

Step 2. For example, the 6th player adds 5 matches: $10 + 5 = 15$.

Step 3. The total is 15 with 6 players.

ANSWER C **6 players**

25 Fewest time slots

Four players. Every player plays one game against every other player. A player can play only one game in a time slot.

Step 1. Call the players A, B, C and D. List all the games.

AB, AC, AD, BC, BD, CD | (6 games)

Step 2. Each game needs 2 players. There are only 4 players. So at most 2 games can be played in one time slot.

Step 3. Divide the games into time slots of 2 games.

$$6 \text{ games} \div 2 \text{ games in each slot} = 3 \text{ slots}$$

Step 4. So at least 3 time slots are needed. Now check that 3 slots are enough.

Time slot	Games played
Slot 1	AB and CD
Slot 2	AC and BD
Slot 3	AD and BC

Step 5. Each player plays only once in each slot. All 6 games are done. So 3 time slots are enough.

ANSWER B **3 time slots**