Estimation Card Sort **Answers**

$\dfrac{462 \times 81}{0.41}$	100 000
$\dfrac{4.91 \times 3.95}{0.39 \times 0.52}$	100
The two integers that $\sqrt{26}$ lies between.	5 and 6
$\sqrt{26}$ to 1d.p.	5.1
$4.2 \times 5.2 \div 0.51$	40
The two integers that $\sqrt{85}$ lies between.	9 and 10
$\sqrt{85}$ to 1 decimal place.	9.2
$\dfrac{3.82 \times 7.95}{9.7}$	3.2

$$\frac{462 \times 81}{0.41}$$

$$\frac{4.91 \times 3.95}{0.39 \times 0.52}$$

The two integers that √26 lies between.

$4.2 \times 5.2 \div 0.51$

The two integers that √85 lies between.

√85 to 1 decimal place.

$$\frac{3.82 \times 7.95}{9.7}$$

5.1

40

100

9.2

100 000

3.2

9 and 10

5 and 6

$$\frac{462 \times 81}{0.41}$$

$$\frac{4.91 \times 3.95}{0.39 \times 0.52}$$

The two integers that √26 lies between.

√26 to 1d.p.

$$4.2 \times 5.2 \div 0.51$$

The two integers that √85 lies between.

√85 to 1 decimal place.

$$\frac{3.82 \times 7.95}{9.7}$$

5.1

40

100

9.2

100 000

3.2

9 and 10

5 and 6

Estimation Card Sort **Answers**

450 + 201	700
68 × 2.4	140
59.4 ÷ 2.9	20
7.88 × 5.2	40
4.2 × 5.2 ÷ 0.51	40
20.2 − 9.01 + 1.92	13
208 ÷ 0.378	500
2.5 × 2.3 × 5.9	36

$450 + 201$

68×2.5

$59.4 \div 2.9$

7.88×5.2

$4.2 \times 5.2 \div 0.51$

$20.2 - 9.01 + 1.92$

$208 \div 0.378$

$2.5 \times 2.3 \times 5.9$

Estimation Card Sort	Estimation Card Sort
20	40

Estimation Card Sort	Estimation Card Sort
700	13

Estimation Card Sort	Estimation Card Sort
500	140

Estimation Card Sort	Estimation Card Sort
36	40

450 + 201

68 × 2.5

59.4 ÷ 2.9

7.88 × 5.2

4.2 × 5.2 ÷ 0.51

20.2 - 9.01 + 1.92

208 ÷ 0.378

2.5 × 2.3 × 5.9

20

40

700

13

500

140

36

40

Estimation Card Sort **Answers**

$\dfrac{462 \times 81}{0.41}$	100 000
$\dfrac{4.91 \times 3.95}{0.39 \times 0.52}$	100
$\dfrac{38.3 + 27.5}{0.762}$	87.5
$\dfrac{29.\,8 + 29.7}{0.28}$	200
$4.2 \times 5.2 \div 0.51$	40
$20.2 - 9.01 + 1.92$	13
$\dfrac{585 - 212}{0.22}$	2000
$2.5 \times 2.3 \times 5.9$	36

$$\frac{462 \times 81}{0.41}$$

$$\frac{4.91 \times 3.95}{0.39 \times 0.52}$$

$$\frac{38.3 + 27.5}{0.762}$$

$$\frac{29.\ 8 + 29.7}{0.28}$$

$$4.2 \times 5.2 \div 0.51$$

$$20.2 - 9.01 + 1.92$$

$$\frac{585 - 212}{0.22}$$

$$2.5 \times 2.3 \times 5.9$$

Estimation Card Sort

200

Estimation Card Sort

2000

Estimation Card Sort

100 000

Estimation Card Sort

36

Estimation Card Sort

87.5

Estimation Card Sort

100

Estimation Card Sort

13

Estimation Card Sort

40

$$\frac{462 \times 81}{0.41}$$

$$\frac{4.91 \times 3.95}{0.39 \times 0.52}$$

$$\frac{38.3 + 27.5}{0.762}$$

$$\frac{29.\ 8 + 29.7}{0.28}$$

$$4.2 \times 5.2 \div 0.51$$

$$20.2 - 9.01 + 1.92$$

$$\frac{585 - 212}{0.22}$$

$$2.5 \times 2.3 \times 5.9$$

Estimation Card Sort	Estimation Card Sort
200	2000
Estimation Card Sort	Estimation Card Sort
100 000	36
Estimation Card Sort	Estimation Card Sort
87.5	100
Estimation Card Sort	Estimation Card Sort
13	40

Estimation

Approximate the value of each of the following by rounding each number to 1 significant figure.

1. Which two integers does $\sqrt{8}$ lie between?

    _____

    _____

2. Which two integers does $\sqrt{130}$ lie between?

    _____

    _____

3. Which two integers does $\sqrt{28}$ lie between?

    _____

    _____

4. Which two integers does $\sqrt{19}$ lie between?

    _____

    _____

5. Which two integers does $\sqrt{24}$ lie between?

    _____

    _____

6. Approximate $\sqrt{90}$ to 1d.p.

    _____

    _____

7. Approximate $\sqrt{50}$ to 1d.p.

    _____

    _____

8. Approximate $\sqrt{72}$ to 1d.p.

    _____

    _____

9. Explain why $\sqrt{20}$ lies between 4 and 5.

    _____

    _____

10. Explain why $\sqrt{65}$ lies between 8 and 9.

    _____

    _____

Estimation **Answers**

1. **2 and 3 because $\sqrt{4} < \sqrt{8} < \sqrt{9}$**

2. **11 and 12 because $\sqrt{121} < \sqrt{130} < \sqrt{144}$**

3. **5 and 6 because $\sqrt{25} < \sqrt{28} < \sqrt{36}$**

4. **4 and 5 because $\sqrt{16} < \sqrt{19} < \sqrt{25}$**

5. **4 and 5 because $\sqrt{16} < \sqrt{24} < \sqrt{25}$**

6. **$9^2 = 81$**
   $10^2 = 100$
   $90 - 81 = 9$
   $100 - 81 = 19$
   $9 \div 19 = 0.5$ to 1d.p.
   $9 + 0.5 = 9.5$
   $\sqrt{90}$ to 1d.p. = 9.5

7. **$7^2 = 49$**
   $8^2 = 64$
   $50 - 49 = 1$
   $64 - 49 = 15$
   $1 \div 15 = 0.1$ to 1d.p.
   $7 + 0.1 = 7.1$
   $\sqrt{50}$ to 1d.p. = 7.1

8. **$8^2 = 64$**
   $9^2 = 81$
   $72 - 64 = 8$
   $81 - 64 = 17$
   $8 \div 17 = 0.5$ to 1d.p.
   $8 + 0.5 = 8.5$
   $\sqrt{72}$ to 1d.p. = 8.5

9. **$4^2 = 16$**
   $5^2 = 25$
   $\sqrt{16} < \sqrt{20} < \sqrt{25}$

10. **$8^2 = 64$**
    $9^2 = 81$
    $\sqrt{64} < \sqrt{65} < \sqrt{81}$

Estimation

Approximate the value of each of the following by rounding each number to 1 significant figure.

1. 7.15 × 2.14

2. 14.45 + 31.7

3. 312.6 – 49.8

4. 5.01 × 0.89

5. 24.02 ÷ 2.4

6. 56.92 + 17.09

7. 712 +201

8. 2.9 × 7.09

9. 4.7 × 5.2 + 1.92

10. 19.7 – 9.02 ÷ 0.51

Estimation **Answers**

1. **7 × 2 = 14**
2. **10 + 30 = 40**
3. **300 – 50 = 250**
4. **5 × 0.9 = 4.5**
5. **20 ÷ 2 = 10**
6. **60 + 20 = 80**
7. **700 + 200 = 900**
8. **3 × 7 = 21**
9. **5 × 5 + 2 = 27**
10. **20 – 9 ÷ 0.5 = 2**

Estimation

Approximate the value of each of the following by rounding each number to 1 significant figure.

1. $\dfrac{61 + 39}{1.6}$

2. $\dfrac{6.2 \times 4.8}{2.4}$

3. $\dfrac{5.9 - 2.4}{0.52}$

4. $\dfrac{982 - 102}{101}$

5. $\dfrac{482 + 5.2}{9.6 \times 0.51}$

6. $\dfrac{72.9 + 19.9}{2.7 \times 2.5}$

7. $\dfrac{35 + 5.2}{4.9 - 0.49}$

8. $\dfrac{310 + 292}{125}$

9. $\dfrac{424 + 30.2}{172}$

10. $\dfrac{52 \times 2.4}{142.2}$

Estimation **Answers**

1. **(60 + 40) ÷ 2 = 50**
2. **(6 × 5) ÷ 2 = 15**
3. **(6 – 2) ÷ 0.5 = 8**
4. **(1000 – 100) ÷ 100 = 9**
5. **(500 + 5) ÷ (10 × 0.5) = 101**
6. **(70 + 20) ÷ (3 × 3) = 10**
7. **(40 + 5) ÷ (5 – 0.5) = 10**
8. **(300 + 300) ÷ 100 = 6**
9. **(400 + 30) ÷ 200 = 2.15**
10. **(50 × 2) ÷ 100 = 1**

Estimation **Mixed Calculations Answers**

1. 10 + 30 = 40

2. 5 + 2 × 5 = 15

3. 20 − 9 ÷ 0.5 = 2

4. (70 + 20) ÷ (3 × 3) = 10

5. (300 + 300) ÷ 100 = 6

6. 50 + 9 − 10 = 49
    $\sqrt{49}$ = 7

7. 90 + 1 − 10 = 81
    $\sqrt{81}$ = 9

8. 5^2 = 25
    6^2 = 36
    $\sqrt{25} < \sqrt{28} < \sqrt{36}$
    $\sqrt{28}$ lies between 5 and 6.

9. 4^2 = 16
    5^2 = 25
    $\sqrt{16} < \sqrt{20} < \sqrt{25}$
    $\sqrt{20}$ lies between 4 and 5.

10. 7^2 = 49
    8^2 = 64
    $50 - 7^2$ = 1
    $8^2 - 7^2$ = 15
    1 ÷ 15 = 0.01 to 1d.p.
    7 + 0.1 = 7.1
    $\sqrt{50}$ to 1 decimal place ≈ 7.1

Estimation **Mixed Calculations**

Instructions

Answer each of the following questions by showing your working out clearly. Remember that, where necessary, you will need to round numbers in the question to 1 significant figure.

1. Estimate the value of: $14.45 + 31.7$

2. Estimate the value of: $4.7 + 1.92 \times 5.2$

3. Estimate the value of: $19.7 - 9.02 \div 0.51$

4. Estimate the value of: $\dfrac{72.9 + 19.6}{2.7 \times 2.5}$

5. Estimate the value of: $\dfrac{310 + 292}{125}$

6. Estimate the value of: $\sqrt{54.3 + 8.7 - 13.4}$

7. Estimate the value of: $\sqrt{92 + 1.32 - 12.6}$

_____

_____

_____

8. Which integers does $\sqrt{28}$ lie between?

_____

_____

_____

9. Explain why $\sqrt{20}$ lies between 4 and 5.

_____

_____

_____

10. Approximate $\sqrt{50}$ to 1d.p.

_____

_____

_____

_____

Estimation **Mixed Calculations**

Instructions

Answer each of the following questions by showing your working out clearly. Remember that, where necessary, you will need to round numbers in the question to 1 significant figure.

1. Estimate the value of: 14.45 + 31.7

_____

_____

2. Estimate the value of: 4.7 + 1.92 × 5.2

Hint 1: Round each number to 1 significant figure.
Hint 2: Remember BIDMAS.

3. Estimate the value of: 19.7 – 9.02 ÷ 0.51

Hint 1: Round each number to 1 significant figure.
Hint 2: Remember BIDMAS.

4. Estimate the value of: $\dfrac{72.9 + 19.6}{2.7 \times 2.5}$

Hint 1: Round each number to 1 significant figure.
Hint 2: Calculate the addition followed by the multiplication.
Hint 3: Carry out the division.

5. Estimate the value of: $\dfrac{310 + 292}{125}$

Hint 1: Round each number to 1 significant figure.
Hint 2: Carry out the division.

6. Estimate the value of: $\sqrt{54.3 + 8.7 - 13.4}$

Hint 2: Remember your BIDMAS.

7. Estimate the value of: $\sqrt{92 + 1.32 - 12.6}$

_____

_____

_____

| Hint 1: Complete the calculations inside the square root. |
| Hint 2: Square root. |

8. Which integers does $\sqrt{28}$ lie between?

$5^2 =$ _____

$6^2 =$ _____

_____

_____

9. Explain why $\sqrt{20}$ lies between 4 and 5.

$4^2 =$ _____

$5^2 =$ _____

_____

_____

10. Approximate $\sqrt{50}$ to 1d.p.

$7^2 =$ _____

$8^2 =$ _____

$50 - 7^2 =$ _____

$8^2 - 7^2 =$ _____

$(50 - 7^2) \div (8^2 - 7^2) =$ _____

_____

_____

Estimation **Mixed Calculations**

Instructions

Answer each of the following questions by showing your working out clearly. Remember that, where necessary, you will need to round numbers in the question to 1 significant figure.

1. Estimate the value of: 14.45 + 31.7

_____

_____

2. Estimate the value of: 4.7 + 1.92 × 5.2

_____ | Hint : BIDMAS |

_____

_____

3. Estimate the value of: 19.7 − 9.02 ÷ 0.51

_____ | Hint : BIDMAS |

_____

_____

4. Estimate the value of: $\dfrac{72.9 + 19.6}{2.7 × 2.5}$

_____ | Hint : Your final step is to divide |

_____

_____

5. Estimate the value of: $\dfrac{310 + 292}{125}$

_____ | Hint : Your final step is to divide |

_____

_____

6. Estimate the value of: $\sqrt{54.3 + 8.7 - 13.4}$

_____ | Hint : Complete the calculations inside the square root first |

_____

7. Estimate the value of: $\sqrt{92 + 1.32 - 12.6}$

Hint : BIDMAS

8. Which integers does $\sqrt{28}$ lie between?

Hint : What are the perfect squares above and below 28?

9. Explain why $\sqrt{20}$ lies between 4 and 5.

Hint : What are the perfect squares above and below 20?

10. Approximate $\sqrt{50}$ to 1d.p.

$7^2 =$ _____

$8^2 =$ _____

$50 - 7^2 =$ _____

$8^2 - 7^2 =$ _____

$(50 - 7^2) \div (8^2 - 7^2) =$ _____

Number and Place Value
Estimation Quiz
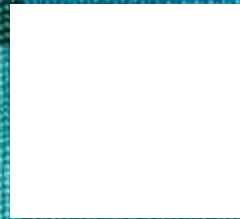
Instructions

Estimate the answer to the calculation by rounding integers to 1 significant figure.

Approximate the value of 215 + 52

250	267
150	350

Well Done!

Question 2

Approximate the value of 2.5 × 3.2

6

27

Well Done!

1

9

Question 3

Approximate the value of $\frac{65 + 21}{9.8}$

9	90
70	20

Well Done!

Question 4

Approximate the value of 5685 ÷ 0.789

4800

6000

7500

1

Question 5

Approximate the value of $\dfrac{905 + 101.5}{0.42 \times 9.8}$

250	22.5
0.24	90.9

Well Done!

Question 6

Approximate the value of 51.2 × 2.4 ÷ 0.52

100

200

50

25

Question 7

Which two integers does $\sqrt{35}$ lie between?

3 5	30 40
5 6	6 7

Question 8

Approximate the value of 21.5 − 15.4 × 0.64

5

15

8

0

Approximate the value of $\sqrt{150}$ to 1d.p.

12.2

12.9

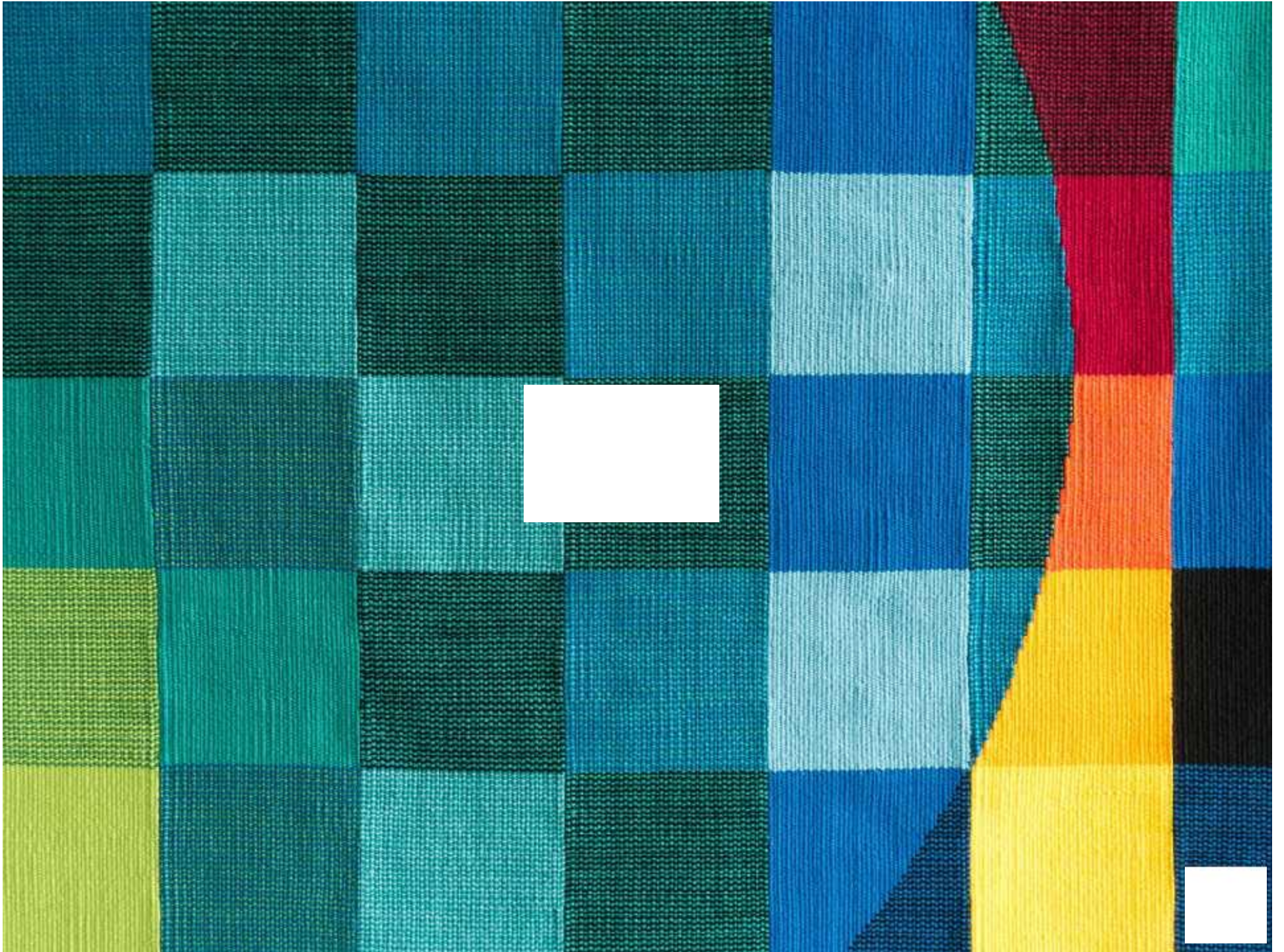Well Done!

1.5

13.2

Question 10

Approximate the value of $\sqrt{26}$ to 1d.p.

2.6

5.1

13

5.9

Using Estimation to Check Answers

Evaluate each of the following questions to decide whether the estimated answer is true or false when rounding each number to 1 significant figure. If the answer is incorrect, you will need to give the correct answer.

The first question has been completed for you.

Question	Estimated Answer	True or False	Correct Answer
$\dfrac{462 \times 81}{0.41}$	92 000	False	$(500 \times 80) \div 0.4 = 100\ 000$
$\dfrac{4.91 \times 3.95}{0.39 \times 0.52}$	100		
Estimate the two integers that $\sqrt{26}$ lies between.	5 and 6		
$\sqrt{26}$ to 1d.p.	5.1		
$4.2 \times 5.2 \div 0.51$	20		
The two integers that $\sqrt{85}$ lies between.	84 and 86		
$\sqrt{85}$ to 1 decimal place.	8.5		
The two integers that $\sqrt{145}$ lies between.	11 and 12		
$\dfrac{3.82 \times 7.95}{9.7}$	3.2		
$\sqrt{145}$ to 2 decimal places.	12		
The two integers that $\sqrt{35}$ lie between.	5 and 6		

Using Estimation to Check Answers

Evaluate each of the following questions to decide whether the estimated answer is true or false when rounding each number to 1 significant figure. If the answer is incorrect, you will need to give the correct answer.

The first question has been completed for you.

Question	Estimated Answer	True or False	Correct Answer
$\dfrac{462 \times 81}{0.41}$	92 000	False	$(500 \times 80) \div 0.4 = 100\,000$
$\dfrac{4.91 \times 3.95}{0.39 \times 0.52}$	100	True	
Estimate the two integers that $\sqrt{26}$ lies between.	5 and 6	True	
$\sqrt{26}$ to 1d.p.	5.1	True	
$4.2 \times 5.2 \div 0.51$	20	False	$4 \times 5 \div 0.5 = 40$
The two integers that $\sqrt{85}$ lies between.	84 and 86	False	$\sqrt{81} < \sqrt{85} < \sqrt{100}$ 9 and 10
$\sqrt{85}$ to 1 decimal place.	8.5	False	$\sqrt{85} = 9.2$ to 1d.p.
The two integers that $\sqrt{145}$ lies between.	11 and 12	False	$\sqrt{144} < \sqrt{145} < \sqrt{169}$ 12 and 13
$\dfrac{3.82 \times 7.95}{9.7}$	3.2	True	
$\sqrt{145}$ to 2 decimal places.	12	False	$\sqrt{145} = 12.04$ to 2d.p.
The two integers that $\sqrt{35}$ lie between.	5 and 6	True	

Using Estimation to Check Answers

Evaluate each of the following questions to decide whether the estimated answer is true or false when rounding each number to 1 significant figure. If the answer is incorrect, you will need to give the correct answer.

The first question has been completed for you.

Question	Estimated Answer	True or False	Correct Answer
450 + 201	650	False	500 + 200 = 700
68 × 2.4	140		
59.4 ÷ 2.9	20		
7.88 × 5.2	40		
4.2 × 5.2 ÷ 0.51	20		
20.2 − 9.01 + 1.92	13		
208 ÷ 0.378	500		
2.5 × 2.3 × 5.9	36		
5435 × 7.31	37 800		
4.6 × 2.9 − 1.68	6		
51 + 11 - 23	39		

Using Estimation to Check Answers **Answers**

Evaluate each of the following questions to decide whether the estimated answer is true or false when rounding each number to 1 significant figure. If the answer is incorrect, you will need to give the correct answer.

The first question has been completed for you.

Question	Estimated Answer	True or False	Correct Answer
450 + 201	650	False	500 + 200 = 700
68 × 2.4	140	True	
59.4 ÷ 2.9	20	True	
7.88 × 5.2	40	True	
4.2 × 5.2 ÷ 0.51	20	False	4 × 5 ÷ 0.5 = 40
20.2 − 9.01 + 1.92	13	True	
208 ÷ 0.378	500	True	
2.5 × 2.3 × 5.9	36	True	
5435 × 7.31	37 800	False	5000 × 7 = 35 000
4.6 × 2.9 − 1.68	6	False	5 × 3 − 2 = 13
51 + 11 - 23	39	False	50 + 10 − 20 = 40

Using Estimation to Check Answers

Evaluate each of the following questions to decide whether the estimated answer is true or false when rounding each number to 1 significant figure. If the answer is incorrect, you will need to give the correct answer.

The first question has been completed for you.

Question	Estimated Answer	True or False	Correct Answer
$\dfrac{462 \times 81}{0.41}$	92 000	False	(500 × 80) ÷ 0.4 = 100 000
$\dfrac{4.91 \times 3.95}{0.39 \times 0.52}$	100		
$\dfrac{38.3 + 27.5}{0.762}$	87.5		
$\dfrac{29.8 + 32.7}{0.28}$	20		
4.2 × 5.2 ÷ 0.51	20		
20.2 − 9.01 + 1.92	13		
$\dfrac{585 - 212}{0.22}$	1925		
2.5 × 2.3 × 5.9	30		
$\dfrac{3.82 \times 7.95}{9.7}$	3.2		
5.6 × 2.9 − 1.68	6		
$\dfrac{782 - 575}{22}$	10		

Using Estimation to Check Answers **Answers**

Evaluate each of the following questions to decide whether the estimated answer is true or false when rounding each number to 1 significant figure. If the answer is incorrect, you will need to give the correct answer.

The first question has been completed for you.

Question	Estimated Answer	True or False	Correct Answer
$\dfrac{462 \times 81}{0.41}$	92 000	False	(500 × 80) ÷ 0.4 = 100 000
$\dfrac{4.91 \times 3.95}{0.39 \times 0.52}$	100	True	
$\dfrac{38.3 + 27.5}{0.762}$	87.5	True	
$\dfrac{29.8 + 32.7}{0.28}$	20	False	(30 + 30) ÷ 0.3 = 200
4.2 × 5.2 ÷ 0.51	20	False	4 × 5 ÷ 0.5 = 40
20.2 − 9.01 + 1.92	13	True	
$\dfrac{585 - 212}{0.22}$	1925	False	(600 − 200) ÷ 0.2 = 2000
2.5 × 2.3 × 5.9	30	False	3 × 2 × 6 = 36
$\dfrac{3.82 \times 7.95}{9.7}$	3.2	True	
5.6 × 2.9 − 1.68	6	False	6 × 3 − 2 = 16
$\dfrac{782 - 575}{22}$	10	True	

Number and Place Value
Estimation

Learning Objective

To estimate an answer to a calculation.

Success Criteria

- To estimate the answer to a simple calculation by rounding to 1 significant figure.

- To estimate the answer to calculations involving fractions by rounding to 1 significant figure.

- To estimate square roots.

Starter: What Is Estimation?

Write down your answers to the following questions:

1. What do you understand by estimation?

2. What do you think is involved when estimating?

3. Why do we estimate?

Starter: Rounding

Round the following to 1 significant figure:

4.8	5		2.45	2
10.2	10		0.52	0.5
196	200		0.098	0.1
451	500			

Introducing Estimation

Sometimes we don't need to know the value of something exactly.

Write down some examples of things we could estimate.

Introducing Estimation

Sometimes, an estimate may be good enough for us to make statements or perform calculations.

To estimate answers to questions, we round up or down to 'nice' numbers that make it easier to calculate mentally.

We can round to 1 significant figure to make these 'nice' numbers

Introducing Estimation

£34.99 × 26 = £984.54

27 × £3.04 = £62.80

Are these calculations correct? How would you know?

We can use estimation to decide whether these calculations might be correct.

Estimation

How can I estimate 49 × 57?

We can estimate the answer to this calculation by rounding each integer to 1 significant figure.

49 × 57

50 × 60

50 × 60 = 3000

49 × 57 ≈ 3000

Estimation

Approximate the value of 51.6 + 52.8

50 + 50

50 + 50 = 100

51.6 + 52.8 ≈ 100

Estimation

167 × 14 = 12 221

Give a reason why this is correct/incorrect.

Give a better estimate of the answer.

More Estimation

Approximate the value of:

$$\frac{792 + 496.2}{0.52}$$

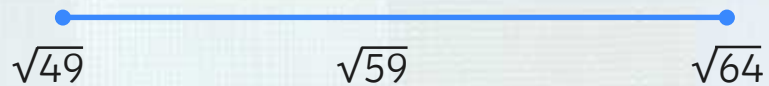Round each part of the calculation to 1 significant figure.

$$\frac{800 + 500}{0.5} \quad = \quad \frac{1300}{0.5} \quad = \quad 2600$$

$$\frac{792 + 496.2}{0.52} \quad \approx \quad 2600$$

Estimating Square Roots

What two integers does $\sqrt{59}$ lie between?

Think: which perfect squares are close to $\sqrt{59}$?

$\sqrt{49}$ $\sqrt{59}$ $\sqrt{64}$

$\sqrt{49}$ = 7 and $\sqrt{64}$ = 8

so the two integers that $\sqrt{59}$ lies between are 7 and 8.

Estimating Square Roots

Approximate $\sqrt{125}$ to 2 decimal places.

1. $\sqrt{121} < \sqrt{125} < \sqrt{144}$ so $11 < \sqrt{125} < 12$
   Therefore, the whole number part of the answer is 11.

2. Find the difference between the given number,
   125, and the lower perfect square.
   $125 - 121 =$ **4**

3. Find the difference between the greater perfect
   square and the lower perfect square.
   $144 - 121 =$ **23**

4. $\dfrac{4}{23}$ = 0.17 to 2d.p.

5. $11 + 0.17 = 11.17$

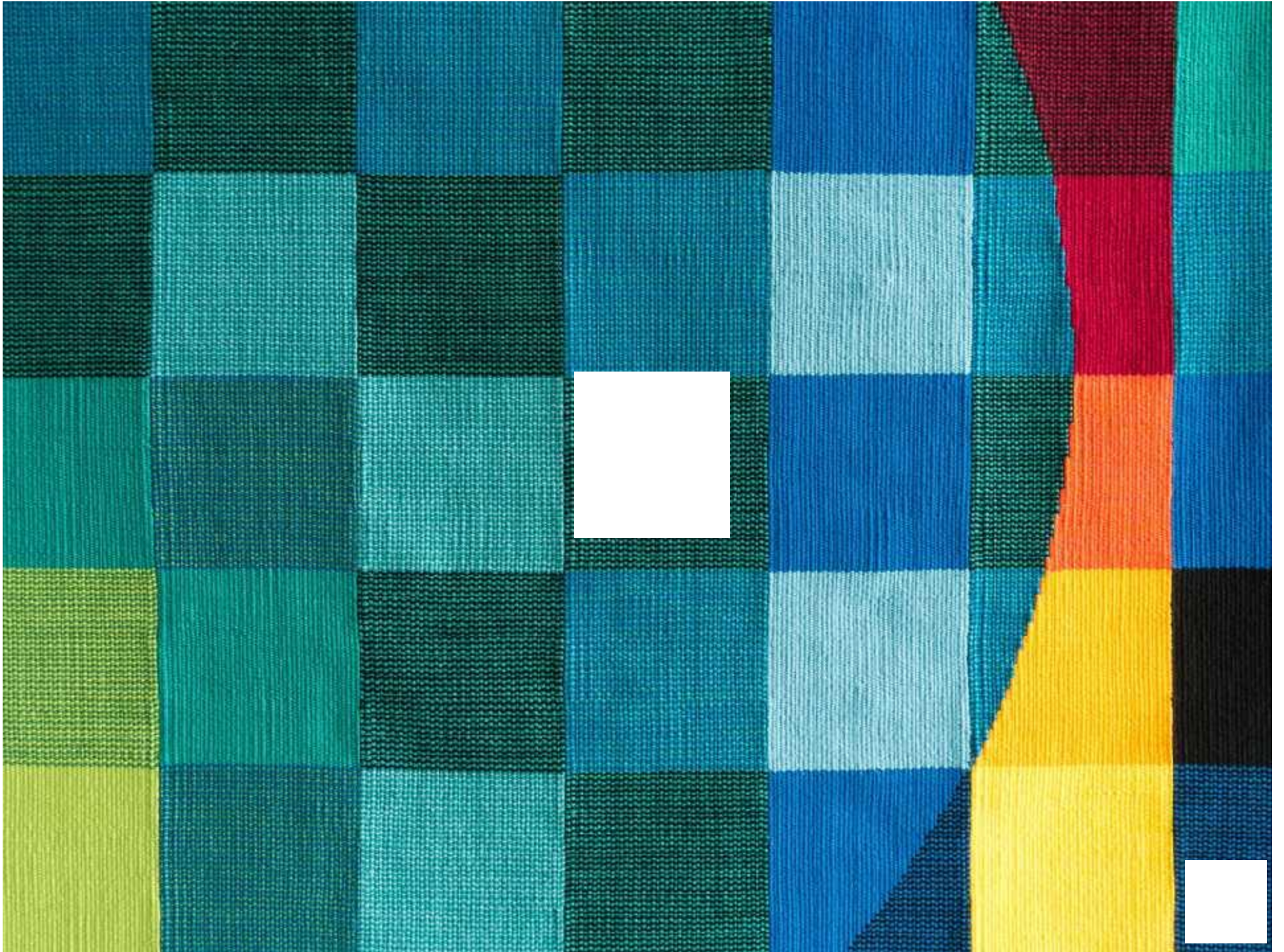The approximate value of $\sqrt{125}$ to 2 decimal places is 11.17

Plenary: What Is Estimation?

Refer back to your answers from the beginning of the lesson:

1. What do you understand by estimation?

2. What do you think is involved when estimating?

3. Why do we estimate?

Have your thoughts changed?

Summarise your progress in 3 key points.

Number and Place Value **Estimation**
Teaching Ideas

Learning Objective:	To estimate an answer to a calculation.
Success Criteria:	• To estimate the answer to a simple calculation by rounding to 1 significant figure. • To estimate the answer to calculations involving fractions by rounding to 1 significant figure. • To estimate square roots.
Context:	This can be used as the eighth lesson in a unit of work on the topic of Number and Place Value for KS3. Students will see how to estimate calculations by rounding to 1 significant figure. Students should have a firm understanding of rounding to various decimal places as well as to 1 significant figure. Additionally, students should be able to recall the first 15 square numbers as well as the square roots.

Starter

Starter: What Is Estimation?

The starter is designed to encourage students to be reflective in their learning from the outset. These questions will be revisited during the plenary. You may wish for students to discuss these in pairs, as a whole class or write them down in books or on pieces of paper.

Rounding

You can use this as a brief review of how to round integers and decimals to 1 significant figure. You may wish to check students' understanding of how to round to significant figures and a brief demonstration may be appropriate before commencing this activity. The activity could then be completed independently or in pairs.

Main Activities

Introducing Estimation

You can use **slide 5** to open up discussion with students about why we use estimation. Encourage them to think of real-life examples of when we might use estimation to contextualise their learning. You may opt to do this as a whole class, independently or in pairs. The three bullet points on the following slide cover how and why we estimate. The questions on **slide 7** could be posed to the whole class to demonstrate how we can't always do mental calculations quickly. This highlights the importance of being able to estimate a calculation.

Estimation

Slides 8–9 include step-by-step examples of how to estimate simple calculations. You should emphasise that these have been estimated by rounding to 1 significant figure; rounding to 1 significant figure should be continually reinforced and emphasised. **Slide 10** encourages students to use their reasoning and fluency skills by identifying whether the calculation is correct or incorrect and what would be a better estimate. You may wish to display the question to the whole class and encourage discussion between pairs before bringing the whole class together to share ideas. The conclusion that students should come to is that the calculation is incorrect, and they should provide valid a reason for this. If they round all numbers in the calculation to 1 significant figure, they will obtain 200 × 10 = 2000 which is not close to 12 221.

Following these slides, you can use the **Estimation Differentiated Activity Sheets** to allow students to apply their understanding of how to estimate simple calculations to a short problem solving task. This task could be completed individually or in pairs. Confident explanations and workings should be seen at this point.

More Estimation

Slide 11 offer a step-by-step walkthrough of how to estimate calculations involving more complex calculations in the form of fractions. You should use your judgement regarding the pace of this delivery depending on your students' understanding. Consistent reinforcing and questioning should be used throughout, for example, 'Why have we done this?' 'Why is this the answer?'.

Estimating Square Roots

Slides 12–13 progresses students' understanding by encouraging them to think about how to estimate a square root by identifying the perfect squares either side of the root they are estimating. This extends to estimating a square root to 2 decimal places without using a calculator.

Following the teacher demonstrations, you may want your students to consolidate their learning by completing activity sheets and practice questions. You can choose from the following:

Estimation Differentiated Activity Sheets

These activity sheets are differentiated into simple calculations, more complex calculations presented as fractions and estimating square roots.

Estimation Mixed Calculations Differentiated Activity Sheets

Each activity sheet includes a mixture of estimation questions, including estimating square roots, with each sheet differentiated through scaffolding.

Estimation Differentiated Card Sorts

A range of card sorts differentiated into simple calculations, more complex calculations presented as fractions and estimating square roots.

Using Estimation Differentiated Reasoning Activity Sheets

These activity sheets enable students to practise their reasoning and fluency skills. Differentiated by difficulty, students will have to prove whether a statement is true or false.

Estimation Quiz

Plenary

What Is Estimation?

The plenary involves students referring to their thoughts at the beginning of the lesson and reflecting on their progress during the lesson. Students should be encouraged to summarise their learning and understanding of estimation in three key points. This can be presented in different ways, for example, in written form, pictorial form such as diagrams or cartoon strips, or in verbal form with the teacher.