Alan Smith

Cambridge checkpoint

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Revision Guide

for the Cambridge Secondary 1 Test

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Introduction

Preparing for the Test

You may find the following points helpful in preparing for the Cambridge Checkpoint Mathematics, Cambridge Secondary 1 Test.

- Make sure you are familiar with the mathematical content that the test will cover. Use this revision guide to check your understanding of each of the topic areas.
- Read the Tips for success for some useful pointers of what the test is looking to check your understanding on.
- Make sure you are familiar with the types of questions you will be asked in the test.
- Obtain some past papers, and practise working through these in the time limits given, so that you know what is expected of you.
- Spend some time practising the test-style questions (Spotlight on the test) in this revision guide.
- Remember to look at the mark scheme so that you know how much each answer is worth.
- Check your answers against the sample answers supplied so that you can see how your answers will be assessed. You can download the answers for free at www.hoddereducation.com/checkpointextras

General revision tips

- Find somewhere quiet to revise. Sit on a comfortable chair at a table and have a pen or pencil and some sheets of paper as well as this book. Plan what you will revise in your revision session. Remember to take a break perhaps every twenty minutes or half an hour to let your mind rest.
- When using a calculator, write down the calculation you are intending to do first, before entering it onto the calculator keypad.
- Just reading through the text is not always the best way of learning. It is better to make your revision more active. You should use a variety of active ways to make your learning secure. Here are some of them:
  - Cover up the solution to a worked example on the topic you are revising. Write out your own solution, and then check it against the worked solution. In addition to getting the right answer, make sure all your key steps of working are shown clearly.
  - Continue your active revision by completing the Spotlight on the test sections. Write your answers on paper.
  - Study the Tips for success; write up some of them on revision cards.

Contents

The chapters in this book have been arranged to match the Cambridge Secondary 1 Mathematics Curriculum Framework as follows:

- Number
- Algebra
- Geometry
- Measure
- Handling data
- Calculation and mental strategies
- Problem solving

1 Place value, ordering and rounding

Comparing two quantities

Student's book references

- Book 1 Chapter 1
- Book 2 Chapter 1
- Book 1 Chapter 8

Worked example

Insert a > or < sign to show the larger number.

6324 ____ 6234

Solution

Comparing the highest place values in the two numbers:

6324
6234

Both numbers contain 6000, so now compare the next place value:

6**3**24
6**2**34

The first number contains 300, the second only 200.
Thus 6324 is greater than 6234, and we write this as:

6324 > 6234

Tips for success

- Remember that the sign > means 'is greater than'.
- The sign < means 'is less than'.
- If you forget which is which – the larger quantity goes at the wider end of the symbol.

Check your understanding 1.1

Insert a > or < sign between each pair of numbers.

1 623 ____ 652
2 3108 ____ 3112
3 0.235 ____ 0.215
4 9740 ____ 12 350
5 13.226 ____ 12.895

Multiplying and dividing by powers of 10

If you multiply or divide a number by 10, all of the place values shift one position. Multiplying or dividing by 100 moves them two positions, and so on.

Worked examples

Work out:

a) 2992 × 100
b) 38 400 ÷ 10

Solution

a) 2992 × 100 = 292 200 (two position shift).
b) 38 400 ÷ 10 = 3840 (one position shift).

Check your understanding 1.2

Work out each of these multiplications or divisions.

1 362 × 10

2 13 700 ÷ 10

3 1220 × 100

4 14 000 ÷ 100

5 1800 ÷ 10

6 600 × 100

7 740 × 1000

8 300 000 ÷ 100

9 540 000 ÷ 1000

10 130 × 100

Rounding whole numbers

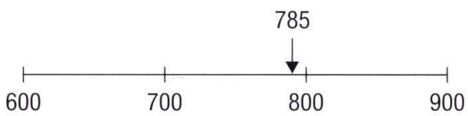
Sometimes numbers are recorded to a higher level of accuracy than we really need. In the case of whole numbers we often then round them to the nearest ten, hundred or thousand.

Worked example

A school has 785 pupils in the Middle School years, and 215 in the Sixth Form. Round these numbers, to the nearest hundred in each case.

Solution

Rounding to the nearest hundred means we can only use values like 600, 700, 800, 900:



Clearly 785 is nearer to 800 than any of these other options.
So, 785 to the nearest hundred is 800 (rounded up).
Similarly, 215 to the nearest hundred is 200 (rounded down).

Tips for success

- If you are exactly halfway between two options, round up, not down. So, for example, 450 would round to 500, not 400.

Check your understanding 1.3

Round each of these as indicated.

1 2532 (nearest 10).

2 4760 (nearest 100).

3 87 (nearest 10).

4 259 (nearest 10).

5 259 (nearest 100).

6 6822 (nearest 10).

7 A football match is watched by 12 371 people. Round this number to the nearest hundred.

8 A house costs $123 499 to build. Round this cost to the nearest thousand dollars.

Decimal places

Some numbers may have a large number of decimal places, and we may wish to round them to fewer places. This follows a similar procedure to that for whole numbers in the previous section.

Tips for success

- If the first figure after the cut lies between 0 and 4 you round down.
- If this figure lies between 5 and 9 you round up.
- In the worked example part b) it would have been wrong to write 0.17 – even though this has the same value as 0.170 – because then you are rounding to two decimal places.

Worked examples

Round these numbers to three decimal places:

a) 16.2371 **b)** 0.16973.

Solution

a) 16.237**1**. The first figure after three decimal places is low – 1 – so we round down to 16.237.

b) 0.1697**3**. The first figure after three decimal places is high – 7 – so we round up to 0.170.

Check your understanding 1.4

Round each of these as indicated.

1 18.562 (one decimal place).
2 304.849 (one decimal place).
3 8.0671 (two decimal places).
4 28.2219 (three decimal places).
5 61.4587 (two decimal places).
6 72.203 (two decimal places).
7 3.141 59 (three decimal places).
8 1.414 (one decimal place).
9 0.0688 (two decimal places).
10 7.0707 (three decimal places).

Significant figures

Significant figures are the figures that give information about the size of each of the place values. Significant figures are counted from the left. For example, 3285 contains four significant figures (s.f.). The number 0.002 16 has three s.f., since the 2 is the first significant figure counting from the left.

Tips for success

- Sometimes zeros count as significant figures; other times they do not (they are just place holders). Study these examples carefully to make sure you understand the different ways in which zeros are used.
- In the worked example part d) it would have been wrong to write 0.069 – even though this has the same value as 0.0690 – because then you are rounding to two significant figures.

Worked examples

Write these numbers to three significant figures:

a) 19 345 **b)** 306 820 **c)** 0.006 086 **d)** 0.068 955.

Solution

a) 19 3**4**5 rounds down, to become 19 300.

b) 306 **8**20 rounds up, to become 307 000.

c) 0.006 08**6** rounds up, to become 0.006 09.

d) 0.068 9**5**5 rounds up, to become 0.0690.

Check your understanding 1.5

Round each of these as indicated.

1 3.141 59 (two significant figures).
2 156.13 (four significant figures).
3 165.5 (three significant figures).
4 154 285 (four significant figures).
5 16 324 (three significant figures).
6 851 (one significant figure).
7 2524 (three significant figure).
8 0.003 16 (two significant figures).
9 0.010 13 (two significant figures).
10 1.357 (one significant figure).

Estimating the answer to a calculation

To obtain an estimate of the answer to a multiplication or division problem, you can round off all of the quantities to one significant figure, and then do the calculation using these approximate values.

Worked example

There are 32 coaches on a cross-river ferry. Each coach carries 48 passengers. Estimate the total number of passengers on the coaches.

Solution

The exact calculation is 32×48.
The approximate calculation is $30 \times 50 = 1500$.
So the coaches carry approximately 1500 people in total.

Tips for success

- Do not try to be too precise here: the purpose of the estimate is to get an answer to one significant figure only. There is no need to do an exact calculation.

Check your understanding 1.6

Round the numbers to one significant figure and hence make estimates of the answers to each of these.

1 Estimate the answer to 231×39.
2 Estimate the answer to 52×22.
3 Estimate the answer to $1721 \div 48$.
4 Estimate the answer to $611 \div 28$.
5 A chocolate bar weighs 65 grams. Find the total weight of 18 bars.
6 463 sweets are shared out between 21 people. Find out how many sweets they each get.
7 Some wedding guests travel to a reception by taxi. Each taxi can carry four guests. How many taxis are needed for 59 people?
8 39 215 toy bricks are sorted into bags, each containing 200 bricks. How many bags will there be?
9 A group of 32 friends win $613 000. How much will they each receive, if they share it out equally among themselves?
10 Baby William has 19 boxes of pencils; each box contains 12 pencils. He shakes them all out on the floor. How many pencils are there in total?

Spotlight on the test

1 Insert one of the symbols $>$, $<$ or $=$ into the middle of each statement.

a) 7325 ____ 7236.

b) 20×1000 ____ 200×100.

c) 29×59 ____ 31×61.

d) $40\,000 \div 100$ ____ $400 \div 10$. [4]

2 Insert the missing number into this calculation:

$0.6221 \times$ ____ $= 6221$. [1]

3 Using the digits 2, 5, 8, 9 once each, make a four-digit number that meets all of these rules:

- The number is greater than 9000.
- The number is odd.
- If rounded to the nearest thousand, the number rounds down. [1]

4 b) Work out the answer to $\frac{8.3 \times 4.7}{2.5}$ using a calculator. Write down all the figures.

b) Now write your answer to part a) correct to three significant figures. [2]

5 Look at the numbers on these cards:

285.3	21.03

a) Write each number correct to one significant figure.

b) Without working out the exact answer, make an estimate for the value of 285.3×21.03 correct to one significant figure. Write down all of your working. [3]

6 The number of seconds in one year can be worked out like this:

$365 \times 24 \times 60 \times 60$.

a) Explain where each of these numbers comes from.

b) Estimate the answer to 365×24 by rounding the numbers to one significant figure.

c) Work out the exact answer to 60×60. Give your answer to one significant figure.

d) Using your answers to b) and c) estimate the number of seconds in one year. Give your final answer correct to one significant figure. [4]

2 Integers, powers and roots

Adding, subtracting and ordering with positive and negative numbers

Student's book references

- Book 1 Chapter 8
- Book 2 Chapter 8
- Book 3 Chapters 1 and 8

The integers are the positive and negative whole numbers, and zero. Addition and subtraction problems with integers are often illustrated using the number line. Adding a positive number corresponds to moving to the right, and subtracting a positive number means moving to the left. Adding or subtracting a negative integer causes these rules to reverse.

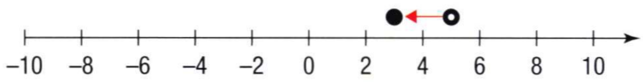
Worked examples

Use the number line to work out:

a) (+5) + (–2) **b)** (–3) – (+6) **c)** (+6) – (–2).

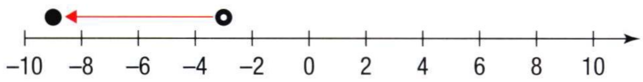
Solution

a) For (+5) + (–2), start at (+5) and move two in the negative direction:



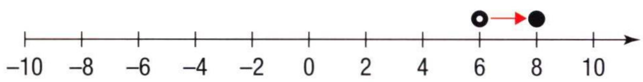
So (+5) + (–2) = (+3) = 3.

b) For (–3) – (+6) start at (–3) and move six in the negative direction:



So (–3) –(+ 6) = (–9) = –9.

c) For (+6) – (–2) start at (+6) and move two in the positive direction:



So (+6) – (–2) = (+8) = 8.

The same principles can be applied to addition and subtraction problems with decimal numbers.

Worked example

Without a calculator, find the value of (2.4) + (–3.7).

Solution

(2.4) + (–3.7) is the same as 2.4 – 3.7 = –1.3.

Check your understanding 2.1

Sketch a number line from –10 to +10 and use it to help answer these questions.

1 a) (+3) + (+2) **b)** (+8) + (–1) **c)** (+6) + (–5).
2 a) (–3) + (–4) **b)** (–6) + (+2) **c)** (+5) + (–7).
3 a) (+6) – (+2) **b)** (–3) – (–1) **c)** (–6) – (+1).
4 a) (–5) + (–5) **b)** (–1) – (+1) **c)** (+3) + (–4).
5 a) (+6.8) – (+7.2) **b)** (–3.1) + (+1.5) **c)** (–4.2) – (–4.2).
6 a) (+4.5) + (–3.8) **b)** (–2.2) + (–1.8) **c)** (–2.1) – (–6.2).
7 a) (+7.2) – (–7.2) **b)** (+7.2) + (–7.2) **c)** (–1.4) – (+2.5).
8 Arrange these in order of size, smallest first: (–4), (+6), (–3).
9 Arrange these in order of size, smallest first: (–1), (+2), (–5), (–10).
10 Arrange these in order of size, smallest first: (+1), (–8), (–5), (–10).

Factors, multiples, primes and tests of divisibility

Tips for success

- Remember that if a number is divisible by (for example) 5, then it is called a **multiple** of 5. We say 5 is a **factor** of the number.
- A number which has no factors (other than 1 and itself) is called a **prime** number. The first few primes are 2, 3, 5, 7, 11 …

Property	Test	Example
A number is divisible by 2	The units digit is 0, 2, 4, 6 or 8	5**6**
A number is divisible by 3	The sum of the digits is divisible by 3	87 as 8 + 7 = 15 = 5 × **3**
A number is divisible by 5	The units digit is 0 or 5	4**5**
A number is divisible by 6	The number is divisible by 2 and 3	42 as 4**2** and 4 + **2** = 6 = 2 × **3**
A number is divisible by 9	The sum of the digits is divisible by 9	774 as 7 + 7 + 4 = 18 = 2 × **9**

Check your understanding 2.2

1 Look at this list of whole numbers (integers): 10, 11, 12, 13, 14, 15, 16, 17
a) Which of the numbers are divisible by 3?
b) Which are divisible by 5?
c) Which numbers are prime?

2 Find the largest number which is a factor of 35 and also a factor of 65. (This is called the highest common factor of the two numbers.)

3 Find the highest common factor of 18 and 30.

4 Here is part of a sieve of Eratosthenes. Prime numbers are marked in bold and shaded. Non-primes are greyed out.

Use the sieve to answer the following questions.

1	**2**	**3**	4	**5**	6	**7**	8	9	10
11	12	**13**	14	15	16	**17**	18	**19**	20
21	22	**23**	24	25	26	27	28	**29**	30
31	32	33	34	35	36	**37**	38	39	40
41	42	**43**	44	45	46	**47**	48	49	50
51	52	**53**	54	55	56	57	58	**59**	60
61	62	63	64	65	66	**67**	68	69	70
71	72	**73**	74	75	76	77	78	**79**	80

a) Find the next prime above 31.
b) Write down all the primes between 40 and 50.
c) Is it true that 51, 61 and 71 are all primes?
d) How many primes are there between 1 and 20?

Multiplication and division of integers

To multiply or divide signed integers, carry out the multiplication or division without any signs first. Then count the number of minus signs. No minus signs: positive; one minus sign: negative; two minus signs: positive (and so on if needed).

Worked examples

Work out the values of **a)** (+5) × (–2), **b)** (–6) ÷ (–2).

a) For (+5) × (–2), we know that 5 × 2 = 10. One minus sign means a negative answer, so (+5) × (–2) = (–10) = –10.

b) For (–6) ÷ (–2), we know that 6 ÷ 2 = 3. Two minus signs means a positive answer, so (–6) ÷ (–2) = (+3) = 3.

Check your understanding 2.3

1 Work out the answers to these multiplications:

a) (+7) × (–2) **b)** (–3) × (+4) **c)** (+2) × (+9) **d)** (–2) × (–9).

2 Work out the answers to these divisions:

a) (–10) ÷ (+2) **b)** (+20) ÷ (–5) **c)** (–16) ÷ (–8) **d)** (+30) ÷ (–2).

3 Work out the answers to these multiplications and divisions:

a) (+8) × (–6) **b)** (+20) ÷ (–5) **c)** (–12) × (–3) **d)** (–40) ÷ (–4).

Factors and factor trees

Factors of a number are all the whole numbers (positive integers) that divide exactly into that number.

- The factors of 20 are 1, 2, 4, 5, 10 and 20.
- The factors of 30 are 1, 2, 3, 5, 6, 10, 15 and 30.

The largest factor to appear in both groups is 10, so 10 is the highest common factor (HCF) of 20 and 30.

- The multiples of 6 are those numbers in the 6× table: 6, 12, 18, 24, 30, and so on.
- The multiples of 8 are those numbers in the 8× table: 8, 16, 24, 32, 40, and so on.

The smallest multiple to appear in both groups is 24, so 24 is the lowest common multiple (LCM) of 6 and 8.

Worked examples

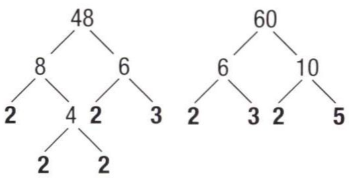
a) Write 48 and 60 as products of their prime factors.

b) **i)** Find the highest common factor (HCF) and

ii) the lowest common multiple (LCM) of 48 and 60.

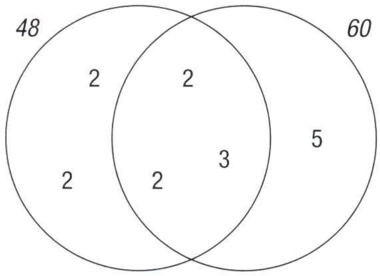
Solution

a) 48 and 60 may be factorised using factor trees (or the table method):



So $48 = 2^4 \times 3$ and $60 = 2^2 \times 3 \times 5$.

b) The factors may be represented in a Venn diagram:



i) To find the HCF, look at the overlap (intersection) of the two circles: HCF (48, 60) = $2 \times 2 \times 3 = 12$.

ii) To find the LCM, look at the entire diagram: LCM (48, 60) = $2^4 \times 3 \times 5 = 240$.

Check your understanding 2.4

1 Write each of these as a product of primes. You may use a factor tree to help.
a) 45 **b)** 44 **c)** 72 **d)** 180.
2 Work out the highest common factor (HCF) of 28 and 42.
3 Work out the lowest common multiple (LCM) of 35 and 45.
4 a) Express 120 and 144 in prime factor form.
b) Find the highest common factor (HCF) of 120 and 144.
5 a) Express 75 and 120 as in prime factor form.
b) Find the lowest common multiple (LCM) of 75 and 120.

Squares, cubes and roots

Here are some of the more commonly encountered squares and cubes:

The first 20 square numbers									
1^2	2^2	3^2	4^2	5^2	6^2	7^2	8^2	9^2	10^2
1	4	9	16	25	36	49	64	81	100
11^2	12^2	13^2	14^2	15^2	16^2	17^2	18^2	19^2	20^2
121	144	169	196	225	256	289	324	361	400

The first ten cube numbers									
1^3	2^3	3^3	4^3	5^3	6^3	7^3	8^3	9^3	10^3
1	8	27	64	125	216	343	512	729	1000

Worked examples

Write down the values of **a)** 14^2, **b)** 6^3, **c)** $\sqrt{196}$, **d)** $\sqrt[3]{343}$

Solution

a) $14^2 = 196$

b) $6^3 = 216$

c) $\sqrt{324} = 18$ (because $= 18^2 = 324$)

d) $\sqrt[3]{343} = 7$ (because $7^3 = 343$).

Worked example

The square root of 73 lies between the integers n and $n + 1$. Find the value of n.

Solution

The square numbers 64 and 81 are located below and above 73, so

$$64 < 73 < 81$$
$$\sqrt{64} < \sqrt{73} < \sqrt{81}$$
$$8 < \sqrt{73} < 9$$

Therefore $n = 8$.

Check your understanding 2.5

1 Write down the values of **a)** 11^2, **b)** 6^3, **c)** $\sqrt{144}$, **d)** $\sqrt[3]{64}$

2 Write down the values of **a)** 9^2, **b)** 8^3, **c)** $\sqrt{289}$, **d)** $\sqrt[3]{729}$

3 Write down the values of **a)** 13^2, **b)** 5^3, **c)** $\sqrt{361}$, **d)** $\sqrt[3]{27}$

4 Here are some clues about a number:
- The number is a perfect cube.
- The number has three digits.
- The digits multiply together to make 36.

What is the number?

5 Explain how you can tell whether the square root of 105 lies between 10 and 11.

6 Pedro says that the square root of 43 lies between 5 and 6.
Anton says that the square root of 43 lies between 6 and 7.
Explain how you can tell which one of them is right.

Working with indices

Quantities involving repeated multiplication can be written using index notation, such as

$$2 \times 2 \times 2 \times 2 \times 2 = 2^5$$

In this example the number 2 is the **base** and 5 is the **index** (or power). Here are some commonly used laws of indices:

Law	Example
$a^m \times a^n = a^{m+n}$	$5^3 \times 5^4 = 5^7$
$a^m \div a^n = a^{m-n}$	$2^8 \div 2^5 = 2^3$
$(a^m)^n = a^{mn}$	$(4^3)^5 = 4^{15}$
$x^{-n} = \dfrac{1}{x^n}$	$5^{-2} = \dfrac{1}{5^2} = \dfrac{1}{25}$
$x^0 = 1$	$7^0 = 1$

Worked example

Write as a single power $4^4 \times 4^5 \div 4^3$

Solution

$$\begin{aligned} 4^4 \times 4^5 \div 4^3 &= 4^{4+5} \div 4^3 \\ &= 4^9 \div 4^3 \\ &= 4^{9-3} \\ &= 4^6. \end{aligned}$$

Check your understanding 2.6

Write each of these as a single power:

1 $3^4 \times 3^5$
2 $6^2 \times 6^3$
3 $4^5 \div 4^2$
4 $2^7 \div 2^5$
5 $5^4 \times 5^8$
6 $4^4 \div 4^5$
7 $(8^4)^3$
8 $(5^3)^2$
9 $4^4 \times 4$
10 $10^6 \div 10^5$
11 $6^7 \times 6^{-2}$
12 $7^8 \div 7^5$
13 Simplify $3^5 \times 3^4$
14 Find the value of 4^0
15 Find the value of m if $2^4 \times 2^m = 2^7$
16 Find the value of t if $4^5 \div 4^t = 4^8$

Order of operations

Some calculations involve several different operations. Brackets should always be worked out first, followed by indices. Then come divisions and multiplications, and finally additions and subtractions. These are conveniently remembered as BIDMAS:

B brackets

I indices

D division

M multiplication

A addition
S subtraction

Tips for success

- Divide and multiply have equal priority to each other. If both are present, do them in the order you meet them.
- Addition and subtraction also have equal priority (but lower than multiplication and division).
- Modern calculators have BIDMAS programmed in automatically.

Worked example

Find the value of $5 \times 6 + 7 \times 8$.

Solution
The multiplications are done before adding, so

$$\begin{aligned} 5 \times 6 + 7 \times 8 &= 30 + 56 \\ &= 86. \end{aligned}$$

Worked example

Find the value of $15 + (2 + 4)^2$.

Solution

$$\begin{aligned} 15 + (2+4)^2 &= 15 + (6)^2 && \text{(brackets)} \\ &= 15 + 36 && \text{(indices)} \\ &= 51 && \text{(addition).} \end{aligned}$$

Check your understanding 2.7

Find the value of each of these. Do not use your calculator.

1 $3^2 + 5^2$

2 $(3 + 5)^2$

3 $5 + 3 \times 2$

4 $14 \div (5 + 2)$

5 $(3 + 4) \times (5 + 6)$

6 $3 + 4 \times 5 + 6$

7 $3 \times (30 - 5^2)$

8 $(18 + 42) \div (27 - 7)$

9 $(5^2 - 3^2) \div 2$

10 $8 \times 6 \div 12$

Spotlight on the test

1 Look at this list of integers:

20, 21, 22, 23, 24, 25, 26, 27, 28

a) Which one is a multiple of 6?
b) Which one is a factor of 60?
c) Which one is prime? [3]

2 On the Moon the daytime temperature reaches 105 °C, but at night falls to –155 °C. Work out the difference between the daytime and night temperatures on the Moon. [2]

3 Adam the gardener mows his lawns every six days. He weeds the flower beds once every eight days. On 1 July he mows his lawns and weeds the flower beds. On what date does he next do both tasks on the same day? [2]

4 During one week last year I recorded the temperatures as 2 °C on Tuesday, –6 °C on Wednesday and –4 °C on Thursday.
a) Which day was coldest?
b) How much warmer was Tuesday compared with Thursday? [2]

5 Fred says: 'The square root of 60 is between 7 and 8.'
Evie says: 'The cube root of 250 lies between 7 and 8.'
a) Explain how you can tell that Fred is right.
b) Explain how you can tell that Evie is wrong. [2]

6 Work out the values of a, b and c in these statements:
a) $5^3 \times 5^a = 5^7$.
b) $7^5 \div 7^8 = 7^b$.
c) $9^c = 1$. [3]

7 Work out the value of $6 + 7 \times 5$. [1]

8 Simplify: **a)** $(5^3)^4$, **b)** $2^3 \times 2^5$, **c)** 6^0. [3]

9 Find the value of $10 + 4 \times 3^2$. [2]

10 The lowest common multiple of 10 and y is 60. Find the value of y (given that y is not 60). [1]