Edexcel GCSE

Mathematics

Foundation Tier

Number: Roots and powers

Information for students

The marks for individual questions and the parts of questions are shown in round brackets: e.g. **(2)**.
There are 34 questions in this selection.

Advice for students

Show all stages in any calculations.
Work steadily through the paper. Do not spend too long on one question.
If you cannot answer a question, leave it and attempt the next one.
Return at the end to those you have left out.

Information for teachers

The questions in this document are taken from the 2009 GCSE Exam Wizard and include questions from examinations set between January 2003 and June 2009 from specifications 1387, 1388, 2540, 2544, 1380 and 2381.

Questions are those tagged as assessing “Roots and powers” though they might assess other areas of the specification as well. Questions are those tagged as “Foundation” so could have (though not necessarily) appeared on either a Foundation or Intermediate tier paper.

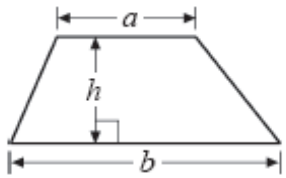
GCSE Mathematics

Formulae: Foundation Tier

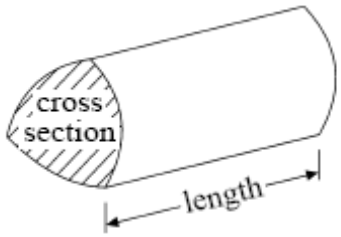
You must not write on this formulae page.

Anything you write on this formulae page will gain NO credit.

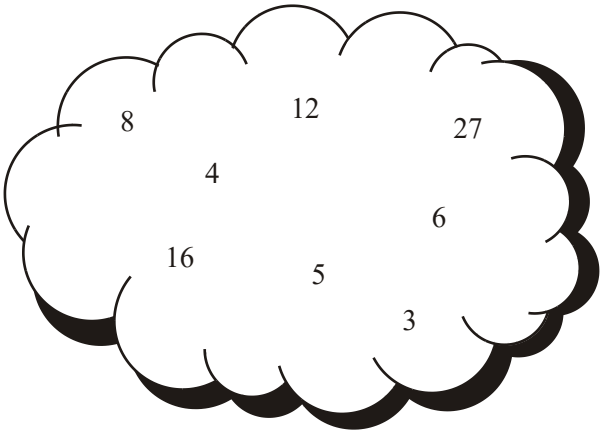
Area of trapezium = $(a + b)h$



Volume of prism = area of cross section × length



1.



Using only the numbers in the cloud, write down

(i) all the multiples of 6, …….

(ii) all the square numbers, …….

(iii) all the factors of 12, …….

(iv) all the cube numbers. …….

(Total 4 marks)

2. (a) Write down all the prime numbers between 40 and 50.

……

(2)

(b) Write down the cube of 10.

……

(1)

(Total 3 marks)

3. Here is a list of eight numbers.

5 6 12 20 25 26 28 33

(a) From the list, write down

(i) a square number,

.....

(ii) a number that is a multiple of 7,

.....

(iii) **two** numbers that are factors of 40,

..... and .....

(iv) **two** numbers with a sum of 59.

..... and .....

(4)

(b) Tony says that "6 is a cube number because $2^3 = 6$".
Tony is wrong. Explain why.

.....

(1)
(Total 5 marks)

4. Here is a list of 8 numbers.

11 16 18 36 68 69 82 88

(a) Write down **two** numbers from the list with a sum of 87

…… , ……

(1)

(b) Write down a number from the list which is

(i) a multiple of 9,

……..

(ii) a square number.

……..

(2)

cube	multiple	factor	product

(c) Use a word from the box to complete this sentence correctly.

11 is a ……..…… of 88

(1)

Here are the same 8 numbers drawn larger.

II	**I6**	**I8**	**36**
68	**69**	**82**	**88**

(d) From these numbers, write down a number which has

(i) exactly **one** line of symmetry,

……..

(ii) 2 lines of symmetry **and** rotational symmetry of order 2,

……..

(iii) rotational symmetry of order 2 but **no** lines of symmetry.

……..

(3)

(Total 7 marks)

5. (a) Work out the value of $4^2 + 2^5$

.....

(2)

(b) Write down the cube root of 64

.....

(1)
(Total 3 marks)

6. Charlotte worked out the sum of some consecutive odd numbers starting with 1.
She put her results in a table.

Sum of the first odd number	1	= 1
Sum of the first 2 odd numbers	1 + 3	= 4
Sum of the first 3 odd numbers	1 + 3 + 5	= 9
Sum of the first 4 odd numbers	1 + 3 + 5 + 7	= 16
Sum of the first 5 odd numbers	1 + 3 + 5 + 7 + 9	= 25
Sum of the first 6 odd numbers		

(a) Complete the bottom row of the table.

(2)

(b) What is the special name for the numbers 1, 4, 9, 16, 25?

.....

(1)
(Total 3 marks)

7.

factor	multiple	square	square root	half

(a) Use a word from the list above to complete the following sentence.

10 is a ..... of 5

(1)

(b) From the list below, write down the odd number.

10 15 18 20 24

……...

(1)

(c) From the list below, write down the square number.

10 12 14 16 18 20

……...

(1)

(Total 3 marks)

8. Here is a list of numbers.

2 4 5 6 7

From the list of numbers write down

(i) an odd number

.....

(ii) a square number

.....

(iii) a multiple of 3

.....

(iv) a factor of 10

.....

(Total 4 marks)

9. (a) Work out the square of 3

.....

(1)

(b) Work out the value of 2^6

.....

(1)

(c) Write 80% as a fraction.
Give your answer in its simplest form.

.....

(2)

(d) Work out 10% of £320

£ .....

(2)

(e) Write these numbers in order of size.
Start with the smallest number.

$\frac{2}{5}$ 45% 0.35 $\frac{3}{8}$

.....

(2)
(Total 8 marks)

10. Here is a list of 8 numbers.

3 5 6 8 9 10 11 16

From the list, write down

(a) **two** odd numbers,

..... and .....

(1)

(b) **two** numbers with a sum of 15

..... and .....

(1)

(c) a factor of 12

.....

(1)

(d) a multiple of 4

.....

(1)

James says that 10 is a square number because $5^2 = 10$

(e) James is wrong.
Explain why.

.....

.....

(1)
(Total 5 marks)

11. Use a calculator to work out

$$\sqrt{2.56} + 8.4$$

.....
(Total 2 marks)

12. (a) Find the positive square root of 2.56.

……
(1)

(b) Write these numbers in order of size.
Start with the smallest number.

$$0.4 \qquad \frac{7}{15} \qquad 35\% \qquad \frac{3}{7}$$

……

(2)
(Total 3 marks)

13. Write down the value of

(i) 2^3

……

(ii) $\sqrt{81}$

……
(Total 2 marks)

14. 2, 8, 12, 15, 21, 24, 36, 43

Write down a number from the list that is

(i) a square number,

……

(ii) a cube number.

……
(Total 2 marks)

15. Work out

$$\sqrt{46} - 2.5^2$$

Write down all the figures on your calculator display.

……

(Total 2 marks)

16. 2 8 15 17 25 35

Write down a number from this list that is

(i) a square number,

……

(ii) a cube number.

……

(Total 2 marks)

17. Find the value of the square root of 1.5625

…….

(Total 1 mark)

18. (a) Work out the value of

(i) 4^2

...……

(ii) 2^3

…...……

(2)

(b) Write as a power of 10

$10 \times 10 \times 10 \times 10 \times 10$

…...……

(1)
(Total 3 marks)

19. Explain why $\sqrt{90}$ is less than 10.

…….

…….

…….

…….

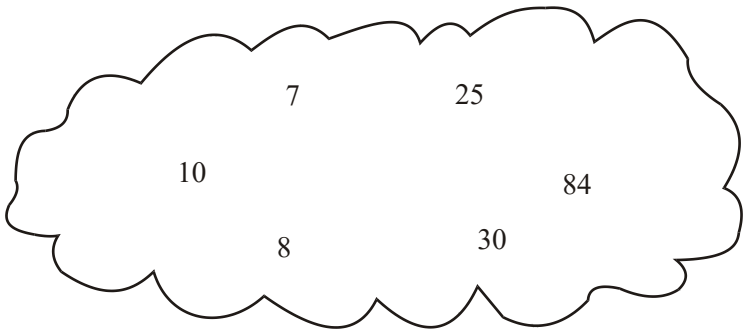
(Total 1 mark)

20. Find the value of 2.2^3

…….

(Total 1 mark)

21.



(a) From the numbers shown, write down

(i) a square number,

.....

(ii) a cube number.

.....

(2)

(b) Write down the value of $\sqrt{49}$

.....

(1)

(Total 3 marks)

22. Find the value of

(i) the square root of 36

.....

(ii) 5×10^2

.....

(iii) 2^3

.....

(Total 3 marks)

23. Work out the cube of 6

.....

(Total 1 mark)

24. Here is a list of numbers.

2 5 7 8 9 12

Write down a number from the list which is

(i) a multiple of 6,

.....

(ii) a factor of 15,

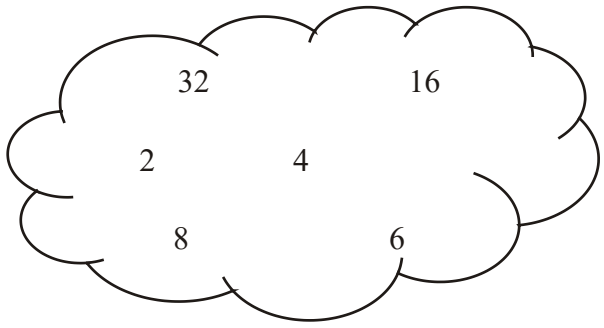
.....

(iii) a square number.

.....

(Total 3 marks)

25.



From the numbers in the cloud, write down

(a) a square number,

.....

(1)

(b) the square root of 16,

.....

(1)

(c) the cube of 2,

.....

(1)

(d) the prime number.

.....

(1)
(Total 4 marks)

26. Write down the value of

(a) 5^2

.....

(1)

(b) $\sqrt{49}$

.....

(1)

(c) $5 + 2 \times 4$

.....

(1)
(Total 3 marks)

27. Here is a list of numbers.

2 4 8 12 16 20 32 40

From the list,

(a) write down a square number.

.....

(1)

(b) write down a cube number.

.....

(1)
(Total 2 marks)

28. (a) Find the value of 4^2

.....

(1)

(b) Find the value of $\sqrt{2.25}$.

.....

(1)
(Total 2 marks)

29. (a) Write down a square root of 25

.....

(1)

(b) Write down the cube of 2

.....

(1)
(Total 2 marks)

30. Find the value of

(a) 8^2

.....

(1)

(b) $\sqrt{100}$

.....

(1)

(c) the cube of 5

.....

(1)
(Total 3 marks)

31. (a) Write 3.9 to the nearest whole number.

.....

(1)

(b) Write down the square of 4

.....

(1)
(Total 2 marks)

32. What is 5 squared?

30	10	20	25	15
A	**B**	**C**	**D**	**E**

(Total 1 mark)

33. (a) Find the square of 6

.....

(1)

(b) Find the square root of 225

.....

(1)

(c) Find the value of 10^3

.....

(1)
(Total 3 marks)

34. (a) Find the square root of 196

.....

(1)

(b) Find the cube of 7

.....

(1)
(Total 2 marks)

01. (i) 6, 12 4
B1 cao

(ii) 4, 16
B1 cao

(iii) 3, 4, 6 or 3, 4, 6, 12
B1 Condone omission of 12

(iv) 8, 27
B1 cao

[4]

02. (a) 41, 43, 47 2
B2 3✓ & 0×
(B1 for 2✓ & ≤ 1×)

(b) 1000 1

B1 cao

[3]

03. (a) (i) 25 4

B1 for 25

(ii) 28

B1 for 28

(iii) 5 and 20

B1 for 5 and 20

(iv) 26 and 33

B1 for 26 and 33

(b) $2^3 = 8$

or $2^3 = 2 \times 2 \times 2$ (which is not 6) 1

B1 for valid 'explanation'

[5]

04. (a) 18, 69 1

B1

(b) (i) 18 or 36 1

B1

(ii) 16 or 36 1

B1

(c) factor 1

B1

(d) (i) 18 3

B1 cao

(ii) 11 or 88

B1

(iii) 69

B1 cao

[7]

05. (a) 16 + 32
= 48 2

B2 cao
(B1 for 16 or 32 seen)

(b) 4 1

B1 cao

[3]

06. (a) Row complete 2

B2 for 1+..+11; 36 (B1 for one of the 2 cells complete)

(b) Square 1

B1 "square"

[3]

07. (a) Multiple 1

B1 cao

(b) 15 1

B1 cao

(c) 16 1

B1 cao

[3]

08. (i) 5 or 7 1

B1 5 or 7

(ii) 4 1

B1 cao

(iii) 6 1

B1 cao

(iv) 2 or 5 1

B1 2 or 5

[4]

09. (a) 9 1

B1 cao

(b) 64 1

B1 cao

(c) $\frac{4}{5}$ 2

B2 for 4/5
(B1 for 80/100 oe or 0.8)

(d) £32 2

M1 for 10/100 × 320, or 320 ÷ 10
A1 cao
NB: £320-£32=£288 or £320+£32=£352 can be awarded M1 A1, but £288 or £352 without working award B1

(e) 0.35, 3/8
2/5, 45% 2

B2 all correct, or for equivalents in order: 0.35,0.375,0.4,0.45, or for a mixture of equivalents as long as the order is correct.
(B1 one error of misplacing numbers, or correct conversion to decimals or %, or correct order but reversed).
NB: accept 0.38 or 0.37 instead of 0.375 for B1, but not B2

[8]

10. (a) Two of 3, 5, 9, 11 1

B1 cao

(b) 5, 10 or 6,9 1

B1 cao

(c) 3 or 6 1

B1 for 3 or 6

(d) 8 or 16 1

B1 for 8 or 16

(e) e.g. "$5^2 = 25$" 1

B1 for correct explanation, e.g. $5^2 = 25$ or $3^2 = 9$ and $4^2 = 16$ so 10 cannot be a square number or showing diagramatically that 10 is not a square number

[5]

11. 1.6 + 8.4

10 2

B2 for 10
(B1 for sight of 1.6)

[2]

12. (a) 1.6 1

B1 cao

(b) 35%, 0.4, $\frac{3}{7}$, $\frac{7}{15}$ 2

0.4 0.466 0.35 0.429

B2 for all correct positions
(B1 for one incorrectly placed)
[SC: B1 for correct reverse order]

[3]

13. (i) 8 2

B1 cao

(ii) 9

B1 cao

[2]

14. (i) 36 2

B1

(ii) 8

B1

[2]

15. 0.5323…

6.782…–6.25

M1 for sight of 6.782… or 6.25 or 0.532
A1 cao

2

[2]

16. (i) 25

B1

2

(ii) 8

B1

[2]

17. 1.25

B1 for 1.25 oe

1

[1]

18. (a) (i) 16

B1

2

(ii) 8

B1

(b) 10^5

B1

1

[3]

19. reason

B1 for correct explanation with 81 ***or*** *100 seen*

1

[1]

20. 10.648

B1

1

[1]

21. (a) (i) 25 2
B1

(ii) 8
B1

(b) 7 1
B1

[3]

22. (i) 6 3
B1

(ii) 500
B1

(iii) 8
B1

[3]

23. 216 1
B1 cao

[1]

24. (a) 12 1
B1 accept twelve

(b) 5 1
B1 accept five

(c) 9 1
B1 accept 9

[3]

25. (a) 4 or 16 1

B1 for either 4 or 16 or both

(b) 4 1

B1 cao

(c) 8 1

B1 cao

(d) 2 1

B1 cao

[4]

26. (a) 25 1

B1 cao

(b) 7 1

B1 for 7 or 7 and –7 or ±7 or –7 alone

(c) 13 1

B1 cao

[3]

27. (a) 4 or 16 1

B1for 4 or 16

(b) 8 1

B1 for 8

[2]

28. (a) 16

B1 cao

(b) 1.5

B1 for 1.5 or $\frac{3}{2}$ *or* $1\frac{1}{2}$ *(accept –1.5 or ±1.5 or fraction equivalents)*

[2]

29. (a) 5 1

B1 for 5, –5, +5 or ±5

(b) 8 1

B1 cao

[2]

30. (a) 64 1

B1 cao

(b) 10 1

B1 for 10 (accept –10 or ± 10)

(c) 125 1

B1 cao
[Ignore any mention of units in any part]

[3]

31. (a) 4 1

B1 accept 4.0(0)

(b) 16 1

B1

[2]

32. D

[1]

33. (a) 36 1

B1 cao accept answer in words, ignore spelling

(b) 15 1

B1 cao accept answer in words, ignore spelling

(c) 1000 1

B1 cao accept answer in words, ignore spelling

[3]

34. (a) 14 1

B1 for 14 cao

(b) $7 \times 7 \times 7$

343 1

B1 for 343 cao

[2]

01. Answers to this varied widely both within and between centres. As far as any pattern was discernible, candidates appeared to be most familiar with multiples and factors and least familiar with cube numbers.

02. There were less completely correct responses to part (a) than might have been expected. Many candidates wrote down two or three prime numbers and gained at least one mark but 49 was often included. Some simply listed all the odd numbers. There were more successful attempts in part (b) but some candidates left the answer as '10^3'. Common incorrect answers were '30', '100' and '10000'.

03. Thus was well understood and well answered with over two thirds of candidates obtaining the correct answer to parts (a) (ii), (iii) and (iv). The idea of a square number however was only understood by 25% of candidates. In the explain question in part (b) there were only 19% of candidates with the correct response. A significant number of candidates thought that Tony was actually correct in his assumption that $2^3 = 6$.

04. **Specification A**

Most candidates achieved some success but few gained full marks. Part (b)(i) (multiple of 9) was well answered but it was not unusual for candidates to then give "multiple" as their answer to part (c). In the final part (symmetry), candidates performed best on part (ii), perhaps helped by the fact that there were two possible answers.

Specification B

Most candidates were able to successfully access at least 4 marks on this question. In part (a) and (b) they were able to write down two numbers from the list with a sum of 87 and write down a number which was a multiple of 9 but found providing a square number a more challenging task. Although candidates clearly understood the term 'multiple', they very often went on to state that 11 was a *multiple* of 88.
Many candidates could identify the number with 2 lines of symmetry in (d) they had more trouble recognising that 18 was the required answer to (i) and 69 was the answer to (iii).

05. Unfortunately, many candidates attempted to use the rules of indices in part (a) and gave an answer of 6^7. Those with the right idea usually worked out 4^2 as 16 but often calculated 2^5 incorrectly, most commonly as 64. The response to part (b) was just as disappointing with less than 30% of candidates able to identify the cube root of 64 as 4. Common incorrect answers were 8 (the square root) and 16 (from dividing 64 by 4).

06. Most candidates could complete both missing elements in the table to gain 2 marks in part (a) of this question. However, less than one in five could identify the numbers as square numbers in part (b). Many candidates thought that they were prime numbers.

07. In part (a) of this question recognition of the correct word proved to be beyond most candidates. "Factor" was chosen by more candidates than the correct answer. "Half" was also commonly seen. Most, but by no means all candidates, could identify 15 as the odd number in part (b). Part (c) was answered correctly by less than half of the candidates. "14" and "18" were commonly seen incorrect answers. Some candidates gave more than one number in their answers to (b) and (c), despite the question implying that only one number satisfied the criteria.

08. Most parts of this question were well attempted, but in part (ii) performance was poor, with many candidates unable to identify the "4" from the list as the square number.

09. The success rate in parts (a) & (b) in this question was related to that of question 2(ii), about half the candidates gaining the mark, with many lacking an understanding of square numbers or indices. In part (c) most were able to express the fraction as $\frac{80}{100}$, but of these half were then unable to cancel the fraction into its simplest form.

Candidates used a variety of methods in part (d), with many realising that a division by 10, or "10p in the £" would lead to the correct answer.

Candidates found part (e) far more challenging. The most successful method appeared to be conversion to decimals.

10. 95% of candidates could identify 2 odd numbers from the list given and the great majority could identify a pair of numbers whose sum was 15 though some gave the pair whose product was 15. Parts (c) and (d) of the question were also well answered though some candidates gave 4, a number which did not appear in the list given, as a factor of 12. Explanations given in part (e) were generally correct, clear and succinct. The main loss of marks in this part was due to attempts to explain that square numbers "go into themselves" or confusion between the terms square and prime.

11. Although the correct answer of 10 was often seen (in 54% of the cases), there were many who just wrote 10.96 (the sum of 2.56 and 8.4) or 3.31 (the square root of 10.96). Others wrote 14.9536 ($= 2.56^2 + 8.4$).

12. Part (a) was usually done very well, although a small minority of candidates either doubled or squared 2.56 instead of finding the square root.
Few failed to score at least 1 mark on part (b), the rest being evenly split between 1 and 2 marks.
Decimal equivalents were not often seen; in fact most candidates showed no working at all.

13. In part (i) there was much evidence to suggest that candidates appreciated that 2^3 represented $2 \times 2 \times 2$ but a significant number, after showing this working, then went on to give 6 as the answer. Only a few wrote $2 \times 3 = 6$.
Finding $\sqrt{81}$ gave rise to $9 \times 9 = 81$ but often candidates were unable to select 9 as being the required answer.

14. This was a challenging first question for most candidates with few candidates scoring the first 2 marks. Often 8 and 36 were involved but then candidates were unable to select which was the square number and which was the cube number.

15. It was not always evident that the candidates understood what they were meant to do with the square root and the square. Success, however, did seem to come where the intermediate working was written down. 4.282329983 was a common incorrect answer. Candidates did not always write down all the digits on their calculator display.

16. Identification of a square number and a cube number from a list of numbers proved to be more challenging than expected. There were many examples of 25 and 8 being identified but the vast majority of these examples gave 25 as the cube number and 8 as the square number. Those hedging their bets listed more than one number thus gaining no marks. Many candidates thought that a cube number meant that it was divisible by 3 giving 15 as their answer.

17. Many candidates (67%) gained the 1 mark in this question, demonstrating their ability to use the square root button on the calculator. A surprising number failed to gain the mark; 1.25^2, $1.5625^2 = 2.44140625$, $1.5625/2$ and 1.5625×2 were frequent incorrect answers.

18. Handling powers met with moderate success as the writing of 4^2 and 2^3 were often indicated in the format 4×4 and $2 \times 2 \times 2$. The evaluation of these, however, was only partially completed correctly. Usually the 4^2 led to 16 although 8 was also seen; the result of $2 \times 2 \times 2$ did produce the occasional 8 but 6 was the most common response. In part (b) the evaluation of $10 \times 10 \times 10 \times 10 \times 10$ as 10^5 was well rewarded although some struggled to achieve an answer and 5^{10}, 5×10 and 50 were frequent incorrect responses.

19. This proved to be somewhat challenging with only a few candidates able to offer a convincing reason why $\sqrt{90}$ is less than 10. Again it became necessary to home in on the key item and this could be achieved by reference to either the fact that $\sqrt{100} = 10$, $10 = 100$, $\sqrt{81} = 9$ or $9^2 = 81$. Many got the vocabulary of squares and square roots muddles. There were many fanciful reasons given. Perhaps "*because you take away the 0 from 90 and you are left with 9 and 9 is less than 10* " typifies the attempts which scored no marks. Candidates clearly need more practice in explaining how you reach answers.

20. Only 24% of candidates correctly reached the answer of 10.648. Some lost the mark by seeing 10.648 on their calculator but only writing 10.6, 10.64 or 10.65 on paper. Seeing $2.2 \times 2.2 \times 2.2$ in the working was reassuring that some had understood what to do.

21. (a) Apart from the square number being correctly stated as '25' both '10' and '8' were regularly seen. Some working suggested that '$5 \times 2 = 10$' instead of '$5 \times 5 = 25$' and '$4 \times 2 = 8$' instead of testing '$4 \times 4 = 16$' were calculated. Recognition of a cube number from the list provided a variety of responses. It was encouraging to note that a few offered the statement '$2 \times 2 \times 2 = 8$' as a means of testing their chosen answer. 43% of candidates got 25 and only 34% achieved a mark for 8 in (ii).
(b) Candidates seemed to identify the square root of 49 as being connected with the seven times table by either listing the multiplication or writing '$7 \times 7 = 49$'. 47% of the candidates scored the mark available for this question.

22. Just over half the candidates were able to provide the answer of 6 when finding the square root of 36 with the most common incorrect response being 6×6. It was evident that many candidates understood that 10^2 meant 10×10 and 2^3 meant $2 \times 2 \times 2$ but unfortunately after writing this down, their arithmetic let them down. It was not uncommon to see $2 \times 2 \times 2 = 6$ written in full. Under 40% of the candidates scored the mark in parts (ii) or (iii).

23. Over a half of the candidature scored the mark here for correctly cubing 6. A common error was to square 6 or to find the cube root of 6.

24. This question was well understood with 90% of candidates understanding the difference between a factor and a multiple, however only 40% of candidates could identify a square number.

25. Only half candidates realized that 4 or 16 was a square number and just under a half of the candidates recognised that the square root of 16 was 4. Cubing 2 caused more problems with 6 being a common incorrect response. Just under 40% of the candidates knew that 2 was the prime number from the numbers in the cloud.

26. The most common error in part (a) was to give an answer of 10. In part (b) 7 × 7 was often seen. This gained no credit. In part (c) the understanding of the order of operations was poor resulting the incorrect answer of 28 being the most common offered.

27. Part (a) was answered well with over a half of the candidature gaining full marks. In part (b), many candidates clearly failed to understand the term 'cube' when referred to a number.

28. Both parts (a) and (b) were correctly answered by well over a half of candidates. 8 was a common incorrect answer seen in (a) and in (b) many candidates either tried to halve or square 2.25

29. In part (a) 73% of the candidates were successful. Many candidates wrote 5 × 5 which did not score the mark. Other common incorrect responses were 625 where candidates found the square rather than square root, whilst others wrote $\sqrt{25}$ and then did not work out the answer.

Candidates were far less successful in part (b) with only 31% scoring the mark. Although some showed their working by writing 2 × 2 × 2 they then went on to write 6 as their answer. Another very common incorrect response was 4.

30. The most common errors here were; 16 in part (a), 50, 25, 1000 or 10000 in part (b) and 25, 2.5 and 15 in part (c). This final part was particularly poorly answered.

31. Part (a) of this question was well understood with 93 % of candidates scored the mark for either 4, 4.0 or 4.00 whilst part (b) was less well understood as only 52% of candidates scored the marks; 2 and 8 were common wrong answers.

32. No Report available for this question.

33. This question tested whether candidates understood the concept of powers and roots. Whilst 67% could find the square of 6 only 43% could find the square root of 225 and even fewer (41%) could find the value of 10^3. This was an indication of the size of the lack of calculator problem.

34. 55% of candidates were able to give the correct answer in part (a) of this question. Common incorrect responses included “98” and “38416” presumably obtained by dividing by 2 and squaring respectively. In part (b) just under 36% of candidates gave the correct answer. “21” was the most common incorrect answer seen.