1. The equation $x^3 + 10x = 21$
has a solution between 1 and 2

Use a trial and improvement method to find this solution.
Give your answer correct to one decimal place.
You must show **ALL** your working.

$x =$ .....

(Total 4 marks)

2. $3x^2 = 108$

(a) Find the value of x.

$x =$ .....

(2)

(b) Express 108 as a product of its prime factors.

……

(3)
(Total 5 marks)

The equation $x^3 + 10x = 21$
has a solution between 1 and 2

Use a trial and improvement method to find this solution.
Give your answer correct to one decimal place.
You must show **ALL** your working.

x = ...

(Total 4 marks)

3. $2x^2 = 72$

(a) Find a value of x.

.....

(2)

(b) Express 72 as a product of its prime factors.

.....

(2)
(Total 4 marks)

4. $3x^2 = 108$

Find the value of x

$x =$ …….

(Total 2 marks)

5. $2x^2 = 72$

Find a value of x.

.....

(Total 2 marks)

1. $1 \rightarrow 11$
$2 \rightarrow 28$
$1.1 \rightarrow 12.3(31)$
$1.2 \rightarrow 13.7(28)$
$1.3 \rightarrow 15.1(97)$
$1.4 \rightarrow 16.7(44)$
$1.5 \rightarrow 18.3(75)$
$1.6 \rightarrow 20.0(96)$
$1.7 \rightarrow 21.9(13)$
$1.8 \rightarrow 23.8(32)$
$1.9 \rightarrow 25.8(59)$
$1.65 \rightarrow 20.9(92125)$
1.7 4

B2 for trial between 1.6 and 1.7 inclusive
(B1 for a trial between 1 and 2 inclusive)
B1 for a different trial between 1.6 and 1.7 exclusive
B1 (dep on at least one previous B1) for 1.7
NB: trials should be evaluated to at least 1dp truncated or rounded.

[4]

2. (a) $x^2 = \frac{108}{3}$
6 2

M1 $(x^2 =)\frac{108}{3}$ *(=36) or 36 seen*

A1 cao 6 or – 6 or both. Also accept $\sqrt{36}$

(b) $2 \times 54 = 2 \times 2 \times 27$
$2 \times 2 \times 3 \times 3 \times 3$ 3

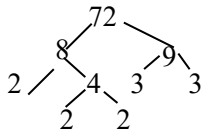
M1 for attempt at continual prime factorisation (at least 2 correct steps); could be shown as a factor tree.
A1 all 5 correct prime factors and no others
A1 $2 \times 2 \times 3 \times 3 \times 3$ or $2^2 \times 3^3$ oe

[5]

3. (a) $x^2 = 72 \div 2$
6 2

M1 for $72 \div 2$ or 36 seen
A1 6 or –6 or ± 6

(b) $72 = 2 \times 36 = 2 \times 2 \times 18$
$= 2 \times 2 \times 2 \times 9$



$2 \times 2 \times 2 \times 3 \times 3$ 2

M1 for a systematic method of at least 2 correct divisions by a prime number oe factor tree or a full process with one calculation error; can be implied by digits 2, 2, 2, 3, 3 on answer line
A1 for $2 \times 2 \times 2 \times 3 \times 3$ or $2^3 \times 3^2$ oe
[Note $1 \times 2 \times 2 \times 2 \times 3 \times 3$ gets M1 A0]

[4]

4. $x^2 = \frac{108}{3}$
6 2

M1 ($x^2 =$) $\frac{108}{3}$ (=36) or 36 seen
A1 cao 6 or – 6 or both. Also accept $\sqrt{36}$

[2]

5. $x^2 = 72 \div 2 = 6$ 2

M1 for $72 \div 2$ or 36 seen
A1 6 or –6 or ± 6

[2]

1. Intermediate Tier

As in previous examinations, many candidates knew how to do trial and improvement and gained at least 2 marks for a trial at 1.6 or 1.7 but fewer than 10% of candidates went on to give a fully correct solution. The trial at 1.65 was often omitted and even when this trial was carried out the final answer was often given as 1.6 or 1.65. Some candidates evaluated x^3 as $3x$ and a few calculated x^3 but then only added 10 each time. Most candidates gave the results of their trials to at least 1 decimal place, but some carried out far too many trials.

Higher Tier

This question was done reasonably well by many candidates; the majority using appropriate trials to evaluate $x^3 + 10x$ to an appropriate degree of accuracy. Many gained the first two marks for a trial of 1.6 or 1.7, fewer gained the mark for a trial between these values. A common approach was to look at the differences between 21 and their evaluations for 1.6 and 1.7, and erroneously conclude an answer 1.6.

2. Intermediate Tier

In part (a) about a half of candidates knew what to do, and most of those gave the correct answer, though some found division of 108 by 3 quite difficult. The most common error was to divide by 2 instead of finding a correct square root, giving 18 as the final answer. Where students attempted to find the square root of 108 first, they often did so by dividing by 2 to get 54, then by 3 to get 18. In part (b) very few candidates knew anything of prime factors. The most common method demonstrated was a factor tree method, but candidates failed to divide the numbers up correctly into their factors. As a result there were usually some 2s and 3s, but not necessarily the correct number of either. There were a significant number of cases where candidates obtained the correct numbers of 2s and 3s but then transcribed these incorrectly on the answer line. It was not uncommon to see candidates spoil their answer by writing $2^2 + 3^3$.

Higher Tier

This question was done well by the majority of the candidates. In part (a), the most common errors included mixing up the order of operations, so that the square root was taken first, and incorrect division of 108 by 3 (common answers being 16 and 96). In part (b), factor trees and long division (seen in equal numbers) were the principal methods used to find the prime factors. Candidates did not always combine these as a product in their final answer, common errors being 2, 2, 3, 3, 3 and 22 + 33. Common errors in method included incomplete prime factorisation, such as $2 \times 2 \times 27$ and $3 \times 3 \times 3 \times 4$; the splitting of 108 to 8 and 100, followed by the prime factorisation of each of part; the listing of factor pairs, 2×54, 3×36, …

3. **Foundation**

It is true to say that performance in part (a) was better than that in part (b), however this question was, in general, not well answered. In part (a), one .mark could be gained by correctly finding a half of 72; many failed to get any further than this, usually dividing 36 by 2 to give 18 as their final answer. Some tried to find the square root of 72 and then divide the result by 2

Many candidates simply did not know where to start in part (b), often simply quoting factors of 72. Any attempts at drawing a factor tree often resulted in the award of one mark, but few completed the process to a correct conclusion. Answers of $2 \times 2 \times 2 \times 9$ and 2, 2, 2, 3, 3 and $2 + 2 + 2 + 3 + 3$ were seen on a number of occasions.

Higher

In part (a) the majority of candidates divided 72 by 2 and then found the square root, usually just giving the positive solution which was sufficient for full marks. The common error was for candidates to try to find the square root of 72 and then divide by 2. A few divided by 2 twice and gave an answer of 18. Part (b) was generally answered well with the most common method being the use of a factor tree. Many fully correct answers were seen and most candidates were comfortable with index notation. Some made errors in their factor tree (often $6 = 3 \times 3$) and some who found the correct prime factors listed them on the answer line or wrote $2^3 + 3^2$.

4. Approximately 80% of candidates were able to answer this question correctly. The most common error was to carry out the two necessary operations in the wrong order and so to attempt to square root 108 before dividing by 3. A number of those candidates who carried out the operations in the correct order were unable to divide 108 by 3 and obtain the correct answer of 36.

5. Candidates who had a strong feeling for Bidmas generally were successful on this question. They divided by 2 and the spotted that 6 squared is 36. Those candidates who tried to find a square root first got nowhere. A few candidates tried trial and improvement with mixed degrees of success as they also had a problem with Bidmas, often doing the doubling of their trial first. Candidates who followed this route successfully were given full marks. Otherwise they received no marks.