# Edexcel GCSE

## Mathematics

# Foundation/Higher Tier

## Number: Approximation, Estimation

### Information for students

The marks for individual questions and the parts of questions are shown in round brackets: e.g. **(2)**.
There are 35 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 "Approximation and Estimation" though they might assess other areas of the specification as well. Questions are those tagged as "Foundation/Higher" so could have (though not necessarily) appeared on either a Foundation, Intermediate or Higher tier paper.

**1.** Use your calculator to work out the value of

$$\frac{(7.91 - \sqrt[3]{81}) \times 4.32}{6.23 + 1.491}$$

Give your answer correct to 3 significant figures.

……

**(Total 3 marks)**

**2.** Each side of a regular pentagon has a length of 101 mm, correct to the nearest millimetre.

(i) Write down the **least** possible length of each side.

..... mm

(ii) Write down the **greatest** possible length of each side.

..... mm

**(Total 2 marks)**

**3.** Use your calculator to work out the value of $\dfrac{6.27 \times 4.52}{4.81 + 9.63}$

(a) Write down all the figures on your calculator display.

.....

**(2)**

(b) Write your answer to part (a) to an appropriate degree of accuracy.

.....

**(1)**

**(Total 3 marks)**

**4.** On average, Nick walks 18 000 steps every day.
He walks 1 mile approximately every 3500 steps.

Work out an estimate for the average distance, in miles, that Nick walks **in one year.**

..... miles

**(Total 3 marks)**

**5.** Fred runs 200 metres in 21.2 seconds.

(a) Work out Fred's average speed.
Write down all the figures on your calculator display.

..... metres per second

**(2)**

(b) Round off your answer to part (a) to an appropriate degree of accuracy.

..... metres per second

**(1)**

**(Total 3 marks)**

**6.** Work out an estimate for the value of $\frac{637}{3.2 \times 9.8}$

……..

**(Total 2 marks)**

**7.** (a) Work out the value of $3.8^2 - \sqrt{75}$
Write down all the figures on your calculator display.

…….

**(2)**

(b) Write your answer to part (a) correct to 1 significant figure.

…….

**(1)**
**(Total 3 marks)**

**8.** Three woman earned a total of £36

They shared the £36 in the ratio 7:3:2

Donna received the largest amount.

(a) Work out the amount Donna received.

£……..

**(3)**

A year ago, Donna weighed 51.5 kg.

Donna now weighs $8\frac{1}{2}$% less.

(b) Work out how much Donna now weighs.
Give your answer to an appropriate degree of accuracy.

…….kg

**(4)**
**(Total 7 marks)**

**9.** Work out an estimate for the value of $\frac{5.79 \times 312}{0.523}$

.....

**(Total 3 marks)**

**10.** Work out an estimate for $\frac{412 \times 5.904}{0.195}$

**(Total 3 marks)**

**11.** Work out $\frac{\sqrt{2.56 + 3.50}}{8.765 - 6.78}$

(a) Write down all the figures on your calculator display.

.....

**(2)**

(b) Give your answer to part (a) to an appropriate degree of accuracy.

.....

**(1)**

**(Total 3 marks)**

**12.** Estimate the value of $\frac{21 \times 3.86}{0.207}$

.....

**(Total 3 marks)**

**13.** (a) Use your calculator to work out $\frac{\sqrt{19.2+2.6^2}}{2.7\times1.5}$

Write down all the figures on your calculator display.

.....

**(2)**

(b) Write your answer to part (a) correct to 3 significant figures.

.....

**(1)**

**(Total 3 marks)**

**14.** Use your calculator to work out the value of $\sqrt{20.25}+1.65^2$

(a) Write down all the figures on your calculator display.

.....

**(2)**

(b) Write your answer to part (a) correct to 1 decimal place.

.....

**(1)**

**(Total 3 marks)**

**15.** Work out an estimate for $\frac{302 \times 9.96}{0.51}$

.....

**(Total 3 marks)**

**16.** Use a calculator to work out

$$\sqrt{\frac{21.6 \times 15.8}{3.8}}$$

(a) Write down all the figures on your calculator display.

.....

**(2)**

(b) Give your answer to part (a) correct to 3 significant figures.

.....

**(1)**

**(Total 3 marks)**

**17.** (a) Work out $\dfrac{4.6+3.85}{3.2^2-6.51}$

Write down all the numbers on your calculator display.

.....

**(2)**

(b) Give your answer to part (a) correct to 1 significant figure.

.....

**(1)**

**(Total 3 marks)**

**18.** Work out an estimate for the value of

$$\frac{6.8\times191}{0.051}$$

.....

**(Total 3 marks)**

**19.** The length of a path is 14 m correct to the nearest metre.

(i) Write down the minimum possible length of the path.

……m

(ii) Write down the maximum possible length of the path.

……m

**(Total 2 marks)**

**20.** Estimate the value of

$$\frac{813 \times 19.8}{97.6}$$

.....

**(Total 2 marks)**

**21.**

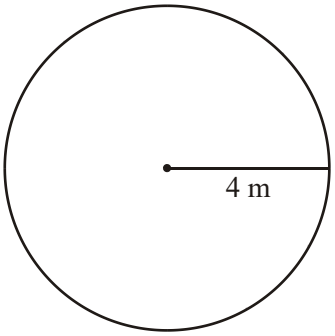


Diagram **NOT** accurately drawn

The radius of a circle is 4 m.

Work out the area of the circle.
Give your answer correct to 3 significant figures.

..... $m^2$

**(Total 2 marks)**

**22.** Jerry measures a piece of wood as 60 cm correct to the nearest centimetre.

(i) Write down the minimum possible length of the piece of wood.

..... cm

(ii) Write down the maximum possible length of the piece of wood.

..... cm

**(Total 2 marks)**

**23.** Use your calculator to work out the value of $\frac{1}{2.73^2 - 3.86}$

(a) Write down all the figures on your calculator display.

…….

**(2)**

(b) Give your answer to an appropriate degree of accuracy.

…….

**(1)**
**(Total 3 marks)**

**24.** (a) Write the number 0.00821 correct to 2 significant figures.

.....

**(1)**

(b) Use your calculator to work out

$$\frac{15.1 + 4.82}{6.2 - 3.7}$$

Write down all the figures on your calculator display.

.....

**(2)**
**(Total 3 marks)**

**25.** Using the information that

$65 \times 423 = 27\,495$

find the value of

(i) $0.65 \times 4230$

.....

(ii) $274.95 \div 650$

.....

**(Total 2 marks)**

**26.** Use your calculator to work out the value of $\frac{5.68 - 1.32^2}{0.73}$

(a) Write down all the figures on your calculator display.

.....

**(2)**

(b) Write your answer to part (a) correct to 2 significant figures.

.....

**(1)**

**(Total 3 marks)**

**27.** A tower has a height of 124 m, correct to the nearest metre.

(i) Write down the **least** possible height of the tower.

.....m

(ii) Write down the **greatest** possible height of the tower.

.....m

**(Total 2 marks)**

**28.** Which is the best estimate for the value of $\frac{410 \times 6.9}{0.23}$ ?

| 14000 | 7000 | 1230 | 1400 | 2800 |
|---|---|---|---|---|
| **A** | **B** | **C** | **D** | **E** |

**(Total 1 mark)**

**29.** (a) Use your calculator to work out

$$\frac{1000}{7.3^2 - 16.3}$$

Write down all the figures on your calculator display.

.....

**(2)**

(b) Write your answer to part (a) correct to 1 decimal place.

.....

**(1)**

**(Total 3 marks)**

**30.** Given that $48.6 \times 35 = 1701$

write down the value of

(a) $4.86 \times 3.5$

.....

**(1)**

(b) $17.01 \div 35$

.....

**(1)**

**(Total 2 marks)**

**31.** (a) Use your calculator to work out the value of $2.58 \times \sqrt{2}$

Write down all the figures on your calculator display.

.....

**(1)**

(b) Write your answer to part (a) correct to 1 decimal place.

.....

**(1)**

**(Total 2 marks)**

**32.** Work out an estimate for $\dfrac{10.1 \times 29.7}{5.9 - 3.1}$

.....

**(Total 3 marks)**

**33.** Which is the best estimate for the value of $\frac{37.9 \times 50.2}{2.1 + 2.98}$?

| 38 | 40 | 400 | 4000 | 1003 |
|---|---|---|---|---|
| **A** | **B** | **C** | **D** | **E** |

**(Total 1 mark)**

**34.** Given that $47 \times 81.6 = 3835.2$

What is the value of $0.47 \times 816$?

| 383.52 | 38 352 | 38.352 | 3835.2 | 3.8352 |
|---|---|---|---|---|
| **A** | **B** | **C** | **D** | **E** |

**(Total 1 mark)**

**35.** Which is the best estimate for the value of $\frac{38.3 \times 51.7}{2.1}$?

| 750 | 2000 | 1000 | 1500 | 100 |
|---|---|---|---|---|
| **A** | **B** | **C** | **D** | **E** |

**(Total 1 mark)**

**01.** 2.00 3

$7.91 - \sqrt[3]{81} = 3.583251$
3.583251…… × 4.32 = 15.47964..…
6.23 + 1.491 = 7.721
15.47964…÷7.721 =

*B3 for 2 to 2.005*
***or***
*B1 for 3.58(3251) (× 4.32) or 15.5 or better*
*B1 for 7.721 seen*

**[3]**

**02.** (i) 100.5 2

Least length = 100.5

*B1 for 100.5*

(ii) 101.5

Greatest length = 101.5

*B1 for 101.5; ACCEPT 101.499 or better*

**[2]**

**03.** (a) 1.9626… 2

$\frac{6.27 \times 4.52}{4.81 + 9.63} = \frac{28.3404}{14.44} = 1.962631579$

*B2 for 1.9626…*

*(B1 for 28.34… or 14.44)*

(b) 1.96 1

*B1 ft from (a) as rounded to 1dp or 2dp.*

*Do not accept 2, 2.00, but accept 2.0*

**[3]**

**04.** 2000 3

$\frac{18000 \times 365}{3500}$

$\frac{20000 \times 400}{4000}$

*M1 for – 3500 or – 4000 or 5 seen*

*M1 for × 365 or × 400 or × 7 × 4 × 12*

*A1 for answer in range 1800 - 2300*

**[3]**

**05.** (a) 9.43396 2

200 – 21.2 = 9.43396…

*M1 for 200 – 21.2 (imply from 9…)*

*A1 for 9.43396.*

(b) 9.4 1

*B1 ft 2sf or 3sf on '9.43396'*

**[3]**

**06.** $20\text{-}21\frac{1}{3}$ 2

$\frac{600}{3\times10}$ or $\frac{640}{3.2\times10}$

*M1 for rounding at least two of the numbers to 1 sf or for sight of 640, 3.2 or 640, 32 or 600, 32 or 30 seen*
*A1 for* $20 - 21\frac{1}{3}$
*Note: 20.3125 scores M0 A0*

**[2]**

**07.** (a) 5.77974(…) 2

14.44 – 8.660254038
*M1 for 14.44 seen or 8.66(...) or 5.7 or 5.8 or better rounded or truncated*

(b) 6 1
*A1 cao*
*B1 ft*

**[3]**

**08.** (a) 21 3

36 ÷ (7 + 3 + 2)
"3" × 7
*M1 for 36 ÷ (7 + 3 + 2)*
*M1 (dep) for "3" × 7 or 3 or 2*
*A1 cao*

(b) 47 or 47.1 or 47.12 4

$51.5 \times \frac{8.5}{100} = 4.3775$
*51.5 – 4.3775 = 47.1225*
*M1 for* $51.5 \times \frac{8.5}{100}$ *or 4.37(75) seen*
*M1 (dep) for 51.5 – "4.37(75)"*
*A1 for 47 or better*
*B1 (indep) for rounding their answer correctly to the nearest whole number or 1 or 2 d.p*
*OR*
*M1 for* $51.5 \times \frac{100 - 8.5}{100}$
*M1 for 51.5 × "0.915" or 0.515 × "91.5"*
*A1 for 47 or better*
*B1 (indep) for rounding their answer correct to the nearest whole number or 1 or 2 d.p*

**[7]**

**09.** Eg $6 \times 300 \div 0.5=$
or
$10 \times 312 = 3000 - 3750$ 3

*B2 for 6, 300 and 0.5 seen, or 10 & 300, or 10 & 312, or 10 & 310, or 1800 & 0.5, or 1500 & 0.5 or 1860 & 0.5 or 1872 & 0.5*
*(B1 for one of 6, 300, 0.5, 10 or 600 seen)*
*B1 cao*

**[3]**

**10.** $\frac{400 \times 6}{0.2} = \frac{2400}{0.2}$
12000–12500 3

*M1 two of 400, 6, 0.2*
*A1* $\frac{2400}{0.2}$ *or* $\frac{2460}{0.2}$ *or* $2000 \times 6$ *or* $2050 \times 6$ *or* $400 \times 30$ *or* $410 \times 30$
*A1 answer in range 12000 – 12500*

**[3]**

**11.** (a) $\frac{\sqrt{6.06}}{1.985}$
1.24015 2

*B2 for 1.24015 .....*
*(B1 for sight of 2.46(....) or 1.985 or 1.24(....))*

(b) 1.24 1

*B1 ft any answer to (a) correctly rounded to 2, 3 or 4 significant figures*

**[3]**

**12.** 386 – 420 3

*M1 for 2 of 20, 4, 0.2*
*A1 for* $\frac{80}{0.2}$ *or* $\frac{84}{0.2}$ *or* $100 \times 4$ *or* $105 \times 4$ *or* $20 \times 20$ *or* $21 \times 20$
*A1 for answer in range 386 – 420*

**[3]**

**13.** (a) $\frac{\sqrt{25.96}}{4.05} = \frac{5.09509...}{4.05}$ 2

1.258048316

*M1 for 5.09... or 4.05 or 25.96 seen*
*A1 for at least 4 sf rounded or truncated:*
*1.258(048316...) or 1.26*

(b) 1.26 1

*B1 for 1.26 or ft from (a); 1.260 gets B0*

**[3]**

**14.** (a) 4.5 + 2.7225 = 7.2225 2

*M1 for 4.5 or 2.7225*
*A1 7.2225 cao*

(b) 7.2 1

*B1 for rounding correctly their 4 or more figure answer in (a)*
*to 1 decimal place; award if 7(a) already to 1dp*

**[3]**

**15.** $\frac{300 \times 10}{0.5} = \frac{3000}{0.5}$

5890 – 6040 3

*M1 for any two of 300, 10 or 0.5*
*M1 for* $\frac{3000}{0.5}$ *or 300 × 20 or 600 × 10 or* $\frac{3020}{0.5}$ *or 302 × 20 or 604 × 10*
*A1 for 5890 – 6040*
*SC: B2 for answer of 1500 or 1510*

**[3]**

**16.** (a) $\sqrt{\frac{21.6\times15.8}{3.8}} =$

9.476841579 2

*M1 for* 89.81052 .... *or 341.28 or 4.86151… or* $\frac{8532}{95}$ *or* $\frac{8532}{25}$
*A1 for 9.47684.....*
*SC : B1 for 9.476841579… truncated or rounded to at least 1 decimal place*

(b) $\sqrt{89.81052632}$

9.48 1

*B1 ft from (a) with at least 4 significant figures*

**[3]**

**17.** (a) $4.6 + 3.85 = 8.45$
$3.2^2 - 6.51 = 3.73$
$8.45 \div 3.73 =$
2.26541555 2

*M1 for* $\frac{169}{20}$ *or* $\frac{256}{25}$ *or* $\frac{373}{100}$ *or 3.73 or 10.24 or 8.45 seen*
*A1 for 2.265(41555); accept* $\frac{845}{373}$

(b) 2 1

*B1 ft for 2 or follow through their answer to part (a)*
*NB: 2.0 gets B0*

**[3]**

**18.** $\frac{7\times200}{0.05} = \frac{1400}{0.05} = 28000$ 3

*B1 for any two of 7, 200 or 0.05*
*M1 for correct processing of at least two of 7, 200 or 190 and 0.05 or 0.1*
*A1 26600 – 28000*

**[3]**

**19.** (i) 13.5 2

*B1 cao*

(ii) 14.5

*B1 for 14.5 or 14.499(999…)*

**[2]**

**20.** 160, 162 or 200 2

$\frac{800 \times 20}{100}$

*M1 for two of 800 (or 810), 20 and 100 seen*
*A1 for 160, 162 or 200.*

**[2]**

**21.** 50.2 to 50.3 2

$\pi \times 4^2$

*M1 for* $\pi \times 4^2$
*A1 for 50.2 to 50.3*

**[2]**

**22.** 59.5
60.5 2

*B1*
*B1*

**[2]**

**23.** (a) 0.278326699 2

*B2 for 0.278326(699…)*
*(B1 for 3.5929)*

(b) 0.28 or 0.278 1

*B1 ft for rounds to 2dp or 3 sf or 2sf*

**[3]**

**24.** (a) 0.0082 1

*B1*

(b) $\frac{19.92}{2.5}$

7.968 2

*B2 for 7.968*
*(B1 for 19.92* ***or*** *2.5 in the working* ***or*** *7.97 as an answer)*

**[3]**

**25.** (i) 2749.5 2

*B1 cao*

(ii) 0.423

*B1 cao*

**[2]**

**26.** (a) (5.68 – 1.7424)/0.73
3.9376/0.73
5.3939(72603) 2

*M1 for 5.68 – 1.7424 or 3.93 or 3.94 or 5.39….seen*
*A1 for 5.3939 or better*

(b) 5.4 1

*B1 ft for correcting to 2 sig. figs.*

**[3]**

**27.** (i) 123.5 2

*B1 cao*

(ii) 124.5

*B1 for 124.5 or* $124.4\dot{9}$

**[2]**

**28.** A

**[1]**

**29.** (a) 27.034…… 2

*B2 for 27.034(3336)*
*(B1 for 53.29 or 36.99 seen)*

(b) 27.0 1

*B1 ft*
*[Note: An answer of 27 or 27.00 only is not acceptable]*

**[3]**

**30.** (a) 17.01 1

*B1 cao*

(b) 0.486 1

*B1 cao*

**[2]**

**31.** (a) $2.58 \times \sqrt{2} =$
3.648670991 1

*B1 for 3.648... cao*

(b) 3.6 1

*B1 ft for "3.6"*

**[2]**

**32.** $\frac{10 \times 30}{6-3} = 100$ 3

*M1 for two of 10, 30, 6, 3*
*A1 for* $\frac{300}{3}$ *or for* $\frac{330}{3}$
*A1 for answer in range 100 – 110*

**[3]**

**33.** C

**[1]**

**34.** A

**[1]**

**35.** C

**[1]**

**01.** Most candidates were able to answer this question correctly. They could use the cube root key of their calculator with confidence and sequence the order of the calculations. The most common incorrect answer was 3.98, obtained as a result of failing to work out the denominator first before completing the division.

**02.** The vast majority of candidates gave the correct answer to part (i) but in (ii) the greatest possible length of each side was given incorrectly as either "101.4" or "101.49" by a significant minority.

**03. Mathematics A**

**Paper 4**

Many candidates are still attempting these questions in one stage using the calculator, and subsequently getting it wrong. Candidates who work out numerator and denominator separately, writing each down in full before carrying out the division, usually assure themselves of at least some method marks, but most go on to give the correct answer. All candidates should be advised to follow this process. The majority of candidates gained the mark in part (b) for appropriate rounding of their answer to (a).

**Paper 6**

This was a straightforward evaluation which most candidates could do well. Very few fell into the trap of not evaluating the denominator fully before doing the division. Answers to part (b) were good with only a few giving 1.963, or worse or at the other end, 2.

**Mathematics B**

**Paper 17**

Candidates who worked out the numerator and denominator separately usually completed the calculation accurately. An answer of 15.52197505 was a common error found by dividing by 4.81 and then adding 9.63.
Often one significant figure was chosen as an appropriate degree of accuracy in part (b); 2 being a common answer.

**Paper 19**

The majority of candidates were able to score full marks on this question. Of those candidates who failed to obtain the correct answer, few wrote down any working and so failed to score any marks. A common incorrect answer was 15.52… coming from the omission of brackets.

**04.** Many candidates realised that they needed to multiply by 365 and divide by 3500 but very few rounded the numbers to make the calculations easier. Arithmetic and place value errors were commonplace and these often led to answers of a strange magnitude. There was very little evidence to suggest that candidates had checked the reasonableness of their results by reference to the size of the numbers. The most successful candidates were those who worked out that Nick walked approximately 5 miles per day.

**05.** **Paper 4**

This was a well answered question, showing candidates strengths in making speed calculations. Nearly $^3/_4$ of candidates gave the correct answer in part (a), with most of those going on to gain the mark in part (b). The main calculation error in part (a) was in undertaking a multiplication rather than a division. The other significant error was in unnecessary rounding of answers in part (a), irrespective of the fact that the question clearly asked candidates to "write down all the figures".

**Paper 6**

This is a speed, distance and time problem. Candidates find the time by dividing 200 by 21.1. The vast majority of candidates were able to d his. Part (b) involved rounding off the answer to part (a) to a sensible degree of accuracy. In this case that meant writing the answer correct to 2 or 3 significant figures.

**06. Specification A**

**Foundation Tier**

Only a minority understood the meaning of "estimate" and consequently there were many attempts to evaluate the expression accurately. Some scored one mark for rounding two of the numbers to one significant figure or for the appearance of 30, even if it were on the answer line. 3.2 × 9.8 was sometimes evaluated as 13 and even progressing as far as $\frac{600}{30}$ was no guarantee of full marks, as it regularly resulted in an answer of 200. Candidates rounding 9.8 down to 9 seldom received any credit and, in addition, gave themselves the daunting task of dividing by 27.

**Intermediate Tier**

Most candidates appreciated the need to undertake some rounding in order to ease the arithmetic. Many rounded 3.2 and 9.8 to one significant figure, though some used 637, 630 or 640 as numerator. Those who used 30 as a denominator usually completed the problem successfully. Candidates who failed to give a complete value by giving the answer with a remainder were not awarded the second mark.

**Specification B**

**Foundation Tier**

It was disappointing to see that over 80% of the candidates did not know how to estimate with many trying to calculate the answer by attempting long multiplication and then a complicated division sum… all for 2 marks. Clearly a number of students are still under the impression that if the question asks for an estimate then the accurate answer is even better! Those that did attempt to estimate were generally able to score at least 1of the 2 available marks by rounding at least 2 of the numbers correctly or writing 30 somewhere. It was evident that even among those who were able to round to 1 significant figure, many were at a loss to deal with numbers as multiples of 10 giving a great variety of incorrect solutions such as 200, 2000 and 210. The ability to work out an estimation is a useful skill and requires greater emphasis in centres.

**Intermediate Tier**

Few candidates rounded all three numbers to one significant figure. $\frac{640}{3\times10}$ was the usual approximation of the given numbers. This usually led to a correct answer of 21 or $21\frac{1}{3}$, or equivalent. 21 remainder 10 was a common error which lost the accuracy mark. Many candidates failed to fully simplify the numbers and left themselves with more demanding calculations. Division of 637 or 600 or 640 by 27 was not uncommon.

**07. Specification A**

**Foundation Tier**

Only 25% of candidates obtained the correct answer to part (a) little intermediate working was shown in answer to this part and as a result it is likely that many candidates (who did not give the correct answer) lost the partial credit they deserved for evaluating either $3.8^2$ or $\sqrt{75}$ correctly. "–71.2" was a commonly seen incorrect answer. In part (b) only 15% of candidates gained the mark available for rounding their answer to (a) to 1 significant figure. Many gave answers correct to 1 or 2 decimal places.

**Intermediate Tier**

Part (a) was well answered. Most candidates gained at least one mark with many scoring full marks. Most often marks were lost because candidates did not write down the full calculator display but rounded or truncated the final answer. In part (b) only about 40% of candidates were able to round the answer given in part (a) correct to the required degree of accuracy. The most common error was to round it to 1 decimal place instead of to 1 significant figure.

**Specification B**

The evaluation of the square root and the subtraction from a square number definitely needed a calculator in order to be able to make any progress in this question. Roughly half were able to demonstrate an ability to process the numbers. The award of part marks for 14.44 or 8.66 meant that those who used a calculator could gain one mark for dealing with either the square root or the square and recording their answer. The question required the full calculator display to be recorded but some were overcome with a desire to shorten the outcome and thus lost the final mark.
Converting the result to one significant figure was not always executed correctly as this was re-written correct to one decimal place with only 14% able to correctly round their answer to part (a) to one significant figure.

**08. Specification A**

**Higher Tier**

Part (a) rarely posed a challenge at this level. Most candidates were also successful on part (b) either by working out 8.5% and subtracting the kg or by working out 91.5% of the initial weight. Generally candidates were able to round off answers to a sensible degree of accuracy. Of those that got it wrong the main faulty approach was to split the 8.5% into parts (5%, 2.5% etc). In this case accuracy was often lost and/or numbers entered in the wrong columns.

**Intermediate Tier**

Part (a) was answered very well and candidates who understood the concept of ratio generally gained full marks. Part marks were rarely awarded. The most common error was for candidates to work out 36 ÷ 7, 36 ÷ 3 and 36 ÷ 2 and then give an answer of £18, the largest amount. Responses to part (b) were mixed. Whilst many candidates (just over 40%) gained full marks there were many poor attempts as well. Build-up methods to find 8½% were common and these often resulted in an incorrect answer. Many candidates did use a calculator to correctly work out 8½% of 51.5 as 4.3775 but some then truncated this to 4.37 or 4.3 before subtracting and others who obtained an answer of 47.1225 did not round it to an appropriate degree of accuracy at the end. Marks were often lost through a lack of understanding of 'percentage'. Quite a few candidates divided 51.5 by 8.5 and subtracted the answer from 51.5 and some merely subtracted 8.5 from 51.5.

**Specification B**

Dividing £36 in the given ratio was usually accurately done in part (a), often showing more work than required in answering the question, by giving the correct answers for all three shares. The most common error here was to divide £36 by 7, 3 and 2 and then select the highest value. In part (b) methods for finding 8.5% of 51.5 kg were varied. Success was usually achieved where candidates multiplied 51.5 by $\frac{8.5}{100}$. Build up methods were very common but usually failed due to arithmetic error, and through no explicit explanation of the method being given. For example; 10% = 5.15 followed by 5% = 0.515 must be explained (ie 5% = 5.15 ÷ 2 = 0.515) if method marks are to be awarded when arithmetic errors are made. Answers given to an appropriate degree of accuracy were common with whole number, one and two decimal places being acceptable. It was not uncommon to see 51.5 ÷ 8.5 in an attempt to find the percentage. Many weaker candidates simply subtracted 8.5 from 51.5 to give 43; this gained no marks.

**09. Intermediate Tier**

This was also a good discriminator. There were some fully correct answers. Of those candidates who used estimation, nearly all scored at least one mark. Many candidates reached 1800 + 0.5 , but then gave their answer as 900 as a result of dividing by 2 instead of 0.5, which was the most common answer seen.

**Higher Tier**

There were many interesting attempts at this question. Many candidates did adopt the method of rounding each of the numbers correct to 1 significant figures and then finding the value 3600. Others opted for the rounded figures 6, 310 and 0.5 to get 3720. A less good approximation seen was to use the figures 5, 300 (or 310) and 0.5 to get 3000 and 3100 respectively. Most candidates used one of the above approximations and scored at least 1 out of the 3 marks. A very common error was to treat the operation of dividing by 0.5 as multiplication by 0.5 or, equivalently, division by 2.

**10. Specification A**

**Intermediate Tier**

Most candidates understood that they had to undertake some rounding of the numbers, though in the case of two of the numbers truncation was inappropriate. Some candidates got as far as 2400 ÷ 0.2, but only the more able performed this division correctly. No marks were awarded for attempts at exact calculation, since the question asked for estimation.

**Higher Tier**

The use of one significant figure for estimation was not always used consistently in this question. Whereas most candidates were happy to round 5.904 To 6, there were some who rounded 412 to 410 (or just left it unrounded). Some candidates rounded 0.195 to 1 or even 0. A significant number of candidates were confused by the decimal point when dividing by 0.2. Common incorrect answers were 120 and 1200.

**Specification B**

**Intermediate Tier**

Most candidates gained at least one mark in this question for rounding two of the given numbers to one significant figure, usually for 400 and 6. The denominator was often approximated to 1 or 0 which resulted in no further progress.

$\frac{2400}{0.2}$ or $\frac{2460}{0.2}$ was often seen, usually being followed by an answer of 1200 or 1230.

Those candidates trying to use long multiplication and division failed to score any marks. A large number of candidates approximated 0.195 to zero and then treated zero as equivalent to one in order to carry out the division.

**11. Intermediate Tier**

It is disappointing that almost 50% of candidates gained no marks in part (a). Many, unfortunately, showed no working. The most common incorrect answer was -4.780684541 obtained by typing the numbers into the calculator without using brackets. Those who evaluated the numerator and denominator separately were more successful. Very often only 2.56 was square rooted but many candidates gained a mark for evaluating the denominator as 1.985. In part (b) more than 60% of candidates were able to round the answer given in part (a) correctly to an appropriate degree of accuracy. Some, however, truncated, some thought that one significant figure was appropriate and some, with a negative answer in (a), forgot to include the negative sign.

**Higher Tier**

There were many correct solutions. However, many candidates misinterpreted the calculation as $\sqrt{\frac{6.06}{1.985}}$ instead of $\frac{\sqrt{6.06}}{1.985}$. A few candidates obtained negative answers from failing to use brackets on the denominator.

**12. Paper 5523**

Some candidates attempted to work out the exact answer to this question. Most candidates, however, attempted to round the numbers to one significant figure although many did not round 21. A significant number of candidates rounded 0.207 to 0 or 1. Three quarters of those who got as far as 80 ÷ 0.2 or 84 ÷ 0.2 could not complete the calculation correctly.

**Paper 5525**

Less than half the candidates were able to gain full marks for this question. Many were able to use an appropriate degree of accuracy for 21 and 3.86, but a significant number had difficulties with the 0.207, which was sometimes approximated as 0, 0.5 or 1. Of those that used appropriate approximations, many were unable to deal with a division by 0.2. Common errors were 84 × 2 and $\frac{80}{5}$.

**13. Paper 5524**

A significant number merely keyed in the numbers into the calculator and inevitably got the wrong answer. Only those who undertook separate calculations for numerator and denominator arrived at the correct answer. Many candidates were unable to round the answer in (a) correctly to 3 significant figures, with many choosing to round to decimal places by mistake, or truncating. Rounding is clearly a general weakness.

**Paper 5526**

Part (a) required the correct use of a calculator. The vast majority of candidates could sequence the calculations and achieve the correct answer. There was a worrying minority of students who did not appreciate the need to apply Bidmas (Or Bodmas) especially when it came to the evaluation of the denominator of the expression, thus the most common errors were to square root only the 19.2 and not the result of $19.2 + 2.6^2$ and to evaluate the numerator and denominator separately and thus divide by 2.7 and multiply by 1.5. Most candidates could round off correct to 3 significant figures.

**14.** Many scored full marks, and then went on o round their answers correctly in part (b). Errors were made in part (a) by those who attempted the calculation in one stage on their calculators. This often resulted in $20.25 + 1.65^2 = 22.9725$ and then 4.792…

There was a problem with decimal points. Either the candidate failed to show them in their answer, or merely moved them in part (b) instead of rounding.

**15. Foundation**

Very few candidates gained full marks for this question. Many were able to round 302 and 9.96 to 300 and 10 respectively but the denominator of 0.51 was often rounded to 1 or somehow became 50. Sadly, the majority of those candidates who did get as far as 3000/0.5 were unable to evaluate this as 6000. Most chose to divide by 2 so that 1500 and 1510 were very common incorrect answers. Too many candidates failed to recognise the need to approximate and embarked on long multiplication and then division in the search for an answer.

**Higher**

The vast majority of candidates were able to score at least one mark in this question but less than half managed to get full marks. Common errors were to round 0.51 to 1 (leading to an answer of 3000) and to calculate 3000/0.5 as 1500 (common) or 4500. A significant number of candidates did not round 302 to 300, but were still able to gain full marks for 6040. Candidates should be advised to round all numbers to one significant figure when doing an approximation.

**16.** Only just under 40% of candidates were able to attain full marks for this very early question. Marks were generally lost due to an inability to use a calculator correctly. Taking the square root of just the numerator rather than the whole fraction was the most common error.

**17.** The advice given to many candidates is to calculate the numerator and denominator separately before dividing to get the final answer.

This advice was ignored by many candidate who just put the numbers into their calculator in the order given in the question and hoped for the best, which was usually no marks as a result. A significant number doubled 3.2 rather than squaring. In part (b) most students did not understand what 1 significant figure meant, and gave their answer to 1dp instead. Many who gave a negative answer in (a) rounded their answer to a positive answer in (b).

**18.** The majority of candidates gained one mark for rounding at least two of the numbers correctly to one significant figure and a further mark for the correct processing of two of the numbers, most usually $7 \times 200 = 1400$. Most candidates, though, were unable to divide correctly by 0.05 with only a few realising that dividing by 0.05 is the same as multiplying by 20. Far too many candidates lacked the understanding that dividing by a number less than 1 makes the final answer larger than the original number. Another common error was for the denominator, 0.051, to be rounded to 0.1 or, less commonly, to 0.5, 1 or 0.

**19.** Part (i) was generally correct. Common incorrect answers for (ii) included 14.4, 14.9 and 14.49.

**20.** This was poorly done with very few correct answers. Some scored a mark for rounding two of the values, but only a small minority of these then went on to obtain one of the acceptable correct answers. Many did not attempt this question and a few tried to calculate the exact value.

**21.** Predictably, the most common wrong answers were 12.6 ($\pi \times 4$), 25.1 ($\pi \times 8$), 39.4 ($\pi^2 \times 4$) and 158 ( $(\pi \times 4)^2$).

**22.** Part (i) was well done with the majority of candidates gaining the available mark. Candidates were less successful in part (b) with less than 50% of candidates able to answer correctly. Common incorrect answers included 60.49, 60.4 and 65.

**23.** This question was answered correctly by the vast majority of candidates. A minority of candidates failed to use their calculator correctly. The common incorrect answer arising from this error was –3.725824042.

**24.** The correct answer of 0.0082 was often seen in part (a) but 0.0, 0.00 and 82 were the usual incorrect responses made. 0.00820 was also not uncommon; it should be noted that the final zero is significant. In part (b) candidates who wrote down the intermediate values for the numerator and the denominator usually went on to score full marks. Those who didn't often gave 12.17…… having confused the order of operations.

**25.** No report available.

**26.** Far too often candidates still fail to show their working when using their calculator in specific calculator questions. 3.293150685 was a very familiar sight resulting from attempts to solve the problem without first working out the value, in this case, of the numerator. Showing the numerator as $5.68 - 1.7424\ (1.32^2)$ would have gained one mark. In part (b) candidates often gave their answer to part (a) correct to two decimal places instead of to two significant figures, and some appeared to believe that 5.40 was the same as 5.4 in this context.

**27.** Over 90% of candidates answered part (a) correctly. The number answering part (b) correctly dropped to approximately 65%. Common wrong answers to part (b) were 124.4m and 124.49m.

**28.** No Report available for this question.

**29.** Those candidates who showed some intermediate working out usually went on to gain full marks in the calculation in part (a). Many candidates, preferring to compute the calculation with one visit to the calculator, often made mistakes by applying an incorrect order of operations, usually resulting in an answer of 2.465246763…It was also not uncommon to see an answer of 0.03699 (the inverse of the correct answer). In part (b) candidates were able to gain the mark irrespective of their accuracy in part (a). Indeed many with 2.465246763… in part (a) correctly rounded to give 2.5 to gain this award. However a significant number wrote 2.4. With the correct answer of 27.0343336 in part (a), many gave 27, 27.03 or 27.00 for their answer to part (b), all gaining no credit.

**30.** In this type of question most candidates do, in general, realise that the required answer is using the digits of the third of the numerical term. In part (a) this understanding usually lead to a correct answer of 17.01, however in part (b) performance was much less good; 4.86 and 48.6 being very common incorrect answers seen.

**31.** A poorly answered question with many candidates not gaining the mark for (a) but picking up the mark in (b) for writing their answer to (a) correct to one decimal place. A frequent response to (a) was to write the square root of 2 as the answer.

**32. Foundation**

Candidates often struggle with approximation questions and this was certainly the case here. Many candidates gained one mark for writing two of the numbers to one significant figure but few candidates could then go on to gain all three marks. It was common to see the answer left as $\frac{300}{3}$.

**Higher**

Candidates often struggle with approximation questions and this was certainly the case here. Many candidates gained one mark for writing two of the numbers to one significant figure but only the more candidates could then go on to gain all three marks. It was common to see the answer left as $\frac{300}{3}$.

**33–35.** No Reports available for these questions.