Edexcel GCSE

Mathematics

Higher Tier

Number: Fractions

Information for students

The marks for individual questions and the parts of questions are shown in round brackets: e.g. **(2)**.
There are 21 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 “Fractions” though they might assess other areas of the specification as well. Questions are those tagged as “Higher” so could have (though not necessarily) appeared on either an Intermediate or Higher tier paper.

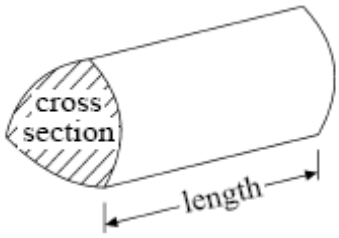
GCSE Mathematics

Formulae: Higher Tier

You must not write on this formulae page.

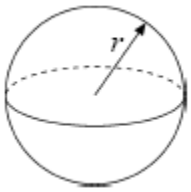
Anything you write on this formulae page will gain NO credit.

Volume of prism = area of cross section × length



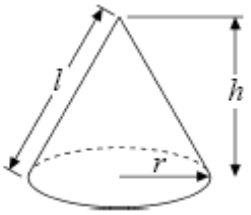
Volume of sphere $\frac{4}{3}\pi r^3$

Surface area of sphere $= 4\pi r^2$

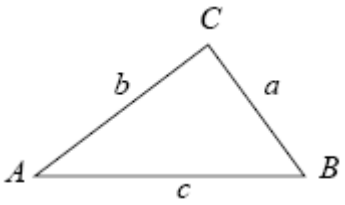


Volume of cone $\frac{1}{3}\pi r^2 h$

Curved surface area of cone $= \pi rl$



In any triangle ABC



Sine Rule $\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$

Cosine Rule $a^2 = b^2 + c^2 - 2bc\cos A$

Area of triangle = $\frac{1}{2}ab\sin C$

The Quadratic Equation

The solutions of $ax^2 + bx + c = 0$

where $a \neq 0$, are given by

$$x = \frac{-b \pm \sqrt{(b^2 - 4ac)}}{2a}$$

1. The fraction, p, of an adult's dose of medicine which should be given to a child who weighs w kg is given by the formula

$$p = \frac{3w + 20}{200}$$

A child weighs 35 kg.

(a) Work out the fraction of an adult's dose which should be given to this child.
Give you answer as a fraction in its simplest form.

……

(2)

(b) Use the formula $p = \frac{3w + 20}{200}$ to find the weight of a child whose dose is the same as an adult's dose.

…… kg

(3)

(Total 5 marks)

2. Convert the recurring decimal $0.\dot{2}\dot{9}$ to a fraction.

.....

(Total 2 marks)

3. Solve $\frac{2}{x+1} + \frac{3}{x-1} = \frac{5}{x^2-1}$

x = ...

(Total 4 marks)

4. (a) Work out the value of $\frac{2}{3} \times \frac{3}{4}$

Give your answer as a fraction in its simplest form.

…….

(2)

(b) Work out the value of $1\frac{2}{3} + 2\frac{3}{4}$

Give your answer as a fraction in its simplest form.

…….

(3)

(Total 5 marks)

5. (a) Change $\frac{3}{11}$ to a decimal.

…….

(1)

(b) Prove that the recurring decimal $0.\dot{3}\dot{9} = \frac{13}{33}$

(3)
(Total 4 marks)

6. Work out $2\frac{2}{3} x \times 1\frac{1}{4}$

Give your answer in its simplest form.

.....
(Total 3 marks)

7. $\frac{1}{u}+\frac{1}{v}=\frac{1}{f}$

$u = 2\frac{1}{2}$, $v = 3\frac{1}{3}$

(a) Find the value of f.

.....

(3)

(b) Rearrange $\frac{1}{u}+\frac{1}{v}=\frac{1}{f}$

to make u the subject of the formula.

Give your answer in its simplest form.

.....

(2)

(Total 5 marks)

8. (a) Express $0.\dot{2}\dot{7}$ as a fraction in its simplest form.

……

(3)

x is an integer such that $1 \leq x \leq 9$

(b) Prove that $0.\dot{0}\dot{x} = \frac{x}{99}$

(2)
(Total 5 marks)

9. (a) Work out $1\frac{7}{8} \times 5\frac{1}{3}$

.....

(2)

(b) Work out $3\frac{1}{2} \div 2\frac{4}{5}$

.....

(2)

(Total 4 marks)

10. Convert the recurring decimal $0.\dot{0}1\dot{3}$ to a fraction.

……..

(Total 3 marks)

11. (i) Convert the recurring decimal $0.\dot{3}\dot{6}$ to a fraction.

……

(ii) Convert the recurring decimal $2.1\dot{3}\dot{6}$ to a mixed number.
Give your answer in its simplest form.

……

(Total 5 marks)

12. Express the recurring decimal $2.0\dot{6}$ as a fraction.
Write your answer in its simplest form.

.....

(Total 3 marks)

13. The recurring decimal $0.\dot{7}\dot{2}$ can be written as the fraction $\frac{8}{11}$

Write the recurring decimal $0.5\dot{7}\dot{2}$ as a fraction.

.....

(Total 2 marks)

14. Express $0.3\,\dot{2}\dot{8}$ as a fraction in its simplest form.

.....

(Total 3 marks)

15. Convert the recurring decimal $2.1\dot{4}\dot{5}$ to a fraction.

.....

(Total 3 marks)

16. Work out

$$2\frac{1}{2}\times 3\frac{1}{5}$$

8	$6\frac{1}{10}$	$5\frac{1}{7}$	$6\frac{2}{7}$	$\frac{75}{10}$
☐	☐	☐	☐	☐
A	**B**	**C**	**D**	**E**

(Total 1 mark)

17. Change the recurring decimal $0.\dot{2}\dot{3}$ to a fraction.

.....

(Total 2 marks)

18. Prove that $0.4\dot{7}\dot{3}$ can be written as the fraction $\frac{469}{990}$

(Total 2 marks)

19. $2\frac{1}{4} \times 1\frac{2}{3}$

$3\frac{3}{4}$	$2\frac{11}{12}$	$3\frac{2}{12}$	$2\frac{2}{12}$	$3\frac{11}{12}$
A	**B**	**C**	**D**	**E**

(Total 1 mark)

20. $5\frac{1}{4} \times 2\frac{1}{7} =$

$10\frac{1}{28}$	$10\frac{11}{28}$	$11\frac{1}{6}$	$10\frac{2}{11}$	$11\frac{1}{4}$
A	**B**	**C**	**D**	**E**

(Total 1 mark)

21. Prove that the recurring decimal $0.\dot{1}\dot{7} = \frac{17}{99}$

(Total 2 marks)

1. (a) $\frac{5}{8}$ 2

$\frac{125}{200}$

M1 for $\frac{125}{200}$

A1 cao

(b) 60 3

$\frac{3w+20}{200} = 1$

$3w + 20 = 200$

M1 ρ *= 1 stated or used*

M1 dep 3w + 20 = 200 oe

A1 cao

[5]

02. $\frac{29}{99}$ 2

$100x = 29.\dot{2}\dot{9}$
$x = 0.\dot{2}\dot{9}$
$99x = 29$

M1 for $29.\dot{2}\dot{9} - 0.\dot{2}\dot{9}$ *or for* $99x = 29$
A1 cao

[2]

03. $x = 0.8$ 4

$2(x - 1) + 3(x + 1) = 5$
$2x - 2 + 3x + 3 = 5$
$5x + 1 = 5$
$5x = 4$

M1 for attempts to multiply by a common denominator
M1 for attempting to multiply out the expression (1 numerator must be correct on LH side)
A1 for correct linear expression
A1 for 0.8 oe

[4]

04. (a) $\frac{1}{2}$ 2

$\frac{2}{3} \times \frac{3}{4} = \frac{6}{12}$

M1 for $\frac{6}{12}$ *or* $\frac{3}{6}$ *or* $\frac{2 \times 3}{3 \times 4}$
A1 accept 0.5

(b) $4\frac{5}{12}$ 3

$1 + 2 + \frac{8}{12} + \frac{9}{12}$

M1 for attempt to convert to fractions with common denominator e.g two fractions, denominator of 12
A1 correct conversion : $\frac{8}{12}$ and $\frac{9}{12}$,
or $\frac{20}{12}$ and $\frac{33}{12}$ seen (oe)
A1 cao for $4\frac{5}{12}$
OR
attempts to convert to decimals: must use at least 2dp
M1 0.66 + 0.75 (or 1.66 + 2.75) or 0.67 + 0.75 etc
A1 4.41, 4.417, 4.416 or 0.41, 0.417, 0.416 or 0.42, 4.42
A1 4.416 (recurring)

[5]

05. (a) 0.2727… 1

B1 for 2.27 recurring or 0.2727…. oe or 0.273

(b) eg $x = 0.3939\ldots$ so $100x = 39.3939\ldots$
$99x = 39$
so $x = \frac{39}{99} = \frac{13}{33}$ 3

M1 for 100x = 39.39…
M1 dep for subtraction of both sides
A1 for $\frac{13}{33}$ from correct proof
Alternative method
M1 for 13.000 ÷ 33
M1 for remainders 31 and 13
A1 for 0.39 recurring
SC:B1 for $\frac{39}{99}$

[4]

06. $\frac{8}{3}\times\frac{5}{4}=\frac{8\times5}{3\times4}=\frac{40}{12}=3\frac{1}{3}$ 3

B1 for $\frac{8}{3}$ *oe or* $\frac{5}{4}$ *oe*

M1 (dep on B1) for multiplying numerator and denominator of "$\frac{8}{3}$*" and "*$\frac{5}{4}$*"*

A1 for $3\frac{1}{3}$ *oe mixed number or* $\frac{10}{3}$

or

B1 for 1.25 and 2.67 or 2.66(...)
M1 (dep on B1) for correct method of multiplication
A1 for $3.\dot{3}$

[3]

07. (a) $\frac{1}{2\frac{1}{2}}+\frac{1}{3\frac{1}{3}}=\frac{1}{f}$

$\frac{2}{5}+\frac{3}{10}=\frac{1}{f}$

$\frac{7}{10}=\frac{1}{f}$

$=\frac{10}{7}$ 3

M1 $\frac{1}{2\frac{1}{2}}+\frac{1}{3\frac{1}{3}}=\frac{1}{f}$

M1 correct addition of the fractions to get $\frac{7}{10}$ *oe*

A1 for $\frac{10}{f}$ *oe*

(b) $\frac{1}{u}=\frac{1}{f}-\frac{1}{v}$

$\frac{1}{u}=\frac{v-f}{fv}$

$u=\frac{fv}{v-f}$ 2

M1 $\frac{1}{u}=\frac{v-f}{fv}$ *oe or* $vf + uf = uv$ *oe or* $\frac{1}{u}=\frac{f-v}{fv}$ *or*

$u=\frac{1}{\frac{v-f}{fv}}$ *or* $u=\frac{1}{\frac{1}{f}-\frac{1}{v}}$

A1 $u=\frac{fv}{v-f}$ *or* $u=\frac{-fv}{f-v}$

[5]

08. (a) $\frac{3}{11}$ 3

Let $x = 0.2727\ldots$
$100x = 27.2727\ldots$
$99x = 27$

M1 for $100x - x = 27.27\ldots - 0.27\ldots$
A1 for 27/99 oe
A1 for 3/11 cao

(b) $y=\frac{x}{99}$ 2

Let $y = 0.0x\ 0x\ldots$
$100y = x.0\ x\ 0\ x\ldots$
$99y = x$

M1 for $100y - y = x.0x\ldots - 0.0x\ldots$ *oe*
A1 for completion of proof

[5]

09. (a) 10 2

$\frac{15}{8} \times \frac{16}{3}$

M1 for $\frac{15}{8} \times a$ *OR* $b \times \frac{16}{3}$

A1 cao

(b) 1 ¼ oe 2

$\frac{7}{2} \times \frac{5}{14}$

M1 for $\frac{7}{2} \times \frac{5}{14}$ *or* $3\frac{1}{2} \times \frac{5}{14}$

A1 cao

[4]

10. $\frac{13}{999}$ 3

1000x = 13.013013…

M1 for 1000x = 013.013...

M1 for 999x = 13

A1 for $\frac{13}{999}$

[3]

11. (a) $\frac{36}{99}$ oe 2

$x = 0.3636..$ $100x = 36.3636..$

M1 for 36.3636… – 0.3636 …or 99x = 36

A1 for $\frac{36}{99}$ *oe*

(b) $2\ \frac{3}{22}$ oe 3

For example $y = 0.13636…$

$10y = 1.3636…$

$1000y = 136.3636…$

$990y = 135$ $y = \frac{135}{990}$

M1 for a clear fully correct method using either $2.1\dot{3}\dot{6}$ *or* $0.1\dot{3}\dot{6}$ *including subtraction to ay = b where at least one of a or b is correct*

A2 for $\frac{47}{22}$ *or* $2\ \frac{3}{22}$

[A1 for any fraction equivalent to $\frac{47}{22}$ *eg.* $\frac{2115}{990}$*]*

Alt method:

M1 for $2\ \frac{1}{10}$ *+ (ans(i)/10)*

A2 for $\frac{47}{22}$ *or* $2\frac{3}{22}$

[A1 for any fraction equivalent to $\frac{47}{22}$ *eg.* $\frac{2115}{990}$*]*

[5]

12. $\frac{31}{15}$ or $2\frac{1}{15}$ 3

$10x = 20.66\ldots$
$x = 2.06\ldots$
$9x = 18.6$
$x = \frac{18.6}{9}$

B1 for 2.0666...
M1 for a clear fully correct method for dealing with a recurring decimal including subtraction to ax = b where at least one of a or b is correct <u>*OR*</u> $0.\dot{6} = \frac{2}{3}$
A1 for $\frac{31}{15}$ *oe (e.g* $\frac{2046}{990}$, $\frac{186}{90}$*)*

[3]

13. $\frac{1}{2} + \frac{8}{110}$
$\frac{63}{110}$ oe 2

M1 for $\frac{1}{2} + \left(\frac{8}{11} \div 10\right)$ *OR* $\left(5 + \frac{8}{11}\right) \div 10$
A1 cao
Alternative method
M1 for $0.5\dot{7}\dot{2} = 0.57272...$
A1 cao

[2]

14. $x = 0.32828\ldots$
$100x = 32.828\ldots$
$99x = 32.5$
$\frac{65}{198}$ 3

M1 for 0.32828...
M1 (dep) for attempt to subtract two recurring decimals that would result in a correct terminating decimal (e.g 328.28…–3.28… or 32.828…–0.328…)
A1 for $\frac{65}{198}$ *oe with numerator and denominator both integer*

[3]

15. $x = 2.1454545\ldots$ 3

$10x = 21.454545\ldots$

$1000x = 2145.4545\ldots$

$990x = 2124$

$2\frac{8}{55}$ oe

M1 for 2.14545(45…) or 0.14545(45…)
[1000x = 2145.45 for example would imply this]
M1 for two recurring decimals that, when subtracted, leave a terminating decimal
A1 for $2\frac{8}{55}$ *oe (eg* $\frac{2124}{990}$*)*
[Note: $\frac{212.4}{99}$ *gets M2 A0]*

Common errors that are being made:
x = 2.1454545……(or x = 0.1454545……or x = 0.0454545….)
[2.14545 (or 0.14545 or 0.04545) is sufficient for the award of the first M1] 100x = 214.54545……
Working out 99x does leave a terminating decimal, 212.4 so the second M1 can be awarded but an answer of $\frac{212.4}{99}$ *does not gain the A1 until the decimal is correctly removed.*
x = 2.1454545……
1000x = 2145.4545……
Working out 999x does not leave a terminating decimal, so M1M0A0

x = 2.145145145 loses the first M1
1000x = 2145.145145
Finding 999x = 2143 then demonstrates a correct method for finding "two recurring decimals that when subtracted leave a terminating decimal" The second M1 can then be awarded. So M0M1A0 is scored

An answer of $\frac{2124}{990}$ *followed by incorrect cancelling gets M2A1 (isw)*

$\frac{144}{990}$ *oe gets M2A0 (for those who lose the 2 units)*

[3]

16. A

[1]

17. $100 \times 0.\dot{2}\dot{3} = 23.\dot{2}\dot{3}$
$99 \times 0.\dot{2}\dot{3} = 23$
$\frac{23}{99}$ 2

M1 for $100 \times 0.\dot{2}\dot{3}$ *or* $10000 \times 0.\dot{2}\dot{3}$
A1 for $\frac{23}{99}$ *oe*

[2]

18. $100x = 47.3737\ldots$
$x = 0.4737\ldots$
$99x = 46.9$
$x = 46.9/99$
proof 2

M1 for valid method
eg 100x = 47.37373, 1x = 0.4737… and subtract
OR 1000x = 473.7373, 10x = 4.737… and subtract
A1 for valid argument leading to $\frac{469}{990}$

[2]

19. A

[1]

20. E

[1]

21. $x = 0.1717...$
$1000x = 171.7171…$
$99x = 17$
$x = \frac{17}{99}$
or
$1000\ x = 171.7171...$
$10x = 1.7171…$
$990x = 170$
$x = 17/99$

Proof 2

M1 for valid method
eg 100x = 17.17…, 1x = 0.1717… and subtract
OR
1000x = 171.7171.., 10x = 1.7171… and subtract
A1 for valid argument leading to $x = \frac{17}{99}$

Alternative method for long division
M1 for identifying 71 and 17 as remainders
A1 for correct statement

[2]