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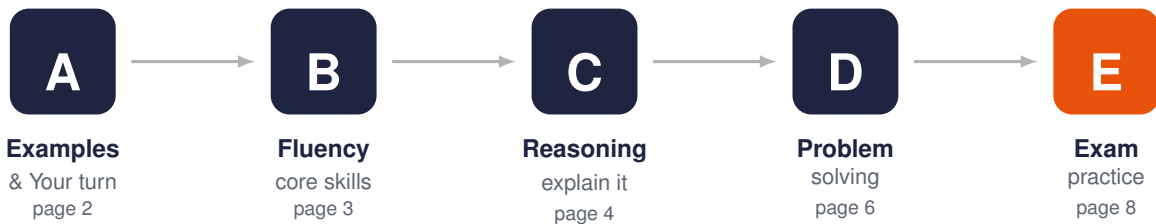
GCSE MATHEMATICS • NUMBER

FDP Equivalence

Worked Solutions

Pearson Edexcel GCSE (1MA1) & International GCSE (4MA1) • No calculator

Full worked solutions for the free FDP Equivalence worksheet, GCSE and iGCSE Maths



Tap a section to jump straight to it

Full worked solutions for every question on the FDP Equivalence worksheet, in the same order and with the same question numbers.

How to mark your work. Tick each step you got right, not just the final answer. In the exam, method marks are given for correct working even when the final answer is wrong. If you lost marks, find the *first* line where your working is different from ours. That is the thing to fix.

In Section E: **M** = method mark, **P** = process mark, **A** = accuracy mark, **B** = independent mark, **C** = communication mark.

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A**Your turn answers**

Compare each line of your working with the solution.

FOUNDATION

A1 $0.85 = \frac{85}{100}$ Divide top and bottom by 5: $\frac{85}{100} = \frac{17}{20}$ $\frac{17}{20}$

A2 $\frac{13}{20} = \frac{13 \times 5}{20 \times 5} = \frac{65}{100}$ 65%

A3 $45\% = 0.45$ $\frac{2}{5} = 0.4 = 0.40$ 0.42
 $0.40 < 0.42 < 0.45$ $\frac{2}{5}$, 0.42, 45%

HIGHER

A4 Let $x = 0.727272\dots$
 $100x = 72.727272\dots$
 Subtract: $99x = 72$
 $x = \frac{72}{99} = \frac{8}{11}$ (dividing top and bottom by 9) $0.\dot{7}\dot{2} = \frac{8}{11}$ as required

A5 Let $x = 0.4333\dots$
 $10x = 4.333\dots$
 $100x = 43.333\dots$
 Subtract: $100x - 10x = 43.333\dots - 4.333\dots$ so $90x = 39$
 $x = \frac{39}{90} = \frac{13}{30}$ (dividing top and bottom by 3) $0.4\dot{3} = \frac{13}{30}$ as required

A6 $0.\dot{6}\dot{3} = 0.6363\dots$ $\frac{5}{8} = 0.6250$ $0.63 = 0.6300$ $63.5\% = 0.6350$
 $0.6250 < 0.6300 < 0.6350 < 0.6363\dots$ $\frac{5}{8}$, 0.63, 63.5%, $0.\dot{6}\dot{3}$



B**Fluency solutions**

One mark for each correct part unless stated. The notes in italics explain why each sequence was chosen.

FOUNDATION

B1 (a) $\frac{7}{10}$ (b) $\frac{25}{100} = \frac{1}{4}$ (c) $\frac{6}{100} = \frac{3}{50}$ (d) $\frac{125}{1000} = \frac{1}{8}$

B2 Divide by 100. (a) 0.37 (b) 0.08 (c) 0.125 (d) 1.4

A single-digit percentage needs a zero after the point (8% is 0.08, not 0.8). More than 100% gives a decimal greater than 1.

B3 Multiply by 100. (a) 61% (b) 90% (c) 3.5% (d) 108%

B4 (a) $\frac{30}{100} = 30\%$ (b) $\frac{75}{100} = 75\%$ (c) $\frac{55}{100} = 55\%$ (d) $\frac{68}{100} = 68\%$

B5 (a) $\frac{9}{100}$ (b) $\frac{40}{100} = \frac{2}{5}$ (c) $\frac{85}{100} = \frac{17}{20}$ (d) $\frac{2.5}{100} = \frac{25}{1000} = \frac{1}{40}$

B6 (a) $\frac{9}{20} = \frac{45}{100} = 0.45$ (b) $3 \div 8 = 0.375$ (c) $7 \div 8 = 0.875$

B7

Fraction	Decimal	Percentage
$\frac{1}{5}$	0.2	20%
$\frac{3}{4}$	0.75	75%
$\frac{7}{20}$	0.35	35%
$\frac{1}{50}$	0.02	2%

One mark for each fully correct row.

HIGHER

B8 (a) $2 \div 9 = 0.222... = 0.\dot{2}$ (b) $5 \div 6 = 0.8333... = 0.8\dot{3}$
 (c) $1 \div 11 = 0.0909... = 0.\dot{0}9$ (d) $7 \div 12 = 0.58333... = 0.58\dot{3}$



B9 (a) $10x - x: 9x = 7$ $\boxed{\frac{7}{9}}$ (b) $9x = 6, x = \frac{6}{9} = \boxed{\frac{2}{3}}$

(c) $100x - x: 99x = 54, x = \frac{54}{99} = \boxed{\frac{6}{11}}$

2 marks

(d) $1000x - x: 999x = 123, x = \frac{123}{999} = \boxed{\frac{41}{333}}$

2 marks

B10 Let $x = 0.1555\ldots$ $10x = 1.555\ldots$ $100x = 15.555\ldots$

$100x - 10x: 90x = 14$ $x = \frac{14}{90} = \frac{7}{45}$ as required

B11 Let $x = 0.272727\ldots$ $100x = 27.2727\ldots$ $99x = 27$ $x = \frac{27}{99} = \frac{3}{11}$

$1.\dot{2}\dot{7} = 1 + \frac{3}{11}$ $1\frac{3}{11}$

C**Reasoning solutions**

Your wording can be different. Check that your reason makes the same point.

FOUNDATION

C1 $\frac{1}{4} = 0.25 = 25\%$ and $\frac{2}{5} = 0.4 = 40\%$

Group 1: $\frac{1}{4}$, 25%, 0.25

Group 2: 0.4, $\frac{2}{5}$, 40%

C2 To change a decimal to a percentage, multiply by 100: $0.4 \times 100 = 40$

$0.4 = 40\%$ (4% is 0.04. Amira has not used place value correctly.)

C3 $\frac{5}{8} = 5 \div 8 = 0.625 = 62.5\%$ $62.5\% > 60\%$

$\frac{5}{8}$ is greater

C4 $0.62 = \frac{62}{100} = \frac{12.4}{20}$ and $68\% = \frac{68}{100} = \frac{13.6}{20}$

The numerator is a whole number between 12.4 and 13.6, so it must be 13.

Check: $\frac{12}{20} = 0.6$ (too small) $\frac{13}{20} = 0.65$ $\frac{14}{20} = 0.7$ (too big)

$\frac{13}{20}$



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C5 $\frac{7}{25} = \frac{28}{100} = 28\%$ $\frac{3}{10} = 30\%$ $\frac{1}{4} = 25\%$

No. $\frac{1}{4}$ is the smallest.

A bigger denominator only means a smaller fraction when the numerators are the same.

HIGHER

C6 A fraction **in its simplest form** terminates only if the prime factors of the denominator are 2s and 5s.

$20 = 2^2 \times 5$ (terminates) $12 = 2^2 \times 3$ (recurs) $16 = 2^4$ (terminates) $15 = 3 \times 5$ (recurs)

$\frac{21}{28} = \frac{3}{4}$ in its simplest form, and $4 = 2^2$ (terminates)

$\frac{7}{20}$, $\frac{9}{16}$ and $\frac{21}{28}$

C7 Let $x = 0.282828\ldots$ $100x = 28.2828\ldots$ $99x = 28$ so $p = \frac{28}{99}$

Use the common denominator $99 \times 7 = 693$: $p = \frac{28 \times 7}{693} = \frac{196}{693}$ $q = \frac{2 \times 99}{693} = \frac{198}{693}$

$\frac{196}{693} < \frac{198}{693}$ **so $p < q$**

C8 Let $x = 0.999\ldots$ $10x = 9.999\ldots$

Subtract: $9x = 9$ $x = 1$ **$0.9 = 1$ as required**

C9 (a) Only the 5 recurs, so $x = 0.3555\ldots$ and $100x = 35.555\ldots$ do **not** have the same decimal part.

$100x - x = 35.2$, not 35. **He should have subtracted $10x$ from $100x$.**

(b) $10x = 3.555\ldots$ $100x = 35.555\ldots$ $90x = 32$ $x = \frac{32}{90} = \frac{16}{45}$

C10 $24 = 2^3 \times 3$

A fraction terminates only if, in its simplest form, the denominator has no prime factors other than 2 and 5.

So the factor of 3 must cancel, which means k must be a multiple of 3. Then $\frac{k}{24} = \frac{k \div 3}{8}$ and $8 = 2^3$, so it terminates.

Multiples of 3 from 1 to 23: 3, 6, 9, 12, 15, 18, 21 **7 values**



C11 Let $x = 0.\dot{a} = 0.aaa\dots$ $10x = a.aaa\dots$ Subtract: $9x = a$ so $x = \frac{a}{9}$

$$0.0\dot{a} = 0.0aaa\dots = x \div 10 = \frac{a}{90}$$

$$0.\dot{a} - 0.0\dot{a} = \frac{a}{9} - \frac{a}{90} = \frac{10a}{90} - \frac{a}{90} = \frac{9a}{90} = \frac{a}{10}$$

$$\frac{a}{10} = 0.a, \text{ which has one decimal place, so it terminates for every digit } a.$$

proved

D

Problem solving solutions

There is often more than one correct method. Any complete, correct method scores full marks.

FOUNDATION

D1 $\frac{3}{10} = 30\%$ Difference: $42\% - 30\% = 12\%$ of the walk

$$10\% \text{ of } 24 = 2.4 \quad 1\% = 0.24 \quad 12\% = 2.4 + 0.48 = \boxed{2.88 \text{ km}}$$

D2 Paper 1: $\frac{34}{40} = \frac{17}{20} = \frac{85}{100} = 85\%$ Paper 2: $\frac{41}{50} = \frac{82}{100} = 82\%$

$$85\% > 82\% \quad \boxed{\text{Paper 1}}$$

D3 Walk: $240 \div 8 = 30$, $30 \times 3 = 90$

$$\text{Bus: } 10\% \text{ of } 240 = 24, \quad 5\% = 12, \quad 35\% = 24 \times 3 + 12 = 84$$

$$\text{Car: } 240 - 90 - 84 = 66 \quad \boxed{66 \text{ students}}$$

D4 Shop A: $\frac{1}{3}$ of £60 = £20 off, so the coat costs £40

$$\text{Shop B: } 30\% \text{ of } £60 = £18 \text{ off, so the coat costs } £42$$

Shop A is cheaper, by £2

D5 Normal cost: adults $2 \times £24 = £48$, children $3 \times £15 = £45$, total £93

$$\text{Family offer: adults pay } \frac{2}{3} \text{ of } £48 = £32; \quad \text{children pay } 60\% \text{ of } £45 = £27; \quad \text{total } £59$$

$$\text{Group offer: } 35\% \text{ of } £93 = £32.55 \text{ off, so they pay } £93 - £32.55 = £60.45$$

$$£60.45 - £59 = £1.45 \quad \boxed{\text{The Family offer is cheaper, by } £1.45}$$



HIGHER

D6 $0.\dot{7} = \frac{7}{9}$ ($9x = 7$) $0.\dot{2}\dot{7} = \frac{27}{99}$ ($99x = 27$)

$$\frac{7}{9} - \frac{27}{99} = \frac{77}{99} - \frac{27}{99} = \frac{50}{99} \quad \boxed{\frac{50}{99}}$$

D7 Let $x = 0.444\dots$ $10x = 4.444\dots$ $9x = 4$ $x = \frac{4}{9}$

$$\sqrt{\frac{4}{9}} = \frac{\sqrt{4}}{\sqrt{9}} = \frac{2}{3} \quad \text{and} \quad \frac{2}{3} = 2 \div 3 = 0.666\dots = 0.\dot{6} \quad \boxed{\text{as required}}$$

D8 Let $x = 0.\dot{a}\dot{b} = 0.ababab\dots$ $100x = ab.ababab\dots$ where the whole-number part is $10a + b$

Subtract: $99x = 10a + b$ so $x = \frac{10a + b}{99}$

$$\frac{2}{11} = \frac{2 \times 9}{11 \times 9} = \frac{18}{99} \quad \text{so } 10a + b = 18 \quad \boxed{a = 1, \quad b = 8}$$

Check: $2 \div 11 = 0.1818\dots$

D9 $0.35 = \frac{35}{100} = \frac{7}{20}$ Common denominator 60: small $= \frac{5}{12} = \frac{25}{60}$ medium $= \frac{7}{20} = \frac{21}{60}$

$$\text{Large} = 1 - \frac{25}{60} - \frac{21}{60} = \frac{14}{60}$$

$$\text{Small} - \text{large} = \frac{25}{60} - \frac{14}{60} = \frac{11}{60} \text{ of the total, and this is 66 bottles.}$$

$$\frac{1}{60} \text{ of the total} = 66 \div 11 = 6 \quad \text{Total} = 6 \times 60 = 360 \quad \boxed{360 \text{ bottles}}$$

Check: small 150, medium 126, large 84, and $150 - 84 = 66$

D10 Let $y = 0.\dot{x}\dot{6} = 0.x6x6x6\dots$ $100y = x6.x6x6\dots$ where the whole-number part is $10x + 6$

Subtract: $99y = 10x + 6$ so $\frac{10x + 6}{99} = \frac{k}{11} = \frac{9k}{99}$ giving $10x + 6 = 9k$

So $10x + 6$ must be a multiple of 9. Testing $x = 0$ to 9: 6, 16, 26, **36**, 46, 56, 66, 76, 86, 96

Only 36 is a multiple of 9, so $x = 3$ and $9k = 36$. $\boxed{x = 3, \quad k = 4}$

Check: $4 \div 11 = 0.3636\dots$



D11 (a) $0.\dot{4} = \frac{4}{9}$ ($9x = 4$)

Increase as a fraction of the tank: $\frac{5}{8} - \frac{4}{9} = \frac{45}{72} - \frac{32}{72} = \frac{13}{72}$

$\frac{13}{72}$ of the capacity is 39 litres, so $\frac{1}{72}$ is $39 \div 13 = 3$ litres Capacity = $72 \times 3 = \boxed{216 \text{ litres}}$

(b) Water in the tank: $\frac{5}{8} \times 216 = 135$ litres, then $135 + 9 = 144$ litres

$\frac{144}{216} = \frac{2}{3}$ (dividing top and bottom by 72) $\frac{2}{3} = 2 \div 3 = 0.666\dots = 0.\dot{6}$ **as required**

E**Exam practice solutions**

Marks are shown on the right of each line.

FOUNDATION *Foundation and Higher crossover*

E1 (a) $0.03 \times 100 = 3$ **3%**

B1

(b) $45\% = \frac{45}{100}$

M1

Divide top and bottom by 5: $\frac{9}{20}$

A1

(c) $\frac{4}{5} = \frac{8}{10}$ **0.8**

B1

E2 0.35 $\frac{1}{3} = 0.333\dots$ 30% = 0.3 $\frac{3}{8} = 0.375$ *M1 converts at least two correctly to the same form*

$0.3 < 0.333\dots < 0.35 < 0.375$ **30%, $\frac{1}{3}$, 0.35, $\frac{3}{8}$** A1

E3 Brother: $250 \div 5 \times 2 = 100$

P1

Sister: 36% of 250: 10% = 25, 1% = 2.5, so 36% = 75 + 15 = 90

P1

Left: $250 - 100 - 90 = 60$ **60 stickers**

A1

Alternative: $\frac{2}{5} = 40\%$, so $100\% - 40\% - 36\% = 24\%$ are left, and 24% of 250 = 60

E4 $\frac{1}{4} = 25\%$ Spent: $25\% + 35\% = 60\%$ Left: $100\% - 60\% = 40\%$

P1

40% of his wages = £320, so 10% = £80

P1

100% = £800 **£800**

A1



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HIGHER

E5 Let $x = 0.4777\ldots$ $10x = 4.777\ldots$ $100x = 47.777\ldots$ M1
 $100x - 10x:$ $90x = 43$ $x = \frac{43}{90}$ as required A1 complete proof

E6 Let $x = 0.234234\ldots$ $1000x = 234.234234\ldots$ M1
 $1000x - x:$ $999x = 234$ $x = \frac{234}{999} = \frac{26}{111}$ (dividing top and bottom by 9) as required A1

E7 $0.\dot{2} = \frac{2}{9}$ ($9x = 2$) M1
 $0.8\dot{1} = \frac{81}{99} = \frac{9}{11}$ ($99x = 81$) M1
 $\frac{2}{9} \times \frac{9}{11} = \frac{18}{99} = \frac{2}{11}$ 2
11 A1

E8 The ratio $2 : 3$ has 5 parts, so juniors are $\frac{2}{5}$ of the members and seniors are $\frac{3}{5}$ P1
 Juniors in a team: $\frac{3}{4} \times \frac{2}{5} = \frac{6}{20} = \frac{30}{100}$ of the members P1
 Seniors in a team: $35\% = \frac{7}{20}$, $\frac{7}{20} \times \frac{3}{5} = \frac{21}{100}$ of the members P1
 Total: $\frac{30}{100} + \frac{21}{100} = \frac{51}{100}$ 51
100 A1
Alternative: suppose there are 100 members. 40 juniors, so 30 play. 60 seniors, so 21 play. $30 + 21 = 51$ out of 100.
 $51 = 3 \times 17$, so $\frac{51}{100}$ is already in its simplest form.

E9 Let $x = 0.296296\ldots$ $1000x = 296.296296\ldots$ M1
 Subtract: $999x = 296$ $x = \frac{296}{999}$ A1
 $296 = 8 \times 37$ and $999 = 27 \times 37$, so $x = \frac{8}{27}$ M1 simplifies to a fraction of cubes
 $\sqrt[3]{\frac{8}{27}} = \frac{\sqrt[3]{8}}{\sqrt[3]{27}} = \frac{2}{3} = 0.666\ldots = 0.\dot{6}$ as required A1 complete chain of reasoning

