HIGHER

6.1 Recurring Decimals to Fractions: 2-hour Pack

Total Marks

EDEXCEL 1MA1 · Calculator allowed · about 120 minutes

Name: _____ Date: ____ / ____ / _____

Answer ALL questions. Show all your working.

1 Write 2/3 as a recurring decimal.

(Total for Question 1 is 2 marks)

2 Show that 0.393939... (39 recurring) = 13/33.

(Total for Question 2 is 3 marks)

3 Write 0.3313131... (31 recurring) as a fraction in its simplest form.

(Total for Question 3 is 4 marks)

4 Write 0.4666... (6 recurring) as a fraction in its simplest form.

(Total for Question 4 is 4 marks)

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5 Write 0.888... (8 recurring) as a fraction. Hence work out 0.888... + 1/5 as a single fraction in its simplest form.

(Total for Question 5 is 4 marks)

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6 Write 0.9555... (5 recurring) as a fraction in its simplest form.

(Total for Question 6 is 4 marks)

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7 Write 0.777... (7 recurring) as a fraction. Hence work out 0.777... + 4/6 as a single fraction in its simplest form.

(Total for Question 7 is 4 marks)

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8 Write 0.0222... (2 recurring) as a fraction in its simplest form.

(Total for Question 8 is 4 marks)

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9 Write 0.1333... (3 recurring) as a fraction in its simplest form.

(Total for Question 9 is 4 marks)

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10 Write 0.777... (7 recurring) as a fraction. Hence work out 0.777... + 2/15 as a single fraction in its simplest form.

(Total for Question 10 is 4 marks)

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11 Write 0.454545... (45 recurring) as a fraction in its simplest form.

(Total for Question 11 is 3 marks)

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12 Convert 0.1666... (6 recurring) to a fraction in its simplest form.

(Total for Question 12 is 3 marks)

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13 Convert 0.2333... (3 recurring) to a fraction in its simplest form.

(Total for Question 13 is 3 marks)

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14 Convert 5/6 to a decimal using your calculator. State which digit(s) recur.

(Total for Question 14 is 2 marks)

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15 A dripping tap loses water at a constant rate of 5/18 of a litre every minute.

(a) Convert 5/18 to a decimal, stating clearly which digit(s) recur. **(2)**

(b) Hence work out, in litres correct to 3 decimal places, how much water the tap loses in exactly 12 minutes. **(2)**

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(Total for Question 15 is 4 marks)

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16 Convert 0.636363... (63 recurring) to a fraction in its simplest form.

(Total for Question 16 is 3 marks)

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17 Convert 0.848484... (84 recurring) to a fraction in its simplest form.

(Total for Question 17 is 3 marks)

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18 Convert 0.161616... (16 recurring) to a fraction in its simplest form.

(Total for Question 18 is 3 marks)

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19 Convert 0.3444... (4 recurring) to a fraction in its simplest form.

(Total for Question 19 is 3 marks)

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20 This question is about the recurring decimal 0.9999... (9 recurring).

(a) Show algebraically that 0.9999... = 1. **(3)**

(b) Explain in words why 0.9999... recurring must be exactly equal to 1, and not just very close to 1. **(2)**

(Total for Question 20 is 5 marks)

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21 Convert 0.162162162... (162 recurring) to a fraction, giving your answer in its simplest form.

(Total for Question 21 is 4 marks)

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22 Priya notices that 1/7 has an unusual decimal expansion. Use this to answer the parts below.

(a) Convert 1/7 to a recurring decimal using your calculator, stating clearly which digits recur. **(2)**

(b) Using your answer to part (a), and without doing any further division, write down the recurring decimal for 3/7. Justify your answer. **(2)**

(c) Show algebraically that 0.428571428571... (428571 recurring) = 3/7. **(3)**

(Total for Question 22 is 7 marks)

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23 Convert 0.512512512... (512 recurring) to a fraction in its simplest form.

(Total for Question 23 is 3 marks)

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24 Convert 0.126126126... (126 recurring) to a fraction, giving your answer in its simplest form.

(Total for Question 24 is 3 marks)

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25 Show that 0.4444... (4 recurring) + 0.2222... (2 recurring) simplifies to 2/3.

(Total for Question 25 is 3 marks)

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Mark scheme · 6.1 Recurring Decimals to Fractions: 2-hour Pack

A correct answer earns full marks unless the question asks for working, a method, proof or explanation.

Question 1

2 divided by 3 by division or equivalent method	**M1**
0.666... (6 recurring)	**A1**

Answer: 0.666... (6 recurring)

Question 2

x = 0.393939... and 100x = 39.3939... written (or equivalent)	**M1**
subtracts to get 99x = 39, dependent on M1	**M1**
cso, x = 13/33 with full algebraic method shown	**A1**

Answer: 13/33 (shown)

Question 3

10x and 1000x written with the same recurring part	**M1**
subtracts: 990x = 328 oe	**M1**
x = 328/990 oe	**M1**
164/495 cao	**A1**

Answer: 164/495

Question 4

10x and 100x written with the same recurring part	**M1**
subtracts: 90x = 42 oe	**M1**
x = 42/90 oe	**M1**
7/15 cao	**A1**

Answer: 7/15

Question 5

10x - x = 8 or equivalent method	**M1**
8/9 cao	**A1**
common denominator used: 8/9 + 1/5	**M1**
49/45 cao	**A1**

Answer: 49/45

Question 6

10x and 100x written with the same recurring part	**M1**
subtracts: 90x = 86 oe	**M1**
x = 86/90 oe	**M1**
43/45 cao	**A1**

Answer: 43/45

Question 7

10x - x = 7 or equivalent method	**M1**
7/9 cao	**A1**
common denominator used: 7/9 + 4/6	**M1**
13/9 cao	**A1**

Answer: 13/9

Question 8

10x and 100x written with the same recurring part	**M1**
subtracts: 90x = 2 oe	**M1**
x = 2/90 oe	**M1**
1/45 cao	**A1**

Answer: 1/45

Question 9

10x and 100x written with the same recurring part	**M1**
subtracts: 90x = 12 oe	**M1**
x = 12/90 oe	**M1**
2/15 cao	**A1**

Answer: 2/15

Question 10

10x - x = 7 or equivalent method	**M1**
7/9 cao	**A1**
common denominator used: 7/9 + 2/15	**M1**
41/45 cao	**A1**

Answer: 41/45

Question 11

x = 0.454545... and 100x = 45.454545... written (or equivalent)	**M1**
subtracts to get 99x = 45, dependent on M1	**dM1**
5/11 cao (from 45/99 simplified)	**A1**

Answer: 5/11

Question 12

x = 0.1666..., 10x = 1.6666... and 100x = 16.6666... all written (or equivalent valid method)	**M1**
subtracts correctly to get 90x = 15, dependent on M1	**dM1**
1/6 cao (from 15/90 simplified)	**A1**

Answer: 1/6

Question 13

x = 0.2333..., 10x = 2.333... and 100x = 23.333... all written (or equivalent valid method)	**M1**
subtracts correctly to get 90x = 21, dependent on M1	**dM1**
7/30 cao (from 21/90 simplified)	**A1**

Answer: 7/30

Question 14

0.8333... seen (or awrt 0.833)	**B1**
correctly states that only the digit 3 recurs (not the 8), oe	**B1**

Answer: 0.8333... ; the digit 3 recurs

Question 15

(a) 0.27777... seen (or awrt 0.2778)	**B1**
(a) correctly states that only the digit 7 recurs (not the 2), oe	**B1**

(a) Answer: 0.27777... ; the digit 7 recurs (the 2 does not)

(b) 12 x 5/18 oe, or 10/3 seen	**M1**
(b) awrt 3.333 litres cao	**A1**

(b) Answer: 3.333 litres (awrt)

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Question 16

x = 0.636363... and 100x = 63.636363... written	**M1**
subtracts to get 99x = 63, dependent on M1	**dM1**
7/11 cao (63/99 simplified)	**A1**

Answer: 7/11

Question 17

x = 0.848484... and 100x = 84.848484... written	**M1**
subtracts to get 99x = 84, dependent on M1	**dM1**
28/33 cao (84/99 simplified)	**A1**

Answer: 28/33

Question 18

x = 0.161616... and 100x = 16.161616... written	**M1**
subtracts to get 99x = 16, dependent on M1	**dM1**
16/99 cao (already in simplest form)	**A1**

Answer: 16/99

Question 19

x = 0.3444..., 10x = 3.444... and 100x = 34.444... all written (or equivalent valid method)	**M1**
subtracts correctly to get 90x = 31, dependent on M1	**dM1**
31/90 cao (already in simplest form)	**A1**

Answer: 31/90

Question 20

(a) x = 0.9999... and 10x = 9.9999... written	**M1**
(a) subtracts to get 9x = 9, dependent on M1	**dM1**
(a) cso, x = 1 with full algebraic method shown	**A1**

(a) Answer: 1 (shown)

(b) states that the difference between 1 and 0.9999... would need to be a number smaller than every positive decimal (i.e. an infinite string of zeros), oe	**B1**
(b) correctly concludes that this difference can only be 0, so the two numbers are exactly equal, oe	**B1**

(b) Answer: There is no number that can be placed between 0.9999... and 1, so they must be the same number.

Question 21

x = 0.162162162... and 1000x = 162.162162... written	**M1**
subtracts to get 999x = 162, dependent on M1	**dM1**
162/999 seen (unsimplified)	**A1**
6/37 cao, simplified fully by dividing numerator and denominator by 27	**A1**

Answer: 6/37

Question 22

(a) 0.142857142857... seen (or awrt 0.1428571)	**B1**
(a) correctly identifies that the block of six digits 142857 recurs, oe	**B1**

(a) Answer: 0.142857142857..., with 142857 recurring

(b) 0.428571428571... stated (or awrt 0.4285714)	**B1**
(b) valid justification, e.g. multiplying the recurring decimal for 1/7 by 3 gives 3 x 0.142857142857... = 0.428571428571... directly, without further long division	**C1**

(b) Answer: 0.428571428571...

(c) x = 0.428571428571... and 1000000x = 428571.428571... written	**M1**
(c) subtracts to get 999999x = 428571, dependent on M1	**dM1**
(c) cso, x = 3/7 with correct simplification shown (e.g. dividing numerator and denominator by 142857)	**A1**

(c) Answer: 3/7 (shown)

Question 23

x = 0.512512512... and 1000x = 512.512512... written	**M1**
subtracts to get 999x = 512, dependent on M1	**dM1**
512/999 cao (already in simplest form)	**A1**

Answer: 512/999

Question 24

x = 0.126126126... and 1000x = 126.126126... written	**M1**
subtracts to get 999x = 126, dependent on M1	**dM1**
14/111 cao (from 126/999 simplified)	**A1**

Answer: 14/111

Question 25

converts both decimals to fractions, 4/9 and 2/9	**M1**
adds to get 6/9	**M1**
cso, 2/3 with full method shown	**A1**

Answer: 2/3 (shown)

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