A GRADUATED SERIES OF EXERCISES IN ELEMENTARY ALGEBRA

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Trieste

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GRADUATED SERIES OF EXERCISES

IN

ELEMENTARY ALGEBRA,

WITH

APPENDICES,

CONTAINING PAPERS OF MISCELLANEOUS EXAMPLES.

Designed for the Use of Schools.

BY

G. F. WRIGHT, M.A.

FELLOW OF CORPUS CHRISTI COLLEGE, CAMBRIDGE,

AND MATHEMATICAL MASTER OF WELLINGTON COLLEGE.

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ADVERTISEMENT.

To this issue I have prefixed questions on the theory of Vulgar and Decimal Fractions, and have added a second series of Miscellaneous Examples of a somewhat more difficult character. These, and a few other additions, though made for a special purpose, may, it is hoped, render the book more generally acceptable to those who find it suited to their needs, either as a companion to Mr. Lund's Easy Algebra, or as a syllabus and exercise book for a system of oral teaching.

G. F. W.

CONTENTS.

ARITHMETICAL FRACTIONS.

1. EXPLAIN fully what is meant by the following: $\frac{3}{5}$ of an orange, $\frac{5}{8}$ of an hour, $4\frac{3}{4}$ yards.

2. By what names are the three kinds of fractional magnitudes $\frac{3}{5}$, $\frac{5}{8}$, $4\frac{3}{4}$ distinguished?

3. Show by reference to a divided line (such as a carpenter's rule) that *three-fourths* of *one* is the same as *one-fourth* of *three*.

4. Show in a similar way that $\frac{2}{3} = \frac{4}{6} = \frac{8}{12} = \&c.$;

and also $= \frac{3}{2} = 1\frac{6}{4} = \&c.$

What general propositions may be inferred from these results?

5. Write down a *proper* fraction, an *improper* fraction, and a *mixed quantity*.

6. Show fully that $2\frac{3}{4} = \frac{11}{4}$. Thence deduce the rule for turning mixed quantities into improper fractions, and conversely.

7. Write down a number of fractions each equal to $\frac{2}{3}$, $\frac{4}{5}$.

8. Write down all the simpler fractions equivalent to $\frac{48}{120}$.

9. Reduce the following to lowest terms: $\frac{6}{32}$, $\frac{18}{26}$, $\frac{14}{21}$, $\frac{14}{18}$, $\frac{54}{108}$, $\frac{12}{174}$.

10. Change the fractions $\frac{7}{12}$, $\frac{3}{5}$, $\frac{7}{18}$, $\frac{17}{20}$, $\frac{4}{15}$, $\frac{5}{24}$, into equivalents with denominators 72, 360, 210, 240, 120, 336.

11. Before fractions can be added together they must generally be modified in form. Why and how? Explain by examples.

In practice, the *least* common denominator is always sought: how is this found?

12. How may the values of two or more proposed fractions be compared?

13. State fully the rule for subtracting one fraction from another.

14. Explain the following:

$$(1.)\quad \tfrac{4}{9} \times 5 = 2\tfrac{2}{9}.$$

$$(2.)\quad \left.\begin{array}{l} \tfrac{7}{12} \times 3 = \tfrac{7}{4} \\ \tfrac{5}{24} \times 9 = \tfrac{15}{8} \end{array}\right\}.$$

Infer from (1) the rule for multiplying a fraction by a whole number. What modifications of the rule do the results (2) point out?

15. Deduce from (1), (2) the rules for dividing a fraction by a whole number. Establish your rules also without reference to those for multiplication.

16. Show that $\frac{3}{5}$ of $\frac{4}{7} = \frac{12}{35}$.

17. State the rules for the so-called multiplication of fractions. Hence show that $\frac{3}{5} \times \frac{4}{7}$ means $\frac{3}{5}$ of $\frac{4}{7}$; and $\frac{12}{35} \div \frac{4}{7}$ means $\frac{7}{4}$ of $\frac{12}{35}$.

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18. Reduce to lowest terms: $\frac{7}{21}$, $\frac{13}{65}$, $\frac{20}{28}$, $\frac{63}{1428}$, $\frac{221}{437}$, $\frac{232}{1088}$, $\frac{6127}{8721}$, $\frac{8893}{8263}$, $\frac{7376}{9981}$.

19. Reduce to improper fractions: $7\frac{3}{5}$, $11\frac{7}{13}$, $8\frac{9}{14}$, $21\frac{7}{15}$, $3\frac{19}{31}$, $19\frac{11}{15}$, $65\frac{8}{81}$.

20. Reduce to simplest mixed numbers: $\frac{99}{7}$, $\frac{62}{12}$, $\frac{92}{12}$, $\frac{48}{26}$, $\frac{321}{142}$, $\frac{5236}{129}$, $\frac{62346}{232}$.

21. Express by simple fractions:

$\frac{1}{3}$ of $\frac{1}{2}$; $\frac{2}{3}$ of $\frac{1}{4}$; $\frac{1}{8}$ of $\frac{4}{7}$; $4\frac{2}{3}$ of $3\frac{3}{4}$; $1\frac{1}{2}$ of $2\frac{5}{12}$ of $\frac{10}{26}$;

$\frac{1}{2}$ of $\frac{3}{4}$ of $9\frac{1}{3}$ of $\frac{16}{37}$ of $\frac{3}{8}$.

22. Compare the following sets of fractions:

$\frac{5}{8}, \frac{7}{12}, \frac{8}{9}$; $\frac{3}{8}, \frac{9}{16}, \frac{23}{40}, \frac{13}{21}$; $\frac{3}{14}, \frac{13}{15}, \frac{17}{70}, \frac{81}{86}, \frac{37}{45}$.

23. Find the values in simplest forms of the following:

(1.) $\frac{1}{2} + \frac{2}{3} + \frac{3}{4}$; $\frac{3}{5} + \frac{10}{13} + \frac{9}{16}$; $\frac{14}{15} + \frac{19}{21}$.

(2.) $\frac{1}{3} + \frac{7}{9}$; $\frac{11}{18} + \frac{5}{24} + \frac{13}{126}$; $\frac{73}{104} + \frac{23}{41}$.

(3.) $3\frac{3}{4} + \frac{5}{6} + \frac{9}{14} + 4\frac{22}{35} + \frac{4}{15} + \frac{11}{21}$; $17\frac{9}{18} + 8\frac{11}{21}$.

(4.) $\frac{7}{13} - \frac{22}{41}$; $5\frac{11}{42} - 3\frac{11}{28}$; $19 - 5\frac{21}{55}$; $17\frac{13}{27} - 8\frac{12}{22}$.

(5.) $\frac{1}{3} + \frac{13}{20} - \frac{11}{36}$; $\frac{35}{52} + \frac{11}{18} - \frac{17}{36} + \frac{9}{14}$; $\frac{54}{61} + \frac{67}{85} + \frac{22}{45} - \frac{33}{46}$.

(6.) $1 - \frac{1}{2} + \frac{2}{3} - \frac{3}{4} + \frac{4}{5} - \frac{5}{6} + \frac{6}{7} - \frac{7}{8} + \frac{8}{9} - \frac{9}{10} + \frac{10}{11} - \frac{11}{12}$.

(7.) $\frac{3}{8} \times 7$; $\frac{5}{12} \times 6$; $\frac{10}{15} \times 11$; $\frac{12}{22} \times 15$; $\frac{28}{28} \times 42$; $3\frac{1}{3} \times 3$.

(8.) $\frac{9}{13} \div 3$; $\frac{7}{16} \div 7$; $\frac{4}{28} \div 12$; $\frac{37}{51} \div 18$; $\frac{18}{68} \div 23$; $\frac{34}{72} \div 36$.

(9.) $\frac{1}{3} \times \frac{1}{2}$; $\frac{2}{3} \times \frac{1}{4}$; $\frac{3}{4} \times \frac{1}{8}$; $\frac{5}{12} \times \frac{3}{8}$; $1\frac{7}{13} \times \frac{7}{8}$; $3\frac{9}{11} \times 2\frac{4}{13}$.

(10.) $\frac{1}{8} \div \frac{1}{2}$; $\frac{3}{10} \div \frac{2}{5}$; $\frac{2}{9} \div \frac{3}{7}$; $6\frac{1}{16} \div 4\frac{1}{8}$; $25\frac{1}{3} \div 34\frac{1}{16}$.

24. Simplify the following:

(1.) $2\frac{1}{3} \times 3\frac{1}{4} \times \frac{1}{7} \times 5\frac{1}{13}$; $\frac{3}{5}$ of $\frac{9}{10} + \frac{17}{20}$; $\frac{3}{5}$ of $(\frac{9}{10} + \frac{17}{20})$.

(2.) $3\frac{5}{8}$ of $2\frac{4}{23}$ of $2\frac{7}{27}$; $\frac{2}{5}$ of $\frac{5}{7} - \frac{4}{10}$; $\frac{2}{5}$ of $(\frac{5}{7} - \frac{4}{10})$.

(3.) $\frac{9\frac{1}{6}}{12\frac{5}{8}}$; $\frac{1\frac{1}{3}}{2\frac{3}{4}}$ of $\frac{3\frac{1}{2}}{21}$; $(\frac{5}{14}$ of $\frac{3}{8}$ of $13) \div \frac{3}{8}$ of $\frac{7\frac{1}{2}}{8\frac{1}{3}}$.

(4.) $\frac{3\frac{1}{5}}{\frac{2}{3} + 1\frac{7}{12}}$; $\frac{2\frac{1}{3} \times 2\frac{1}{3} - 1}{2\frac{1}{3} \times 2\frac{1}{3} + 1}$; $\frac{\frac{18}{25} + 3}{\frac{18}{25}$ of $3} \div \frac{7}{8}\frac{9}{7}$.

(5.) $\dfrac{\frac{1}{2} + \frac{1}{3} + \frac{1}{4}}{\frac{1}{2\frac{1}{2}} + \frac{1}{3\frac{1}{3}} + \frac{1}{4\frac{1}{2}}}$; $\dfrac{1}{2 + \dfrac{1}{3 + \frac{1}{4}}}$; $\dfrac{\frac{3}{4} \times \frac{2}{5} + \frac{1}{2} \div 2\frac{1}{2}}{(\frac{2}{3} - \frac{1}{5}) \div (\frac{1}{2} + \frac{2}{3}$ of $6)}$

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1. What are decimal fractions? Explain the mode in which they are written, and the effect of changing the position of the decimal point.

2. Show that $\frac{2}{3} = \cdot 6$; $\frac{5}{16} = \cdot 3125$; $\frac{6}{7} = \cdot 85714\ldots$.

When can a vulgar fraction be expressed exactly as a decimal? When only approximately?

3. Convert $\frac{1}{9}$, $\frac{1}{11}$, $\frac{1}{999}$, $\frac{1}{9999}$, &c. into decimals; and hence deduce rules for converting circulating decimals, both pure and mixed, into their equivalent vulgar fractions.

4. Add together 63·507 and 7·412, and subtract the latter from the former, giving reasons for your method.

5. State, with reasons, the rule for the multiplication of decimals.

6. Divide ·336 by 42; 3·36 by 4·2; and 33·6 by ·42; giving full explanations regarding the position of the decimal point.

State a rule for the division of decimals.

7. What multiple or what part is each of the following decimals of the one which follows it:

10·23, 1·023, 102·3, ·01023, 1023, ·1023, ·00010231

8. Convert into decimals: $\frac{1}{3}$, $\frac{2}{15}$, $\frac{3}{7}$, $\frac{5}{12}$, $\frac{9}{16}$, $\frac{21}{75}$, $\frac{14}{37}$, $\frac{14}{99}$, $\frac{43}{187}$.

9. Convert into vulgar fractions: ·6, ·12, ·75, ·374, ·0135, ·776, ·666, $\cdot21\dot{2}\dot{1}$, $\cdot423\dot{2}\dot{3}$, $\cdot145\dot{1}\dot{4}\dot{5}$, $\cdot02\dot{1}\dot{4}\dot{5}$.

10. Find the value of the following:

(1.) 27·61 + 398·5 + 2·304 + ·00125; 18·321 — 13·0025.

(2.) 17·62 × 9; 1·762 × ·09; ·012 × ·03; 120 × 45·03; 43·2 × 19.

(3.) 62·5 ÷ 25; 6·25 ÷ 2·5; ·625 ÷ ·25; 6·25 ÷ ·0025; 6·25 ÷ ·25.

(4.) 62·5 ÷ 25000; 25·132 ÷ 6·2835; 196·5 ÷ 61·417; 44·2854 ÷ ·278.

(5.) ·034 ÷ 2·14; 12·34 ÷ ·000027; ·00035 ÷ 250; ·000785 ÷ ·0005.

11. Convert into decimals, accurately to five places:

$$2 + \frac{1}{2} + \frac{1}{2 \times 3} + \frac{1}{2 \times 3 \times 4} + \frac{1}{2 \times 3 \times 4 \times 5} + \text{\&c.} \ldots.$$