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OCCUPATIONAL MATHEMATICS; ADDITION OF FRACTIONS. REPORT NO. 16-E. BOOKLET II. FINAL REPORT.

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This programed mathematics textbook is for student use in vocational education courses. It was developed as part of a programed series covering 21 mathematical competencies which were identified by university researchers through task analysis of several occupational clusters. The development of a sequential content structure was also based on these mathematics competencies. After completion of this program the student should be able to: (1) know that "sum" indicates the operation of addition, (2) add two or three numeric fractions of the form a/b where 0 is less than a/b and when a/b is less than 100, (3) add two or three fractions of the form k/y, where 0 is less than k when k is less than 100 and y is the same literal denominator for all fractions, (4) add two or three literal fractions with the same denominators, and (5) add mixed fractions of the form Xa/b, where 0 is less than (X,a, and b) and these are less than 100. The material is to be used by individual students under teacher supervision. Twenty-six other programed texts and an introductory volume are available as VT 006 882-VT 006 909, and VT 006 975. (EM)

BOOKLET 11

OF

Report No. 16-E

Occupational Mathematics

ADDITION OF FRACTIONS

Hi again!

You have been doing real well.

Let's continue.

You added the fractions and then you reduced your answer. Always follow that process. ADD the fractions and REDUCE the answer.

What is 3/7 + 9/5 ?

(a) 12/12 Turn to page 92

(b) 78/35 Turn to page 99

(c) $2\ \frac{8}{35}$ Turn to page 94

(d) I'm not sure Turn to page 96

Fine! You're getting it now.

Here's another one.

Find the sum of 3/8 and 1/3.

(a) 3/4 Turn to page 100

(b) 17/24 Turn to page 99

(c) 7/12 Turn to page 102

No! 3/7 + 9/5 is <u>not</u> 12/12.

You can do better than that. Never add denominators.

To see how the problem should have been worked,

turn to page 96.

No! You don't quite have it.

Take this problem to your teacher for help.

Then return to page 90 of this Unit, found at the beginning of Booklet II.

Yes! $2\frac{8}{35}$ is an acceptable answer.

Is 78/35 also correct for the sum of 3/7 and 9/5 ?

(a) Yes Turn to page 109

(b) No Turn to page 101

No! You don't quite have it.

Take this problem to your teacher for help.

Then return to page 90 of this Unit, found at the beginning of Booklet II.

The problem was to add 3/7 and 9/5.

First we find a common denominator. Is there any simple relationship between the denominators 7 and 5?

No! There doesn't seem to be. So, how can we find a common denominator?

It is really very easy. Just multiply the two denominators together.

So, a common denominator for 7 and 5 would be $7 \cdot 5$ or 35.

Turn to page 97.

This means we want to change both fractions to equivalent fractions with denominators of 35 so they can be added.

How do we do it?

Watch closely. $3/7 = 3/7 \cdot 5/5 = 15/35$

$9/5 = 9/5 \cdot 7/7 = 63/35$

So, $3/7 + 9/5 = 15/35 + 63/35 = 78/35$.

This is a perfectly acceptable form to leave the answer in. However, vou might also notice that $78/35 = 2\frac{8}{35}$. Either answer is acceptable as they are equivalent to each other.

Let's try this problem.

Find 2/3 + 3/4.

(a) 17/12 Turn to page 91

(b) 5/3 Turn to page 103

(c) 12/17 Turn to page 103

Your answer was correct. Excellent!

You added 6/15 and 25/15 to get 31/15.

That's exactly right.

Now try one with letters.

What is $3/x + 4/y$?

(a) I don't know what to do Turn to page 111

(b) $7/xy$ Turn to page 106

(c) $(3y + 4x)/xy$ Turn to page 105

Good! You are correct. Let's go on.

Here's one using letters.

What is 3/x + 4y ?

(a)	I don't know what to do	Turn to page 111
(b)	7/xy	Turn to page 106
(c)	(3y + 4x)/xy	Turn to page 105

No! You're still having trouble finding the correct common denominator.

The last problem was 3/8 + 1/3.

A common denominator for 8 and 3 is 8 · 3 or 24.

$$3/8 = 3/8 \cdot 1 = 3/8 \cdot 3/3 = 9/24$$

$$1/3 = 1/3 \cdot 1 = 1/3 \cdot 8/8 = 8/24$$

So, $3/8 + 1/3 = 9/24 + 8/24 = 17/24$

Be sure you understand this page before you go on.

Then turn to page 110.

You said that $2\frac{8}{35} \neq 78/35$. (The symbol $\neq$ means "is not equal to").

Wrong! $2\frac{8}{35}$ does equal 78/35. How many 35ths are there in $2\frac{8}{35}$? Let's see. 35/35 = 1.

So, $2\frac{8}{35} = 1 + 1 + 8/35$. O.K.?

Then, $2\frac{8}{35} = 35/35 + 35/35 + 8/35$

Or, $2\frac{8}{35} = 78/35$.

Either answer would be acceptable. But there is really no reason to change 78/35. As long as it is reduced, it is a satisfactory answer.

Go on to page 109.

No! You're still having trouble finding the correct common denominator.

The last problem was 3/8 + 1/3.

A common denominator for 8 and 3 is 8 · 3 or 24.

$$3/8 = 3/8 \cdot 1 = 3/8 \cdot 3/3 = 9/24$$

$$1/3 = 1/3 \cdot 1 = 1/3 \cdot 8/8 = 8/24$$

So, $3/8 + 1/3 = 9/24 + 8/24 = 17/24$.

Be sure you understand this page before you go on.

Then turn to page 110.

Your answer was incorrect!

Let's try again. We want to add 2/3 and 3/4.

(1) Find a common denominator. Remember, one way that <u>always</u> works is to multiply the denominators.
$3 \cdot 4 = 12$ So, 12 is our common denominator.

(2) Change 2/3 and 3/4 into twelfths.
$2/3 \cdot 4/4 = 8/12$ and $3/4 \cdot 3/3 = 9/12$

Notice that by multiplying by 4/4 and 3/3 we did <u>not</u> change the value of the fractions. This is important. <u>NEVER CHANGE THE VALUE OF THE ORIGINAL FRACTIONS</u>.

Turn to page 104.

(3) Add: We now know that 2/3 = 8/12

and 3/4 = 9/12.

So, 2/3 + 3/4 = 8/12 + 9/12 = 17/12

O.K.?

Using the ideas that were just explained, find

2/5 + 5/3.

(a) 19/15 Turn to page 95

(b) 7/8 Turn to page 93

(c) 31/15 Turn to page 98

Excellent! You're making good progress.

Here's another one using letters alone.

Find a/b + c/d.

(a) (a + c)/(b + d) Turn to page 121

(b) (ad + bc)/b Turn to page 116

(c) (ad + bc)/bd Turn to page 118

No! 7/xy is not correct. You got the denominator right, but the numerator is wrong.

Turn to page 111.

You did the calculations correctly, but fell into a trap.

Remember, we just said to use parenthesis when talking about a quantity.

Well, $1/y + 3/z = (x + 3y)/yz$. The parenthesis must be there.

Go to page 113.

No! You forgot to change 1/y and 3/z to equivalent fractions with a common denominator.

Notice that: $1/y = z/yz$

$3/z = 3y/yz$

Now, we can add: $1/y + 3/z = z/yz + 3/yz$

$= (z + 3)/yz.$

You must <u>never</u> change the denominator of a fraction without also changing the numerator.

Go on to page 113.

Good! You know that $2\frac{8}{35}$ and 78/35 are the same.

It is important to recognize both forms. You will see them both used at different times.

Here's one using letters.

What is 3/x + 4/y ?

(a) I don't know what to do. Turn to page 111

(b) 7/xy Turn to page 106

(c) (3y + 4x)/xy Turn to page 105

Add the fractions 2/5 and 5/3.

(a) 19/15 Turn to page 93

(b) 7/8 Turn to page 95

(c) 31/15 Turn to page 98

The last problem was $3/x + 4/y$. We can work this the same as we did the numeric fractions. Remember, we first need a common denominator. This is the product of the two original denominators.

(1) Common denominator = $(x) \cdot (y) = xy$

(2) Now, we want to express both $3/x$ and $4/y$ as equivalent fractions with xy as denominator.

$3/x = 3/x \cdot 1 = 3/x \cdot y/y = 3y/xy$

$4/y = 4/y \cdot 1 = 4/y \cdot x/x = 4x/xy$

(3) So, $3/x + 4/y = 3y/xy + 4x/xy = (3y + 4x)/xy$.

Turn to page 112.

Notice that the numerator was in parenthesis. This is because (3y + 4x)/xy is not the same as 3y + 4x/xy. Remember that the whole quantity (3x + 4y) is the numerator.

Always express quantities like this inside parenthesis.

Find 1/y + 3/z.

(a) (z + 3y)yz Turn to page 105

(b) 4/yz Turn to page 108

(c) z + 3y/yz Turn to page 107

Maybe now you can do it.

Let's back up just a little and try again.

Find 2/5 + 5/3.

(a) 19/15 Turn to page 93

(b) 7/8 Turn to page 95

(c) 31/15 Turn to page 98

No! Your answer was incorrect.

$$3\frac{3}{7} + 4\frac{2}{7} = (3 + 4) + (3/7 + 2/7)$$

$$= 7 + 5/7$$

$$= 7\frac{5}{7}$$

The above solution is the best way to solve the problem.

Here's another one.

Add $4\frac{2}{13}$ to $2\frac{5}{13}$.

(a) $6\frac{10}{13}$ Turn to page 134

(b) $6\frac{7}{13}$ Turn to page 120

Good! That's correct.

Here's another one.

Add $x/3 + 4/y$.

(a) $(xy + 12)/3y$ Turn to page 118

(b) $4x/3y$ Turn to page 117

(c) $(x + 4)/3y$ Turn to page 117

No! The correct answer was:

$a/b + c/d = (ad + bc)/bd$

The only difference between this problem and the others is that letters are used.

The common denominator is the product of the two given denominators, so bd is the common denominator. Changing both fractions to equivalent ones, with bd as the denominator, we get:

$a/b = ad/bd$ and $c/d = bc/bd$.

Now, we can add:

$a/b + c/d = ad/bd + bc/bd = (ad + bc)/bd$.

Notice that the numerator must be in parenthesis.

Find the sum of $m/n + p/q$.

(a) $(m + p)/nq$ Turn to page 122

(b) $(m + p)/(n + q)$ Turn to page 124

(c) $(mq + np)/nq$ Turn to page 115

Oops! I thought you had it.

3y is the correct denominator for x/3 + 4/y.

Let's go through the whole problem.

$$x/3 + 4/y = xy/3y + 12/3y = (xy + 12)/3y.$$

See how easy it is.

Now you try another one.

What is k/8 + 2/m ?

(a) 2k/(8 + m) Turn to page 124

(b) (km + 16)/8m Turn to page 115

(c) km + 16/8m Turn to page 122

Fine! You're doing very well. That was a hard one.

Here's one using mixed numbers.

Add: $2\frac{1}{3} + 1\frac{1}{2}$.

(a) $3\frac{5}{6}$ Turn to page 135

(b) $3\frac{2}{5}$ Turn to page 123

(c) 23/6 Turn to page 135

(d) I don't know how to do it Turn to page 125

Find the sum of $3\frac{3}{7}$ and $4\frac{2}{7}$.

(a) 54/7 Turn to page 129

(b) $7\frac{5}{7}$ Turn to page 129

(c) 17/7 Turn to page 114

Good! You're progressing well.

Here's one more with mixed numbers.

Find the sum of $1\frac{2}{3}$ and $2\frac{3}{4}$.

(a) $4\frac{5}{12}$ Turn to page 142

(b) $5\frac{1}{12}$ Turn to page 140

(c) I don't know how to do it Turn to page 125

No! The correct answer was:

$a/b + c/d = (ad + bc)/bd$

The only difference between this problem and the others is that letters are used.

The common denominator is the product of the two given denominators, so bd is the common denominator. Changing both fractions to equivalent ones, with bd as the denominator, we get:

$a/b = ad/bd$ and $c/d = bc/bd$.

Now, we can add:

$a/b + c/d = ad/bd + bc/bd = (ad + bc)/bd$.

Notice that the numerator must be in parenthesis.

Find the sum of $m/n + p/q$.

(a) $(m + p)/nq$ Turn to page 122

(b) $(m + p)/(n + q)$ Turn to page 124

(c) $(mq + np)/nq$ Turn to page 115

No! You have to understand how to change fractions to correct equivalent fractions before adding them.

Go ask your teacher about this and then return to page 90 in Booklet II.

No! You added incorrectly.

Do you know how to add mixed numbers?

(a) Yes Turn to page 119

(b) No Turn to page 125

Incorrect!

You find the common denominator by multiplying.

Go back to page 116 and reread it then make another selection.

You said you don't know how to add mixed numbers.

Let's look at an example.

First of all, a mixed number is a number that contains both an integer and a fraction. For example: $1\ \frac{1}{2}$, $2\ \frac{1}{3}$, $7\ \frac{3}{8}$ are mixed numbers.

The mixed number $1\ \frac{1}{2}$ really means 1 + 1/2.

Now, let's see how to add two mixed numbers.

Add $1\ \frac{1}{5} + 2\ \frac{2}{5}$

This can be done simply by adding the integers and adding the fractions.

So, $1\ \frac{1}{5} + 2\ \frac{2}{5} = (1 + 2) + (1/5 + 2/5)$

$= 3 + 3/5$

$= 3\ \frac{3}{5}$.

See how easy it is. Here's one more example.

$5\ \frac{1}{4} + 7\ \frac{1}{4} = (5 + 7) + (1/4 + 1/4)$

$= 12 + 2/4$

$= 12\ \frac{2}{4}$

$12\ \frac{1}{2}$

Remember to reduce the 2/4 to 1/2. Go on to page 126.

Now, you do one.

What is $3\frac{3}{7} + 4\frac{2}{7}$?

(a) 54/7 Turn to page 129

(b) $7\frac{5}{7}$ Turn to page 129

(c) 17/7 Turn to page 114

The correct answer was $3\frac{3}{4} = 15/4$.

Let's see why.

You know there are 4/4 in 1. So, how many are there in 3? There are 3 x 4/4, or 12/4.

So, $3\frac{3}{4} = (3 \times 4/4) + 3/4 = 12/4 + 3/4 = 15/4$.

Another example:

$$2\frac{1}{3} = (2 \times 3/3) + 1/3 = 6/3 + 1/3 = 7/3.$$

Do not forget to add the fractional part of the mixed number after the multiplication is done.

Convert $4\frac{1}{2}$ to a fraction.

(a) 5/2 Turn to page 136

(b) 7/2 Turn to page 139

(c) 9/2 Turn to page 132

Converting between fractions and mixed numbers is causing you trouble.

Go back to page 136 and reread the material. Then make a different selection.

Good! 54/7 and $7\frac{5}{7}$ are both correct.

Although both answers are acceptable, it is important that you know how to go from one to the other.

Convert the mixed number $3\frac{3}{4}$ to a fraction.

(a) 15/4 Turn to page 132

(b) 33/4 Turn to page 133

(c) I don't know how Turn to page 127

Converting between fractions and mixed numbers is causing you trouble.

Go back to page 136 and reread the material. Then make a different selection.

7/9 is the correct answer. Good!

Do you see that it's really no harder to add three than to add two fractions?

Here's another one using three fractions.

Add 1/12, 3/4, and 1/6.

(a) 5/12 Turn to page 152

(b) 5/22 Turn to page 158

(c) 1 Turn to page 155

Fine! Now let's look at an example going the other way.

Convert 13/4 to a mixed number.

To do this, you simply divide 13 by 4.

$$4\overline{)13}\quad 3,\ 12,\ 1$$

Remember that the remainder of 1 is really 1 over the divisor 4, or 1/4.

So, $13/4 = 3\frac{1}{4}$.

Here's another example:

$$19/3 = 3\overline{)19}\quad 6,\ 18,\ 1 \qquad = 6\frac{1}{3}$$

Here's one for you.

Convert the fraction 27/5 to a mixed number.

(a) $2\frac{7}{5}$ Turn to page 137

(b) $4\frac{4}{5}$ Turn to page 144

(c) $5\frac{2}{5}$ Turn to page 120

The correct answer was $3\frac{3}{4} = 15/4$.

Let's see why.

You know there are 4/4 in 1. So, how many are there in 3? There are 3 x 4/4, or 12/4.

So, $3\frac{3}{4} = (3 \times 4/4) + 3/4 = 12/4 + 3/4 = 15/4$.

Another example:

$$2\frac{1}{3} = (2 \times 3/3) + 1/3 = 6/3 + 1/3 = 7/3.$$

Do not forget to add the fractional part of the mixed number after the multiplication is done.

Convert $4\frac{1}{2}$ to a fraction.

(a) 5/2 Turn to page 136

(b) 7/2 Turn to page 139

(c) 9/2 Turn to page 132

No! You don't seem to understand the addition of mixed numbers.

Go back to page 125 and reread the material carefully.

Then continue from there.

Right! Both $3\frac{5}{6}$ and 23/6 are the correct answers.

You should be able to work with either form, and convert from one to the other.

Try this one.

What is $1\frac{2}{3} + 2\frac{3}{4}$?

(a) $4\frac{5}{12}$ Turn to page 142

(b) $5\frac{1}{12}$ Turn to page 140

No! That's not quite it. Let's see how to convert $4\frac{1}{2}$ to a fraction.

$$4\frac{1}{2} = 4 + 1/2.$$

How many halves are there in 4?

There are $4 \times 2/2 = 8/2$ in 4

So, $4\frac{1}{2} = 8/2 \div 1/2 = 9/2$

Try another one.

Convert $3\frac{2}{3}$ to a fraction.

(a) 5/3 Turn to page 128

(b) 11/3 Turn to page 132

(c) 13/3 Turn to page 130

No! Not quite. Let's work it together.

$$27/5 = 5\overline{)27} = 5\overline{)\begin{array}{r}5\\27\\\underline{25}\\2\end{array}} = 5\,\frac{2}{5}$$

Study this carefully before going on.

What mixed number represents the fraction 19/7?

(a) $2\,\frac{5}{7}$ Turn to page 120

(b) $3\,\frac{2}{7}$ Turn to page 128

(c) $1\,\frac{6}{7}$ Turn to page 130

No! You seem to be having trouble.

Turn to page 118 and go through this section on mixed numbers again.

No! That's not quite it. Let's see how to convert $4\frac{1}{2}$ to a fraction.

$$4\frac{1}{2} = 4 + 1/2$$

How many halves are there in 4?

There are $4 \times 2/2 = 8/2$ in 4.

So, $4\frac{1}{2} = 8/2 + 1/2 = 9/2$.

Try another one.

Convert $3\frac{2}{3}$ to a fraction.

(a) 5/3 Turn to page 128

(b) 11/3 Turn to page 132

(c) 13/3 Turn to page 130

That was a tough one. Let's look at it again.

We want to add two mixed numbers.

$$1\frac{2}{3} + 2\frac{3}{4} = (1 + 2) + (2/3 + 3/4)$$
$$= 3 + (2/3 + 3/4)$$

Now, 2/3 + 3/4 need a common denominator in order to be added. Do you remember how to find it. Just multiply 3 x 4.

So, 12 is the common denominator.

$$2/3 = 2/3 \times 4/4 = 8/12 \quad \text{and} \quad 3/4 = 3/4 \times 3/3 = 9/12.$$

So, 2/3 + 3/4 = 8/12 + 9/12 = 17/12.

We now must break 17/12 into a mixed number.

$$17/12 = 12\overline{)17} = 12\overline{)\begin{array}{r}1\\17\\12\\\hline5\end{array}} = 1\frac{5}{12}$$

Go to page 141.

Looking at the whole problem now,

$$1\frac{2}{3} + 2\frac{3}{4} = (1 + 2) + (2/3 + 3/4)$$

$$= 3 + 9/12 + 8/12$$

$$= 3 + 17/12$$

$$= 3 + 1\frac{5}{12}$$

$$= 4\frac{5}{12}$$

Be sure you understand this explanation before trying the problem.

Find the sum of $2\frac{1}{2}$ and $3\frac{1}{4}$.

(a) $5\frac{1}{3}$ Turn to page 143

(b) $5\frac{3}{4}$ Turn to page 145

(c) $6\frac{1}{6}$ Turn to page 138

Good! Your last answer was correct. You are doing fine.

You seem to understand how to add two fractions. Adding three or more fractions is no different. Simply make sure all fractions have a common denominator, and add numerators just like you did before.

Let's try one.

What is 1/9 + 2/9 + 4/9?

(a) 7/9 Turn to page 131

(b) 7/27 Turn to page 148

(c) 9/9 Turn to page 151

Whoops! You were on the right track. You must have made a careless mistake.

Go back to page 140 and make another choice.

Turn to page 140.

No! Not quite. Let's work it together.

$$27/5 = 5\overline{)27} = 5\overline{)\begin{array}{r}5\\27\\25\\\hline 2\end{array}} = 5\frac{2}{5}$$

Study this carefully before going on.

What mixed number represents the fraction 19/7?

(a) $2\frac{5}{7}$ Turn to page 120

(b) $3\frac{2}{7}$ Turn to page 128

(c) $1\frac{6}{7}$ Turn to page 130

Fine! You did it right.

Here's another one.

Add $2\frac{5}{6}$ and $1\frac{1}{2}$

(a) $4\frac{4}{6}$ Turn to page 147

(b) $3\frac{7}{6}$ Turn to page 146

(c) $4\frac{1}{3}$ Turn to page 142

No! Not quite. Let's see how to do it.

$$2\frac{5}{6} + 1\frac{1}{2} = (2 + 1) + (5/6 + 1/2)$$
$$= 3 + (5/6 + 1/2)$$
$$= 3 + (5/6 + 3/6)$$
$$= 3 + 8/6$$

But 8/6 reduces to 4/3 or $1\frac{1}{3}$.

As: $4/3 = 3\overline{)4} = 3\overline{)\begin{matrix}1\\4\\3\\1\end{matrix}} = 1\frac{1}{3}$

So: $3 + 8/6 = 3 + 1\frac{1}{3} = 4\frac{1}{3}$

Try this problem.

Add $4\frac{2}{13}$ to $2\frac{5}{13}$.

(a) $6\frac{10}{13}$ Turn to page 134

(b) $6\frac{7}{13}$ Turn to page 120

You were close.

Go back to page 145 and choose another answer.

Come on now. You can do better than that.

You know that to add fractions you never add the denominators. Turn back to page 142 and try again.

Good!

Here's one more.

What is 7/18 + 5/18 + 2/18 ?

(a) 15/18 Turn to page 156

(b) 7/9 Turn to page 131

No! You just don't have it.

Go see your teacher for help in adding three fractions with like denominators.

Then return to page 142 of this Unit.

No!

Let's remember how to add fractions with like denominators. Simply add numerators and keep the same denominator.

So, $1/9 + 2/9 + 4/9 = \frac{1 + 2 + 4}{9} = 7/9$

Find the sum of 3/13, 4/13, and 5/13.

(a) 12/39 Turn to page 157

(b) 6/7 Turn to page 154

(c) 12/13 Turn to page 149

No! You did it incorrectly.

First you need to find a common denominator. Since 12 is a multiple of both 4 and 6, we can use 12 as the common denominator.

$$1/12 + 3/4 + 1/6 = 1/12 + 3/4 \cdot 3/3 + 1/6 \cdot 2/2$$
$$= 1/12 + 9/12 + 2/12$$
$$= 12/12$$

But 12/12 = 1, which was the correct answer. Don't forget to reduce your answers.

O.K. Now you do one.

Add: 2/5 + 1/4 + 1/10.

(a) 3/4 Turn to page 170

(b) 13/20 Turn to page 163

Excellent!

Here's one to try using letters.

What is 3/x + 4/x + 5/x ?

(a) 12/3x Turn to page 176

(b) 4/x Turn to page 169

(c) 12/x Turn to page 172

The correct answer was that:

3/13 + 4/13 + 5/13 = 12/13

Here's another one.

What is 8/17 + 7/17 + 1/17 ?

(a) 12/17 Turn to page 150

(b) 16/17 Turn to page 149

Your answer of 1 is correct. Fine. You noticed that you should reduce 12/12 to 1.

Can you do one with mixed numbers? Let's try.

Find $3\frac{1}{2} + 1/5 + 2\frac{3}{5}$.

(a) $5\frac{5}{12}$ Turn to page 162

(b) 31/5 Turn to page 160

(c) $6\frac{3}{10}$ Turn to page 153

No! Not quite.

Keep in mind that in adding fractions with a common denominator, just add numerators.

Add the fractions 4/13, 5/13, and 3/13.

(a) 12/39 Turn to page 157

(b) 6/7 Turn to page 154

(c) 12/13 Turn to page 149

No! NEVER add denominators. If the denominators are all the same you already have a common denominator.

Go back to page 142 and start from there.

No! You did it incorrectly.

First you need to find a common denominator. Since 12 is a multiple of both 4 and 6, we can use 12 as the common denominator.

$$1/12 + 3/4 + 1/6 = 1/12 + 3/4 \cdot 3/3 + 1/6 \cdot 2/2$$
$$= 1/12 + 9/12 + 2/12$$
$$= 12/12$$

But 12/12 = 1, which was the correct answer. Don't forget to reduce your answers.

O.K. Now you do one.

Add: 2/5 + 1/4 + 1/10.

(a) 3/4 Turn to page 170

(b) 13/20 Turn to page 163

Fine! You're progressing very well.

How about trying one with mixed numbers?

What is $3\frac{1}{2} + 1/5 + 2\frac{3}{5}$?

(a) $5\frac{5}{12}$ Turn to page 162

(b) 31/5 Turn to page 160

(c) $6\frac{3}{10}$ Turn to page 188

No! You didn't do it right.

Let's see how to work it.

$$3\frac{1}{2} + 1/5 + 2\frac{3}{5} = (3 + 2) + (1/2 + 1/5 + 3/5)$$
$$= 5 + (1/2 + 1/5 + 3/5)$$

A good common denominator for the fractional part would be 5 x 2 or 10.

$1/2 = 1/2 \cdot 5/5 = 5/10$

$1/5 = 1/5 \cdot 2/2 = 2/10$

$3/5 = 3/5 \cdot 2/2 = 6/10$

So, $1/2 + 1/5 + 3/5 = 5/10 + 2/10 + 6/10$

$= 13/10$

But remember, $13/10 = 10\overline{)13} = 10\overline{)\begin{array}{r}1\\13\\10\\\hline 3\end{array}}$

$$= 1\frac{3}{10}$$

So far the whole problem,

$$3\frac{1}{2} + 1/5 + 2\frac{3}{5} = 5 + 1\frac{3}{10} = 6\frac{3}{10}$$

Go to page 161

It is important that you remember what you have learned before in order that you can apply those ideas now.

Add: $2\frac{1}{2}$, $3\frac{1}{6}$, and $5\frac{1}{3}$

(a) 12 Turn to page 171

(b) 11 Turn to page 168

(c) Not given Turn to page 166

No! You didn't do it right. Let's see how to work it.

$$3\frac{1}{2} + 1/5 + 2\frac{3}{5} = (3 + 2) + (1/2 + 1/5 + 3/5)$$
$$= 5 + (1/2 + 1/5 + 3/5)$$

A good common denominator for the fractional part would be 5 x 2 or 10.

$1/2 = 1/2 \cdot 5/5 = 5/10$

$1/5 = 1/5 \cdot 2/2 = 2/10$

$3/5 = 3/5 \cdot 2/2 = 6/10$

So, $1/2 + 1/5 + 3/5 = 5/10 + 2/10 + 6/10$

$= 13/10$

But remember, $13/10 = 10\overline{)13} = 10\overline{)\begin{array}{r}1\\13\\10\\3\end{array}}$

$= 1\frac{3}{10}$

So far the whole problem,

$$3\frac{1}{2} + 1/5 + 2\frac{3}{5} = 5 + 1\frac{3}{10} = 6\frac{3}{10}$$

Go to page 161.

Not quite.

2/5 + 1/4 + 1/10 could have 20 as a common denominator, since 5, 4, and 10 are all multiples of 20.

$2/5 = 2/5 \cdot 4/4 = 8/20$

$1/4 = 1/4 \cdot 5/5 = 5/20$

$1/10 = 1/10 \cdot 2/2 = 2/20$

So, 2/5 + 1/4 + 1/10 = 8/20 + 5/20 + 2/20 = 15/20.
But, 15/20 = 3/4 by reducing it.

Don't forget to put your final answer in simplest terms.

Now, try another problem.

Add: 2/3, 1/6, and 1/3.

(a) 6/7 Turn to page 165

(b) 7/6 Turn to page 170

Good! You are correct.

Add: 2/5, 1/4, and $2\frac{3}{4}$.

(a) $2\frac{2}{5}$ Turn to page 175

(b) $3\frac{2}{5}$ Turn to page 168

(c) $3\frac{4}{11}$ Turn to page 175

You're making it too hard.

It's really not much different to add three fractions than to add two fractions.

Ask your teacher for help in this area and then return to page 142 of this Unit.

Incorrect!

Turn back to page 160 and try again.

No! You didn't find the correct common denominator.

For the fractions 1/2, 1/3, and 1/4 each denominator is a multiple of 12. So, 12 can be a common denominator.

$1/2 = 1/2 \cdot 6/6 = 6/12$

$1/3 = 1/3 \cdot 4/4 = 4/12$

$1/4 = 1/4 \cdot 3/3 = 3/12$

So, $1/2 + 1/3 + 1/4 = 6/12 + 4/12 + 3/12 = 13/12$.

Study this page carefully before proceeding.

Here is your next problem.

Add: 1/4, 2/6, and 1/3.

(a) 11/10 Turn to page 165

(b) 11/12 Turn to page 170

(c) 11/14 Turn to page 165

Very good! That was a tricky one.

Add: $4\ \frac{1}{13}$, $5\ \frac{2}{13}$, and $6\ \frac{3}{13}$.

(a) $15\ \frac{6}{13}$ Turn to page 153

(b) $13\ \frac{6}{15}$ Turn to page 173

(c) $15\ \frac{7}{26}$ Turn to page 177

No! That's not correct.

It's really easy to work with letters. Notice that x is the denominator in every fraction. So, you should simply add the numerators. In other words:

$$3/x + 4/x + 5/x = (3 + 4 + 5)/x = 12/x$$

It's that simple.

Here's another one to try.

Add $5/y + 10/y + 12/y$.

(a) $27/y$ Turn to page 172

(b) $27/3y$ Turn to page 183

Fine! You are doing well.

Here's a similar problem.

Add the fractions 1/2, 1/3, and 1/4.

(a) 13/12 Turn to page 159

(b) 7/6 Turn to page 167

No! The correct answer was 11.

$$2\frac{1}{2} + 3\frac{1}{6} + 5\frac{1}{3} = (2 + 3 + 5) + (1/2 + 1/6 + 1/3)$$

But (1/2 + 1/6 + 1/3) can be expressed as sixths.

$1/2 = 1/2 \cdot 3/3 = 3/6$

$1/6 = 1/6$

$1/3 = 1/3 \cdot 2/2 = 2/6$

So, $1/2 + 1/6 + 1/3 = 3/6 + 1/6 + 2/6 = 6/6 = 1$

So, $2\frac{1}{2} + 3\frac{1}{6} + 5\frac{1}{3} = (2 + 3 + 5) + (1) = 11$

If you don't understand this problem, study it carefully before trying the next one.

Add: 2/5, 1/4, and $2\frac{3}{4}$.

(a) $2\frac{2}{5}$ Turn to page 175

(b) $3\frac{2}{5}$ Turn to page 168

Very good! Letters are really no different than numbers.

Here's one more.

Find the sum of a/x, b/x and c/x.

(a) (a + b + c)/x Turn to page 186

(b) (a + b + c)/3x Turn to page 184

(c) abc/3x Turn to page 179

Oops! You missed it and you almost had it.

Try one more.

Add the mixed numbers $1\frac{1}{2}$, $2\frac{1}{2}$, and $4\frac{3}{4}$.

(a) $8\frac{1}{2}$ Turn to page 175

(b) $9\frac{1}{4}$ Turn to page 175

(c) $8\frac{3}{4}$ Turn to page 164

Fine! You did it right.

Try one more just to be sure.

What is the sum of 3/m + 3/m + 2/m ?

(a) k/m Turn to page 180

(b) 8/m Turn to page 172

(c) 8/3m Turn to page 178

No!

Three mixed numbers are giving you trouble.

See your teacher for help. Then return to page 118 of this Unit.

No! That's not correct.

It's really easy to work with letters. Notice that x is the denominator in every fraction. So, you should simply add the numerators. In other words:

$$3/x + 4/x + 5/x = (3 + 4 + 5)/x = 12/x$$

It's that simple.

Here's another one to try.

Add $5/y + 10/y + 12/y$.

(a) $27/y$ Turn to page 172

(b) $27/3y$ Turn to page 183

Oops! You missed it and you almost had it.

Try one more.

Add the mixed numbers $1\ \frac{1}{2}$, $2\ \frac{1}{2}$, and $4\ \frac{3}{4}$.

(a) $8\ \frac{1}{2}$ Turn to page 175

(b) $9\ \frac{1}{4}$ Turn to page 175

(c) $8\ \frac{3}{4}$ Turn to page 164

Incorrect! You made a careless mistake.

Go back to page 183 and work the problem on that page again.

Turn to page 183.

No! The problem was simply to add three fractions like we've been doing all along.

$$a/x + b/x + c/x = (a + b + c)/x$$

Let's try another one.

Add $k/b + L/b + y/b$.

(a) $(k + L + y)/b$ Turn to page 182

(b) $(kL + Ly)/b$ Turn to page 181

(c) $kb + Lb + yb$ Turn to page 181

Incorrect! You made a careless mistake.

Go back to page 183 and work the problem on that page again.

Turn to page 183.

No: Just add numerators.

I'll give you another chance.

What is 2/k + d/k + x/k ?

(a) (2 + d + x)/3k Turn to page 187

(b) (2 + d + x)/k Turn to page 182

(c) 2dx/k Turn to page 187

Right! I think you understand it now.

Add: $3/z + b/z + k/z$.

(a) $(3 + b + 1)/z$ Turn to page 185

(b) $3/z + bk/z$ Turn to page 181

(c) $(3 + b + k)/z$ Turn to page 186

No! You formed an incorrect denominator. y was in all fractions, so it should have been the common denominator.

27/y was the right answer.

Add: 4/k, 3/k, and 21/k.

(a) $2\frac{8}{k}$ Turn to page 178

(b) $6\frac{4}{k}$ Turn to page 180

(c) 28/k Turn to page 174

No! The problem was simply to add three fractions like we've been doing all along.

$$a/x + b/x + c/x = (a + b + c)/x$$

Let's try another one.

Add: $k/b + L/b + y/b$.

(a) $(k + L + y)/b$ Turn to page 182

(b) $(kL + Ly)/b$ Turn to page 181

(c) $kb + Lb + yb$ Turn to page 181

No!

$$3/z + b/z + k/z = (3 + b + k)/z$$

That's all there is to it.

Add: $a/k + b/k + c/k$.

(a) $(a + b + c)/3k$ Turn to page 187

(b) $(a + b + c)/k$ Turn to page 182

(c) $a + b + c/k$ Turn to page 187

Great! You have successfully made it through addition of fractions. Let's review what we've done.

I. To add two fractions with the same denominators, just add numerators, keeping the same denominator in the answer.

II. To add two fractions with different denominators, first find a common denominator. Then add as before.

III. To add fractions containing letters just follow the same rules as you did with numbers.

IV. To add three or more fractions is almost the same as adding two. Make sure all fractions have a common denominator, and add as before.

(Continued on next page)

V. To add mixed numbers, add the integers and fractions separately in order to find the sum. When working with the fractional parts, follow all rules of fractions that we have discussed.

VI. In every case express your answers in simplest terms.

You should now be ready for a test over this Unit.

Go tell your teacher you have finished.

You chose the wrong answer.

Go back to page 181 and rework the problem.

Be more careful this time.

Turn to page 181.

Very good! $6\ \frac{3}{10}$ is correct.

Here's another.

Find: $3\ \frac{1}{2} + 1/5 + 2\ \frac{3}{5}$.

(a) $5\ \frac{5}{12}$ Turn to page 162

(b) 31/5 Turn to page 160

(c) $6\ \frac{3}{10}$ Turn to page 153

NORTHWEST REGIONAL EDUCATIONAL LABORATORY
CAI MATHEMATICS

TEST QUESTIONS
UNIT 5A -- ADDITION OF FRACTION

Directions: The correct answers will always be expressed in lowest terms.

1. The sum of 3 and 2 is

   a) 5

   b) 1

   c) 6

2. What is 3/7 + 2/7?

   a) 5/14

   b) 1/7

   c) 5/7

3. 4 1/5 + 3 3/10 + 2 2/5 =

   a) 9 6/20

   b) 9 9/10

   c) 9 3/10

4. Add $\frac{32}{xy}$ and $\frac{5}{xy}$

   a) 27/xy

   b) 37/2xy

   c) 37/xy

5. Add r/s, t/s

   a) $\frac{r + t}{s}$

   b) rt/2s

   c) rt/s^2

6. What is the sum of 3 1/2, 1/5, and 2 3/5

   a) 5 5/12

   b) 6 3/10

   c) 31/5

7. Add 4/x and 15/x

   a) 19/2x

   b) $19/x^2$

   c) 19/x

8. What is x/z + y/z

   a) xy/2z

   b) (x + y)/2z

   c) (x + y)/z

9. 1/3 + 1/4 + 5/12 =

   a) 1

   b) 7/19

   c) 11/12

10. 4/R + 6/R =

   a) 24/R

   b) 10/R

   c) 10/2R

11. what is the sum of K/V + S/V?

   a) K V/V

   b) $\frac{K + S}{V}$

   c) KS/2V

12. Add 2 1/3 + 3 1/4

    a) 5 7/12

    b) 5 2/7

    c) 5 1/12

13. What is the sum of 5/12 and 2/3?

    a) 1 1/12

    b) 3/12

    c) 7/15

14. 3/x + 2/y =

    a) 5/xy

    b) (3y + 2x)/xy

    c) 5/(x + y)

15. 1/s + 8/s + 3/s =

    a) 18/s

    b) 18/2s

    c) 18/3s

16. Find the sum of k/1w and m/1w

    a) m/1w

    b) $\frac{km}{1 + w}$

    c) $\frac{k + m}{1w}$

17. Find 3 1/4 + 1 1/4

a) 4 1/2

b) 4 2/4

c) 18/4

18. Add 3/17, 4/17 and 5/17

a) 12/51

b) 12/17

c) 2/34

19. What is the sum of 7/9 and 5/9

a) 12/9

b) 1 3/9

c) 1 1/3

20. Add 3/k and 15/k

a) 45/k

b) 18/k

c) 18/2k

21. Add 3/4 and 1/2

a) 5/4

b) 1 3/4

c) 1/4

22. Add 5 7/12 and 6 1/2

a) 11 8/14

b) 12 1/12

c) 11 4/7

23. Find the sum of k/n, 1/n, and t/n

a) $\frac{kl + t}{n}$

b) $\frac{k + lt}{n}$

c) $\frac{k + l + t}{n}$

24. What is 8/m + 7/m?

a) 1/m

b) 15/m

c) 15/2m

25. Add 2/5 and 1/9

a) 23/45

b) 3/14

c) 5/9

ANSWER SHEET - UNIT 5A

OBJECTIVE	QUESTION NUMBER	CORRECT ANSWER
1	1	a
2	2	c
5	3	b
3	4	c
4	5	a
1,5	6	b
3	7	c
4	8	c
2	9	a
3	10	b
1,4	11	b
5	12	a
1,2	13	a
3	14	b
3	15	a
1,4	16	c
5	17	a
2	18	b
2	19	c
3	20	b
2	21	a
5	22	b
4	23	c
3	24	b
2	25	a

OBJECTIVE	QUESTIONS
1	1,6,11,13,16
2	2,9,13,18,19,21,25
3	4,7,10,14,15,20,24
4	5,8,11,16,23
5	3,6,12,17,22

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ABSTRACT

One book of a 21-book series of programmed instruction materials designed to help pupils acquire mathematics capabilities most useful in sub-professional level occupations. Other programmed books in the series are:

Symbols
Representing Numbers by Letters
Equivalent Forms
Fraction and Ratio
Subtraction of Fractions
Multiplication of Fractions
Division of Fractions
Concepts of Decimals and Fractions
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Multiplication of Decimals
Division of Decimals
Conversion of Fractions into Decimal
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