Number Sense Item Bank

Introduction

From McIntosh, A., Reys, B., Reys, R., Bana, J. and Farrell, B. (1997). *Number Sense in School Mathematics. Student Performance in Four Countries*. Perth: MASTE

"Number sense refers to a person's general understanding of number and operations along with the ability and inclination to make mathematical judgments and to develop useful and efficient strategies for managing numerical situations. It results in a view of numbers as meaningful entities and the expectation that mathematical manipulations and outcomes should make sense. Those who view mathematics in this way continually utilise a variety of internal "checks and balances" to judge the reasonableness of numerical outcomes. When an outcome conflicts with the perceived expectation, the person revisits the mathematical situation to view it externally, often through another lens, and attempts to resolve the conflict.

Number sense exhibits itself in various ways as the learner engages in mathematical thinking, including awareness of various levels of accuracy and sensitivity for the reasonableness of calculations. It is characterised by a desire to make sense of numerical situations, by looking for links between new information and previously acquired knowledge, and an innate drive within the learner to make the forming of these connections a priority."

The items that follow were used in assessing student performance in number sense in four countries. Student ages ranged from 8 years to 14 years. The items assess a wide range of abilities in number sense.

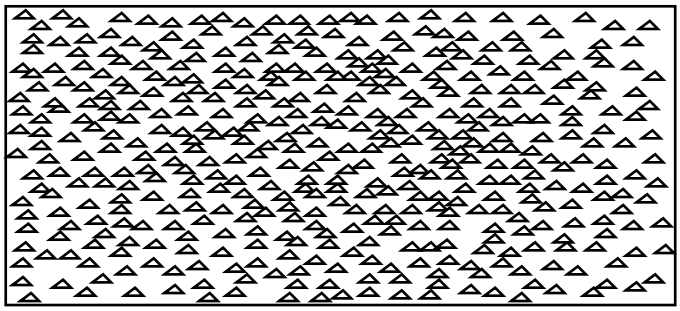
Acknowledgement is made to the authors as mentioned above.

> The answers to the items should be worked out mentally without recourse to use of the calculator or by writing anything on paper.

A comprehensive number sense development programme needs to accompany any use of items in a classroom situation.

Index of Items

Counting and Computation with Whole Numbers

1	*About* how many days has a child in year 1 at school lived?	**A** 200 **B** 2000 **C** 20 000 **D** 200 000
2	*About* how many triangles are there here? 	**A** 20 **B** 50 **C** 100 **D** 200 **E** 400
3	A school has 610 children. If 98 children are away on a trip, *about* how many are still at school?	**A** 400 **B** 500 **C** 600 **D** 700
4	Whitney has ten dollars. She has six dollars less than Rebecca does. How many dollars does Rebecca have?	_____
5	Barb is a nine year old at my school. She says that she is 30 000 days old. Is that possible? Say why.	**A** Yes **B** No **C** Maybe. Tell how you decided. _____ _____
6	*Without calculating the exact answer,* circle the best estimate for: 145 x 4	**A** Greater than 450 **B** Less than 450 **C** Impossible to tell without calculating

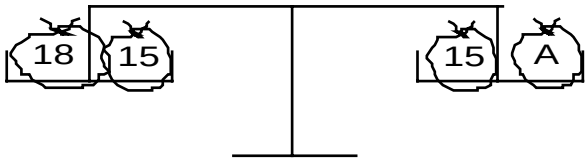
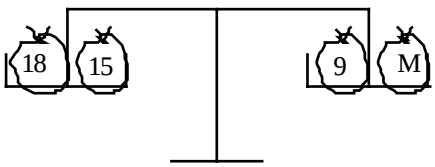
7	*Without calculating the exact answer,* circle the best estimate for: 21 x 19	**A** 299 **B** 399 **C** 499
8	Which two numbers multiplied together give an answer closest to the target number? 4 18 50 37 Target Number : 75	_____ and _____
9	Which two numbers multiplied together give an answer closest to the target number? 4 18 50 37 Target Number : 1000	_____ and _____
10	930 x 134 is equal to 124620. Use this to find the answer to: 124620 ÷ 93	_____
11	A cat eats 600 g of fish in 4 days. How many grams will the cat eat in 6 days?	**A** 400 g **B** 600 g **C** 800 g **D** 900 g **E** 1000 g
12	A trip took 6 hours travelling at an average speed of 80 kilometres per hour. The return trip took 4 hours. What was the average speed for the round trip?	_____

Effect of Operations - Whole Numbers

13	The digits are 0, 1, 2, 3, 4, 5, 6, 7, 8, 9. Put one digit in each box so that the answer will be as *big* as possible. Note that digits 4, 2, 3, and 8 have already been used and therefore should not be used again. Use any digit only once.	4☐☐ - 238 = ?
14	The digits are 0, 1, 2, 3, 4, 5, 6, 7, 8, 9. Put one digit in each box so that the answer will be as *big* as possible. Note that digits 4, 3, 1, and 2 have already been used and therefore should not be used again. Use any digit only once.	431 - 2☐☐ = ?
15	Five bugs each have fifteen spots on their back. Which of these tells us how many spots there are altogether?	**A** 5 + 15 **B** 15+15+15+15+15 **C** 15 + 5 **D** 5 + 5 + 5 + 5 + 5

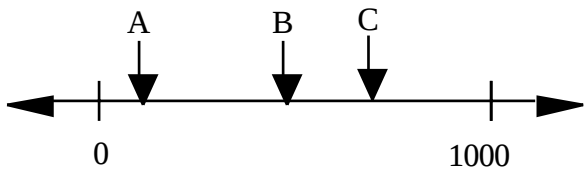
16	When a 3 digit number is added to a 3 digit number the result is:	**A** always a 3 digit number **B** always a 4 digit number **C** always a 5 digit number **D** either a 3,4 or 5 digit number **E** either a 3 or 4 digit number
17	When a 2-digit number is multiplied by a 2-digit number, the result is:	**A** Always a 3 digit number **B** Always a 4 digit number **C** Either a 3 or 4 digit number **D** Sometimes a 5 digit number
18	Austin has a $50 note and he spends $29. He gets $24 in change. Which sum could he do to check if this is the right change?	**A** 29 + 24 **B** 24 + 50 **C** 50 + 24 **D** 50 + 29
19	*Without calculating the exact answer,* circle the best estimate for: 45 x 105	**A** 4000 **B** 4600 **C** 5200

Equivalent Expressions - Whole Numbers

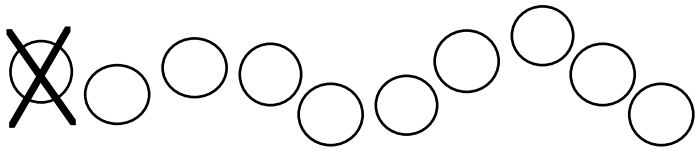
20	 Jim has balanced some bags of marbles. The numbers show how many marbles are in each bag. How many marbles are in the bag marked A? (Circle the correct answer)	**A** 3 **B** 15 **C** 18 **D** 33
21	 Barbara has balanced some bags of marbles. The numbers show how many marbles are in the bags. How many marbles are in the bag marked M?	**A** 6 **B** 9 **C** 15 **D** 24 **E** 42

22	The farmer has stored all his apples in 80 boxes with 40 apples in each box. He now needs to repack them all into 40 new boxes. How may apples will there be in each new box.	**A** 2 **B** 40 **C** 80 **D** 120
23	*Without calculating the exact answer*, circle the largest answer.	**A** 18 x 17 **B** 16 x 18 **C** 17 x 19
24	*Without calculating answers,* circle the expression that represents the larger amount.	**A** 145 x 4 **B** 144+146+148+150
25	**16 x 0 = ☐** The number in the box ...	**A** must be 16 **B** must be 160 **C** must be 0 **D** could be any number
26	**15 x ☐ = 15** The number in the box ...	**A** must be 0 **B** must be $\frac{1}{15}$ **C** must be 1 **D** must be 15 **E** could be any number
27	93 x 134 is equal to 12462. Use this to write the answer to 93 x 135	_____
28	Write $>$ or $=$ or $<$ to make this a true statement.	456 ÷ 8 ☐ 456 x $\frac{1}{8}$
29	A four digit number is represented by ☐☐☐☐. If ☐☐☐☐ ÷ 30 > 40, then which of these statements is true?	**A** 30 x 40 > ☐☐☐☐ **B** 30 x 40 < ☐☐☐☐ **C** 30 x ☐☐☐☐ < 40 **D** 40 x ☐☐☐☐ < 30
30	Jim bought 3 sleeping bags at $98 each. How could he work out how much he spent?	**A** 3 x $100 minus $1 **B** 3 x $100 minus $2 **C** 3 x $100 minus $3 **D** 3 x $100 minus $6

Multiple Representations - Whole Numbers

31	Estimate the number shown by each arrow:  	**A** _____ **B** _____ **C**_____

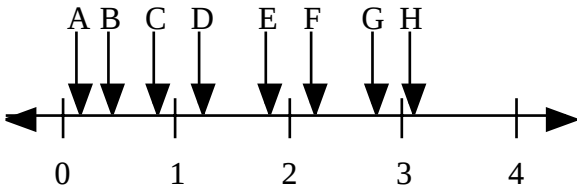
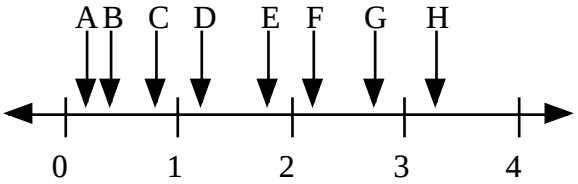
Number Concepts - Whole Numbers

32	Here are five digits: 2, 6, 3, 5, 1. Arrange *all* these digits to make the smallest number possible. Use each digit only once.	_____
33	Here are five digits: 2, 6, 3, 5, 1. Arrange them to make the number nearest to 20 000. Use each digit once.	_____
34	There is a cross on the first circle. Put a cross on the seventh circle.	
35	Thirty-four is the same as 34. Four hundred and three is the same as:	_____
36	Thirty-four is the same as 34. Six thousand and ninety-two is the same as:	_____
37	If I have $378 in my savings account and withdraw all my money what is the maximum number of 10 dollar notes would the bank be willing to give me?	_____

Counting and Computation - Fractions

38	Peter took one third of the apples from a bag. Here are Peter's apples:  Ben took all the others from the bag. How many apples were there in the bag to start with?	_____
39	A watermelon is cut into quarters. Then each quarter is cut in half. How many pieces of watermelon are there now? Circle your answer.	**A** 2 **B** 4 **C** 6 **D** 8
40	Austin had a $5 note which he changes into 20 cent coins. How many coins will he get?	**A** 4 **B** 5 **C** 9 **D** 20 **E** 25
41	Use two of the numbers 3, 4, 9, 12 to make a fraction as close as possible to $\frac{1}{2}$.	$\frac{\square}{\square}$

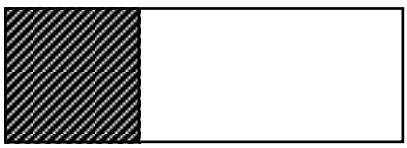
Number Concepts - Fractions

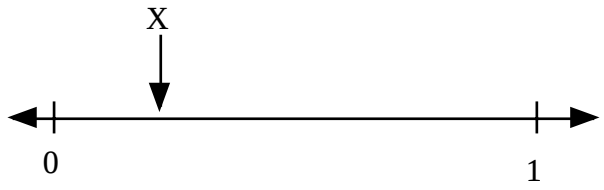
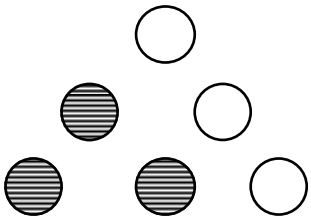
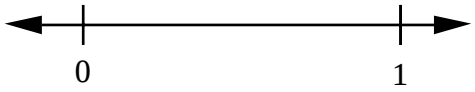
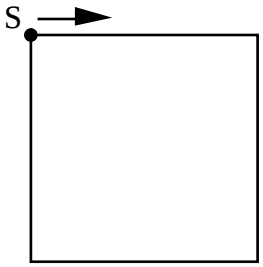
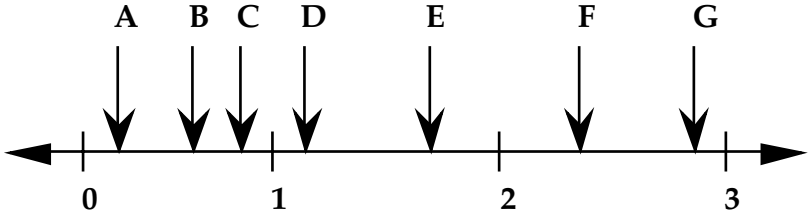
42	*Without calculating*, which total is more than 1?	**A** $\frac{2}{5} + \frac{3}{7}$ **B** $\frac{1}{2} + \frac{4}{9}$ **C** $\frac{3}{8} + \frac{2}{11}$ **D** $\frac{4}{7} + \frac{1}{2}$
43	Circle the number you can put in the box to make this sentence true: $\frac{1}{2} \times \square = \frac{3}{6}$	**A** $\frac{2}{4}$ **B** $\frac{2}{3}$ **C** 1 **D** 3
44	 On the number line above, which letter best represents the following: A x G	_____
45	 On the number line above, which letter best represents the following: B + F	_____

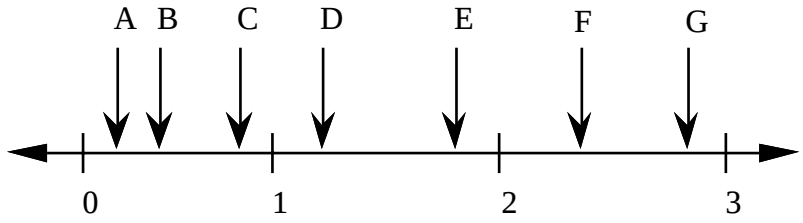
Equivalent Expressions - Fractions

46	Write < or = or > to make this a true statement.	$5 \times 7\frac{1}{2} \square 35 + \frac{1}{2}$

Multiple Representations - Fractions

47	 *About* how much of this box is shaded? Give your answer as a *fraction.*	_____
48	Shade $\frac{3}{4}$ of this rectangle.	

49	What fraction matches the letter X on this number line? Circle the correct answer. 	**A** $\frac{1}{2}$ **B** $\frac{1}{3}$ **C** $\frac{1}{7}$ **D** $\frac{1}{5}$
50	Circle the fraction, which shows how much has been shaded. 	**A** $\frac{1}{2}$ **B** $\frac{2}{6}$ **C** $\frac{4}{6}$ **D** $\frac{4}{2}$
51	Shade in one quarter of this rectangle.	
52	Place the numbers $\frac{1}{10}$ and $\frac{4}{5}$ in their correct positions on this number line:	
53	You are going to walk *once* around a square-shaped field. You start at the corner marked S and move in the direction shown by the arrow. Mark with an X where you will be after $\frac{1}{3}$ of your walk.	
54	Circle all the statements that are true about the number $\frac{2}{5}$.	**A** It is greater than $\frac{1}{2}$ **B** It is the same as 2.5 **C** It is equivalent to 0.4 **D** It is greater than $\frac{1}{3}$
55	 Which letter in the number line above names a fraction where the numerator is *slightly more* than the denominator?	_____

56	 Which letter in the number line above names a fraction where the numerator is *nearly* twice the denominator?	_____
57	Shade in two thirds ($\frac{2}{3}$) of this shape.	

Number Concepts - Fractions

58	Tom cuts a cake into four equal pieces and eats two of them. What fraction of the whole cake is left?	_____
59	How many ten cents make a dollar?	_____
60	$\frac{3}{4}$ is a fraction between $\frac{1}{2}$ and 1. Write two other fractions, between $\frac{1}{2}$ and 1.	_____ and _____
61	Circle the fraction which represents the largest amount:	**A** $\frac{5}{6}$ **B** $\frac{5}{7}$ **C** $\frac{5}{8}$ **D** $\frac{5}{9}$
62	Put two of the numbers 4, 9, 12 in the boxes make a fraction as close as possible to $\frac{2}{3}$.	$\frac{\square}{\square}$
63	How many different *fractions* are there between $\frac{2}{5}$ and $\frac{3}{5}$? Circle your answer and, if there is a blank, fill it in.	**A** None. **B** One. What is it? _____ **C** A few. Give two: _____ and _____ **D** Lots. Give two: _____ and _____
64	Write a number in the box to make a fraction that represents a number between 2 and 3.	$\frac{\square}{8}$
65	In the fraction $\frac{1}{8}$ the numerator is 1. Fill in the boxes to make a fraction between 0 and $\frac{1}{10}$ whose numerator is *not* 1.	$\frac{\square}{\square}$

66	Circle all fractions listed here that are greater than $\frac{3}{4}$ but less than 1.	$\frac{2}{3}$ $\frac{5}{8}$ $\frac{4}{5}$ $\frac{7}{10}$ $\frac{4}{3}$
67	$\frac{1}{3}$ is a fraction between $\frac{1}{2}$ and $\frac{1}{4}$. Name another fraction between $\frac{1}{2}$ and $\frac{1}{4}$.	_____

Counting and Computation - Decimals

68	Ten bottles of juice cost $7.95 at one store. I can get five bottles for $4.15 at a second store. Where is the juice cheaper - at the first or second store?	**A** First store **B** Second store Tell how you decided: _____ _____ _____

Effect of Operations -Decimals

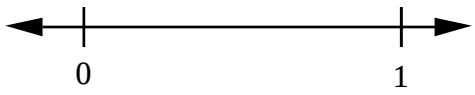
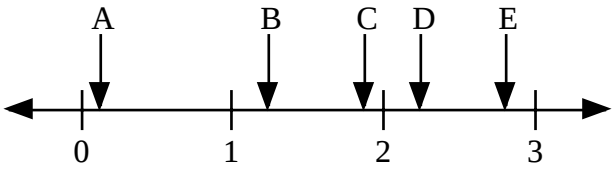
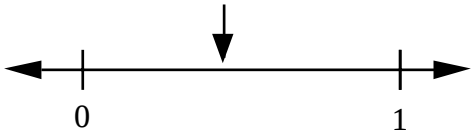
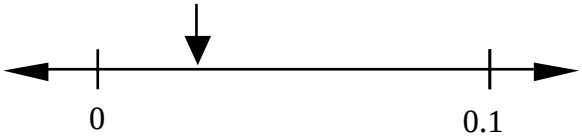
69	*Without calculating the exact answer* circle the best estimate for: 29 x 0.98	**A** more than 29 **B** less than 29 **C** impossible to tell without working it out
70	Which is the greatest number?	**A** 29 + 0.8 **B** 29 x 0.8 **C** 29 ÷ 0.8 **D** 29 - 0.8
71	*Without calculating the exact answer*, circle the best estimate for: 87 x 0.09	**A** a lot less than 87 **B** a little less than 87 **C** a little more than 87 **D** a lot more than 87
72	Only one of the answers is correct. *Without calculating*, decide which one it is, and circle it.	**A** 45 x 1.05 = 39.65 **B** 4.5 x 6.5 = 292.5 **C** 87 x 1.076 = 93.61 **D** 585 x 0.95 = 595.45
73	*Without calculating the exact answer*, circle the best estimate for: 54 ÷ 0.09	**A** a lot less than 54 **B** a little less than 54 **C** a little more than 54 **D** a lot more than 54
74	*Without calculating the exact answer*, circle the best estimate for: 29 ÷ 0.8	**A** less than 29 **B** equal to 29 **C** greater than 29 **D** impossible to tell without calculating

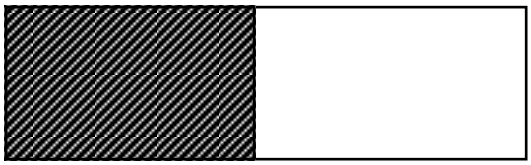
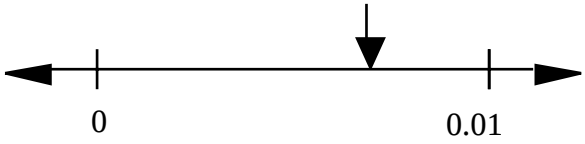
75	Mary had \$426 and spent 0.9 of it on clothes. *Without calculating the exact answer,* circle the best estimate for how much she *spent.*	**A**	slightly less than \$426
		B	much less than \$426
		C	slightly more than \$426
		D	impossible to tell without calculating

Equivalent Expressions - Decimals & Mixed

76	0.5 x 840 is the same as	**A**	840 ÷ 2
		B	5 x 840
		C	5 x 8400
		D	840 ÷ 5
		E	0.50 x 84
77	Circle the number which can be put in *both* boxes to make the sentence true: 243 x ☐ = ☐ x 24.3	**A**	0
		B	0.1
		C	1
		D	10

Multiple Representations - Decimals and Mixed

78	Place the numbers 0.1 and 0.8 in their correct positions on this number line.	
79	 Which letter on the number line above best represents 2.19?	_____
80	*Estimate* the *decimal* shown by the arrow on the number line: 	_____
81	*Estimate* the *decimal* shown by the arrow on the number line: 	_____

82	Circle the decimal which best represents the amount of the box shaded. 	**A** 0.018 **B** 0.15 **C** 0.4 **D** 0.801 **E** 0.52
83	Circle the decimal which best represents the amount of the box shaded. 	**A** 0.018 **B** 0.15 **C** 0.45 **D** 0.801 **E** 0.52
84	 *Estimate* the decimal shown by the arrow on the number line:	_____
85	Put these numbers in order, starting with the smallest on the top row. 0.595 $\frac{3}{5}$ 61% 0.3 30.5%	_____ _____ _____ _____ _____

Number Concepts - Decimals

86	For a long time Jane has been putting only 10 cent coins in her piggy bank. Last night she opened it and counted her money. She had $46.70. How many 10 cent coins were in the bank?	_____
87	Scott ran 100 metres in 14.52 seconds. Kelly took 2 tenths of a second longer. How long did it take Kelly to run 100 metres?	**A** 34.52 seconds **B** 16.52 seconds **C** 14.72 seconds **D** 14.54 seconds **E** 14.50 seconds
88	How many different decimals are there between 1.52 and 1.53? Circle your answer and, if there is a blank, fill it in.	**A** None. **B** One. What is it? _____ **C** A few. Give two: _____ and _____ **D** Lots. Give two: _____ and _____

Counting and Computation - Percentages

89	A student increased his exam score from 40 to 50. What percentage increase is this?	**A** 10% **B** 25% **C** 50% **D** 90%
90	Last week a diary cost $4.50. This week there is 10% off the cost of all diaries. What is the cost of the diary this week?	_____

The Effect of Operations Percentages

91	Mary had $426 and spent 90% of the money on clothes. *Without calculating an exact answer,* circle the best estimate for how much she spent.	**A** slightly less than $426 **B** much less than $426 **C** slightly more than $426 **D** impossible to tell without calculating
92	A tank holds 1000 fish. If I increase the number by 50%, how many fish will there be now in the tank?	**A** 500 **B** 1050 **C** 1500 **D** 2000
93	Dale had $150. She spent 100% of it. How much money did she have left?	**A** $0 **B** $50 **C** $100 **D** $150 **E** $250 **F** $300

Answers

≈ means approximately equal to.
Answers are in plain type.
Explanations are in Italics.

1 B.

2 E.

3 B.

4 $16

5 B. *9 x 365 ≈10 x 300 = 3000*

6 A. *145 x 4 ≈ 150 x 4 = 600 > 450*

7 B. *21 x 19 ≈ 20 x 20 = 400 ≈399*

8 4 and 18. *4 x 18 = 72*

9 18 and 50. *18 x 50 ≈ 20 x 50 = 1000*

10 1340. *124 620 ÷ 930 = 134. So 124620 ÷ 93 is ten times larger.*

11 D. *The cat eats 300 grams in two days .So it eats 900 grams in six days.*

12 96 km/h. *Outward trip is 6 x 80 = 480 km. So the total distance is 2 x 480 = 960 km.*
Total time = 10 hours.
So average = 960 ÷ 10 = 96 km/h.

13 First box has 9 and second box has 7.

14 First box has 0 and second box has 5.

15 B.

16 E. *Smallest possible answer is 100 + 100 = 200 which has 3 digits, and the largest is 999 + 999 = 1998 which has 4 digits.*

17 C. *Smallest possible answer is 10 x 10 = 100 which has 3 digits, and the largest is 99 x 99 which has 4 digits.*

18 A.

19 B. *45 x 105 is a bit more than 45 x 100 = 4500 ≈ 4600.*

20 C.

21 D.

22 C. *80 lots of 40 = 40 lots of 80.*

23 C.

24 B. *145 x 4 = 4 x 145 = 145 + 145 + 145 + 145 < 144 + 146 + 148 + 150.*

25 C. *Any number times zero is zero.*

26 C.

27 12 555.

28 =. *Division by eight is the same as multiplying by an eighth.*

29 B.

30 D. *3 x 98 = 3 x 100 − 3 x 2.*

31 A ≈ 100, B ≈ 450 and C ≈ 700.

32 12356

33 21 356.

34

35 403

36 6092

37 37

38 12. *Each third is 4 apples. There are 3 thirds originally. So 3 x 4 = 12.*

39 D.

40 E.

41 $\frac{4}{9}$

42 D. $\frac{4}{7}$ *is over* $\frac{1}{2}$ *. So* $\frac{4}{7} + \frac{1}{2} > \frac{1}{2} + \frac{1}{2} = 1$

43 C. $\frac{1}{2} = \frac{3}{6}$ *. And multiplying by 1 leaves any number unchanged.*

44 B.

45 G.

46 >. $5 \times 7\frac{1}{2} = 5 \times 7 + 5 \times \frac{1}{2}$
$= 35 + 2\frac{1}{2}$
$> 35 + \frac{1}{2}$

47 About $\frac{1}{3}$.

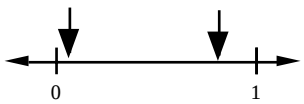
48

49 D.

50 A

51

52



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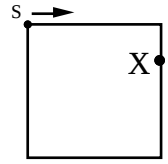


54 C and D true.

55 D.

56 E.

57

58 $\frac{1}{2}$

59 10

60 There are infinitely many answers.
Examples: $\frac{2}{3}$ and $\frac{4}{5}$

61 A.

62 $\frac{9}{12}$

63 D. (Infinite number actually.)
Examples: $\frac{1}{2}$ and $\frac{9}{20}$.

64 $\frac{17}{8}$ or $\frac{18}{8}$ or $\frac{19}{8}$ or $\frac{20}{8}$ or $\frac{21}{8}$ or $\frac{22}{8}$ or $\frac{23}{8}$

65 There are infinitely many answers. In all cases denominator > 10 x numerator.

66 $\frac{4}{5}$

67 There are infinitely many answers. In all cases
Denominator > 2 x numerator. *And*
Denominator < 4 x numerator

68 A. T*en bottles at second store costs 2* x *$4.15 = $8.30 > $7.95*

69 B. *0.98 is just a little less than 1. Multiplying by a number just under 1 reduces the number a little.*

70 C. *Dividing by a number just less than 1 increases the answer a little.*

71 A. *9 hundredths times 87 is a lot less than 87.*

72 C. *87 x 1.076 is a number just over 87.*

73 D. *0.09 is a small number. Dividing by a small number creates much larger numbers.*

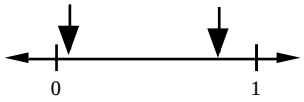
74 C.

75 A.

76 A. *0.5* x *840 = half of 840 = 840 ÷ 2.*

77 A.

78



79 D.

80 Somewhere between 0.4 and 0.5
Example: 0.45

81 About 0.02 up to 0.03
Example: 0.024

82 B.

83 C.

84 About 0.007

85 0.3 then 30.5% then 0.595 then $\frac{3}{5}$ then 61%.

86 467.

87 C.

88 D. There are infinitely many answers.
Example: 1.52345

89 B. *Increase = 10 marks. Fraction increase* $= \frac{10}{40} = 0.25 = 25\%$.

90 $4.05.
90% of $4.50 = 0.90 x *$4.50 = $4.05*

91 A.

92 C.

93 A.