N4 EXPRESSIONS & FORMULAE 1.3

This resource is to support pupils in passing the appropriate National 4 Assessment Standard. The questions and marking schemes used are from SQA past papers and as such test the topics in their entirety from grade A to C and *may* include other areas from the course. In addition the questions from **Paper 1** (P1) should be completed **without** the use of a calculator and questions from **Paper 2** (P2) permit the use of a calculator.

Each Assessment Standard is used to ensure pupils have the minimum competency on the specified sub-skills for the National 4 course. As such each Assessment Standard will test grade C work on that specific topic.

This resource is divided into two sections:

- Section A has an example on each sub skill for the relevant Assessment Standard and the marking scheme for these questions
- Section B has extra practice questions on this Assessment Standard and the marking scheme for these questions

Unit Assessment Standard	Sub skills	Section A – Question Number
Expressions & Formulae 1.3 Applying statistical skills to representing and analysing data and to probability	The sub-skills are: constructing a frequency table with class intervals from raw data	Q1
	determining statistics of a data set	Q2
	interpreting calculated statistics	Q3
	representing raw data in a pie chart	Q4
	using probability	Q5

FORMULAE LIST

Circumference of a circle: $C = \pi d$

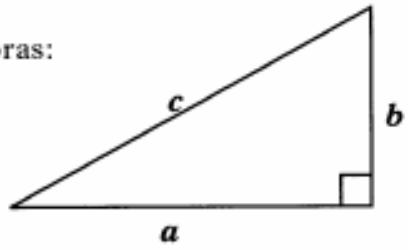
Area of a circle: $A = \pi r^2$

Curved surface area of a cylinder: $A = 2\pi rh$

Volume of a cylinder: $V = \pi r^2 h$

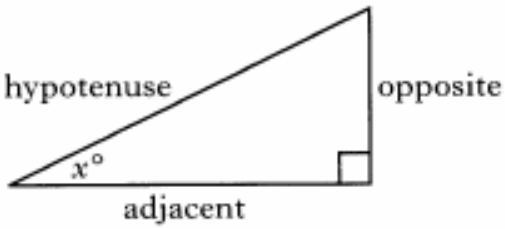
Volume of a triangular prism: $V = Ah$

Theorem of Pythagoras:



$$a^2 + b^2 = c^2$$

Trigonometric ratios in a right angled triangle:

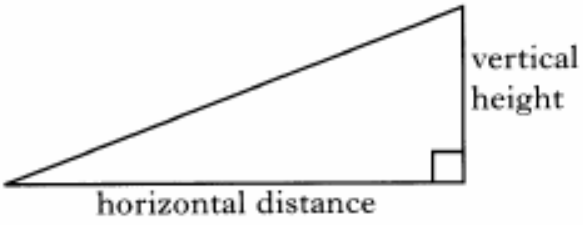


$$\tan x^\circ = \frac{\text{opposite}}{\text{adjacent}}$$

$$\sin x^\circ = \frac{\text{opposite}}{\text{hypotenuse}}$$

$$\cos x^\circ = \frac{\text{adjacent}}{\text{hypotenuse}}$$

Gradient:



$$\text{Gradient} = \frac{\text{vertical height}}{\text{horizontal distance}}$$

Section A

Q		Marks
Q1	Tom measured the heights of pupils in his year at Primary. The results are in centimetres: 112 138 132 122 127 133 129 130 119 121 135 132 114 124 139 132 117 113 119 120 127 132 128 131 a) Display Tom's results in an appropriate frequency table. b) What is the modal class interval of height in Tom's Year?	**2** **1**
Q2 P2	1. Ten people were asked to guess the number of coffee beans in a jar. Their guesses were: 310 260 198 250 275 300 245 225 310 200 (*a*) What is the range of this data? (*b*) Find the median.	 **1** **2**

Q3 P2

8. John and Steven are playing snooker. They play eight games.
Shown below are the number of points John scored in each game.

21 39 22 53 45 19 43 46

(*a*) Find the median. **2**

(*b*) Find the range. **1**

(*c*) The median number of points Steven scored is 23 and the range is 15. **2**

Make **two** comments comparing the number of points scored by Steven and John.

Q4 P2

Kirsty calculated how she spent her free time at the weekend: **3**

Watching TV	4 hours
Time with friends	7 hours
Homework	5 hours
Chores	2 hours

Construct a pie chart to illustrate how Kirsty spends her free time.

Q5 P2

2. There are 2 yellow, 3 red, 1 blue and 4 orange cubes in a bag.

(*a*) Jason takes a cube from the bag. **1**

What is the probability that it is orange?

(*b*) The cube is replaced in the bag and 3 white cubes are added to the bag.

What is the probability that the next cube taken from the bag is **not** red? **2**

Section A

MARKING SCHEME

Section A - Marking Scheme

Q1 — **Marks: 2**

- **1 mark for the correct intervals**
- **1 mark for the correct frequencies**

Height (cm)	Frequency
$110 < h \leq 115$	3
$115 < h \leq 120$	4
$120 < h \leq 125$	3
$125 < h \leq 130$	5
$130 < h \leq 135$	7
$135 < h \leq 140$	2
Total	24

OR

Height (cm)	Frequency
$110 \leq h < 115$	3
$115 \leq h < 120$	3
$120 \leq h < 125$	4
$125 \leq h < 130$	4
$130 \leq h < 135$	7
$135 \leq h < 140$	3
Total	24

Q2

Question No	Give 1 mark for each •	Illustrations of evidence for awarding each mark
1 (a)	**Ans: 112** •[1] correctly calculate range	•[1] 310 – 198 = 112 **1K**
(b)	**Ans: 255** •[1] correctly order list •[2] correctly add middle two numbers in list and half	•[1] 198, 200, 225, 245, 250, 260, 275, 300, 310, 310 •[2] 255 **2K**

NOTES:

In part (b)

(i) 255 can be **incorrectly** obtained from adding 310 & 200 and halving

(ii)

Final answers	**with working**	**without working**
255	2/2	0/2

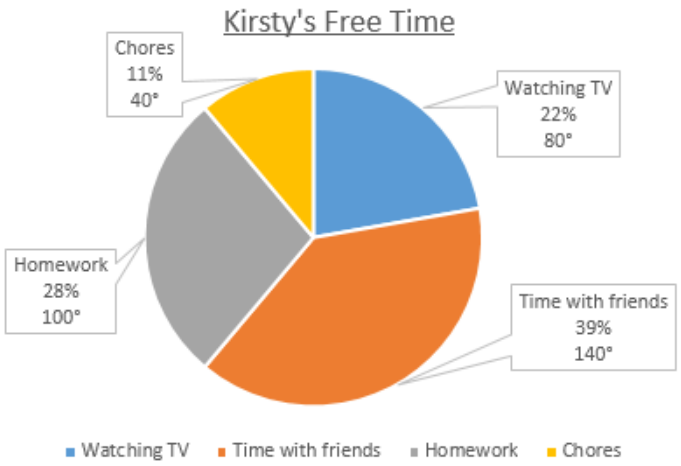
Q3

Question			Expected Answer/s	Max Mark	Additional Guidance	
8	a		**Ans: 41** •1 order numbers: 19 21 22 39 43 45 46 53 •2 find median: 41	2	1. Correct answer without working award 2/2 2. 49 [numbers not ordered] award 1/2 3. If 'correct' median is found from ordered list with one missing or one extra number award 1/2	2
8	b		**Ans: 34** •1 find range: 53 − 19 = 34	1	1. 34 is the **only** acceptable answer, even with an unordered list.	1
8	c		**Ans: On average Steven scored less than John. Steven's scores varied less than John's.** •1 interpret statistics: Steven scored less or equivalent •2 interpret statistics: Steven's scores varied less or equivalent	2	1. Answer must be consistent with answers to parts (a) and (b) 2. Do not accept eg Steven has a lower median Steven has a lower range 3. A common answer: John scored more than Steven as his median and range were higher. award 1/2 ✓×	2

Q4

Activity	Time	Angle
Watching TV	4 hours	80°
Time with friends	7 hours	140°
Homework	5 hours	100°
Chores	2 hours	40°

- 1 mark for the correct angles
- 1 mark for sections drawn correctly
- 1 mark labelled diagram



3

Q5

Question No	Give 1 mark for each •	Illustrations of evidence for awarding each mark
2 (a)	**Ans: 4/10 or equivalent** •1 correct probability	•1 4/10 or equivalent **1K**
(b)	**Ans: 10/13 or equivalent** •1 correct new total of cubes •2 correct probability	•1 10 + 3 = 13 •2 10/13 or equivalent **2R**

NOTES:

In parts (a) and (b)

(i) Accept variations in language e.g. 4:10; 4 out of 10; 4 to 10

In part (b)

(i) For a final answer of 10/13 without working — award 2/2

(ii) For an answer of 9/12 (where cube is not replaced) — award 1/2

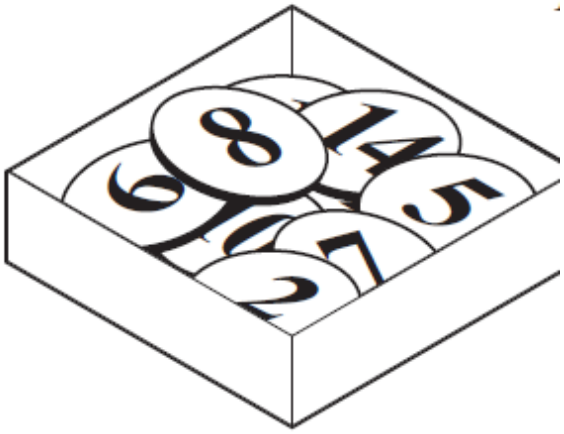
(iii) For an answer of 3/4 without working — award 0/2

1

2

Section B

Section B – Paper 1 – Questions

Q		Marks
1	2. A box contains counters numbered from 1 to 14. A counter is chosen at random.  What is the probability that this counter has a number greater than 9?	2
2	8. Each pupil in a science class is growing a plant. A few weeks later the height of each plant is measured. The heights in centimetres are shown below.  6·3 5·4 5·8 7·0 6·2 7·6 8·3 8·4 5·3 8·8 8·5 5·6 6·8 6·5 6·1 6·7 7·4 7·6 5·3 (*a*) Display these results in an ordered stem and leaf diagram. (*b*) Find the median height.	3 1

3 8. Four girls and two boys decide to organise a tennis tournament for themselves.

Each name is written on a plastic token and put in a bag.

(*a*) What is the probability that the first token drawn from the bag has a girl's name on it? **1**

(*b*) The first token drawn from the bag has a girl's name on it.

This token is **not** returned to the bag.

What is the probability that the next token drawn from the bag has a boy's name on it? **2**

4 6. Fifty students completed a fitness test known as a "Beep Test".

The fitness levels they achieved are shown in the frequency table below.

Fitness Level	Number of Students	Fitness Level × Number of Students
5	4	20
6	5	30
7	9	63
8	21	
9	6	
10	5	
	Total = 50	Total =

(*a*) Complete the table above. **1**

(*b*) Find the mean fitness level achieved by these students. **2**

5	**7.** A bag contains 8 blue marbles, 5 red marbles and 2 yellow marbles. (*a*) A marble is taken from the bag. What is the probability that the marble is yellow? 1 (*b*) This marble is put back in the bag. One red marble and one blue marble are then removed. What is the probability that the next marble taken from the bag is blue?	**1** **2**
6	**2.** A college class consists of 8 male and 12 female students. A student is chosen at random from the class. What is the probability that the student is male? Give your answer as a fraction in its simplest form.	**2**

7 6. Two hundred teenagers were asked how many songs they had downloaded during the previous week.

The frequency table below shows their responses.

Number of Songs	Frequency
5	38
6	72
7	53
8	30
9	7
	Total = 200

(*a*) Write down the modal number of songs downloaded. **1**

(*b*) Find the range of the number of songs downloaded. **1**

6. (continued)

(*c*) Complete the table below **and** find the mean number of songs downloaded.

Number of Songs	Frequency	Number of Songs × Frequency
5	38	190
6	72	432
7	53	371
8	30	
9	7	
	Total = 200	Total =

3

8 8. Thirty students were given homework.

The frequency table shows the length of time each student spent on the homework.

Time (minutes)	Frequency
5	1
10	6
15	11
20	7
25	5
	Total = 30

(*a*) Write down the modal time spent on the homework. **1**

(*b*) What is the probability that a student, picked at random, spent 20 minutes on the homework? **1**

(*c*) Complete the table below **and** find the mean time spent on the homework.

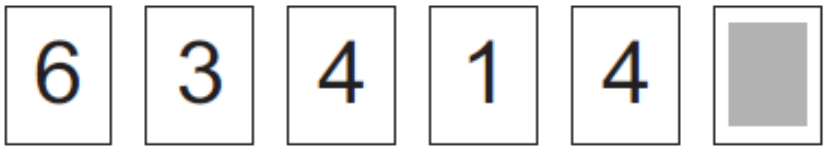
Time (minutes)	Frequency	Time × Frequency
5	1	5
10	6	60
15	11	165
20	7	
25	5	
	Total = 30	Total =

3

9

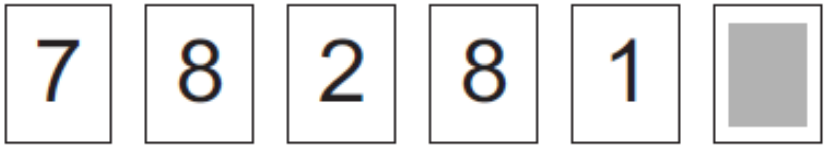
10. Each card in a pile has a number printed on it.

(*a*) Seonaid selects these six cards from the pile.
The number on the last card is hidden.



The range of the numbers on the **six** cards is 8.
Find the hidden number. **1**

(*b*) Kirsty selects these six cards from the pile.
The number on the last card is hidden.



The mean of the numbers on the **six** cards is 5.
Find the hidden number. **2**

Section B – Paper 2 – Questions

Q		Marks
10	10. At the World Athletic Championships the mean time for the first semi-final of the 100 metres was 9·98 seconds.  For the second semi-final the times, in seconds, were: 10·21 10·04 9·92 9·98 10·04 9·94 9·9 9·73. Was the mean time for the second semi-final better than the mean time for the first semi-final? Give a reason for your answer.	4

11

13. Helen has recorded the scores for her last eighteen games of golf.
Her scores are shown below.

4

Score	*Frequency*	*Score × Frequency*
69	3	
70	2	
71	4	
72	4	
73	2	
74	1	
75	2	
	Total = 18	Total =

Complete the above table and find Helen's **mean** score per game.
Round your answer to 1 decimal place.

12

7. Last week Theresa asked 76 students to record how many hours they spent doing homework.

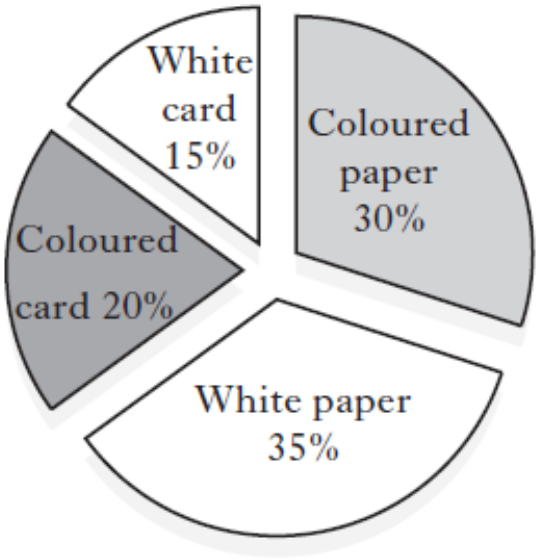
The results are shown below.

Homework hours	*Frequency*	*Homework hours × frequency*
1	16	
2	12	
3	18	
4	11	
5	8	
6	6	
7	5	
	Total = 76	Total =

Complete the above table and find the **mean** time spent on homework last week.

Round your answer to 1 decimal place.

4

13	**10.** The school's ECO group is collecting card and paper for recycling. The percentage of each type of card and paper collected is shown in the pie chart. The weight of white card collected is 90 kilograms. Calculate the total weight of card and paper collected.  	**3**

Section B

MARKING SCHEME

Section B – Paper 1 – Marking Scheme

Q		Marks
1		2
2		3
		1

1

2			**Ans: 5/14** •1 correct number of choices •2 correct probability statement	2 **(KU)**	 •1 5 •2 5/14

Notes:

(i) Accept variations in language e.g. 5:14; 5 out of 14; 5 to 14

(ii) Where 5 is used incorrectly in a probability statement – award 1/2

2

8	(a)	**Ans: DIAGRAM REQ'D** •1 stem correct •2 all leaves on correct level •3 leaves ordered correctly	 •1 •2 •3 **3K**
	(b)	**Ans: 6·7 (cm)** •1 median correctly identified	 •1 6·7 (cm) **1K**

3

8	**(a)**	**Ans:** $\frac{2}{3}$ $\bullet^1$ Correctly finds probability (girl)	$\bullet^1$ $\frac{2}{3}$ or equivalent **1K**	**1**
	(b)	**Ans:** $\frac{2}{5}$ $\bullet^1$ Correct denominator $\bullet^2$ Correct numerator in a probability statement	$\bullet^1$ 5 $\bullet^2$ $\frac{2}{5}$ **2R**	**2**

Notes:

In parts (a) and (b)

(i) Accept variations in language e.g. 2:3; 2 out of 3; 2 to 3

In part (b)

(i) For a final answer of $\frac{2}{5}$ without working – award 2/2

(ii) For an answer of 2:3 (following an incorrect 4:2 in part (a)) – award 2/2

4

Question			Expected Answer/s	Max Mark	Additional Guidance	
6	a		**Ans: 168** **54** **50** **385** •[1] complete table 168 54 50 385	1		1
6	b		**Ans: 7·7** •[1] know to divide $\sum fx$ by 50: $385 \div 50$ •[2] correctly divide $\sum fx$ by 50: $385 \div 50 = 7{\cdot}7$	2	1. Correct answer without working subsequent to part (a) award 2/2 2. 1st mark may only be awarded for attempting $\sum fx \div 50$ 3. Award 0/2 for e.g. $385 \div 6 = 64$ or 64·2 or 64·1(6…) 4. Accept $\sum fx \div 10 \times 5$ or $\sum fx \div 5 \times 10$ as evidence of **knowing** to divide $\sum fx$ by 50 5. For $385 \div 5 = 77$ award 0/2	2

5

7	a		**Ans: $^{2}/_{15}$** •[1] find probability: $^{2}/_{15}$	1	1. Accept 2:15, 2 out of 15, 2 in 15, 2-15, 0·13(3…), 13(·3….)%	1
7	b		**Ans: $^{7}/_{13}$** •[1] correct numerator or denominator: $^{7}/$ or $/_{13}$ •[2] find probability: $^{7}/_{13}$	2	1. Correct answer without working award 2/2 2. Accept 7:13, 7 out of 13, 7 in 13, 7-13, 0·53(8…), 0·54, 53(·8….)%, 54% 3. For (a) = $^{15}/_{2}$ followed by (b) = $^{13}/_{7}$ award 0/1 for (a) and 2/2 for (b)	2

6									**2**
	2			**Ans:** $^{2}/_{5}$ •^{1} find probability: $^{8}/_{20}$ •^{2} simplify fraction: $^{2}/_{5}$	**2**	1. Correct answer without working award 2/2 2. 2/3, 3/5 (no working necessary) award 1/2 ×✓ 3. Final answer must be a fraction 8:20, 2:5, 8 out of 20, 2 out of 5, 8 in 20, 2 in 5, 8-20, 2-5, 0·4, 40% award 1/2 ✓×			

7

Question			Expected Answer/s	Max Mark	Additional Guidance	
6	a		Ans: 6 •[1] find mode: 6	1		1
6	b		Ans: 4 •[1] find range: 9 – 5 = 4	1		1
6	c		Ans: 6·48 •[1] complete table: 240 63 1296 •[2] know to divide Σfx by 200: 1296 ÷ 200 •[3] correctly divide Σfx by 200: = 6·48	3	1. Award of 1st mark: 240, 63 and 1296 need not appear in table but must be shown in working 2. 2nd mark may only be awarded for attempting Σfx ÷ 200 3. Answer / With evidence for 1st mark / Without evidence for 1st mark 6·48 / 3/3✓✓✓ / 2/3 ×✓✓ 259·2 [1296 ÷ 5] / 1/3 ✓×× / 0/3 4. Disregard subsequent rounding after a division e.g. (a) 1296 ÷ 200 = 6·48 = 6·5 award 3/3 (b) 1296 ÷ 200 = 6·5 award 2/3 ✓✓× 5. Accept Σfx ÷ 100 × 2 as evidence of **knowing** to divide Σfx by 200	3

8

8	a		**Ans: 15 minutes** •[1] find mode: 15	**1**	1. For an answer of 15 (a) without working, award 1/1 (b) with evidence of an incorrect method , award 0/1 eg 5, 10, 15, 20, 25 [median] 75 ÷ 5 = 15 ["mean"]	**1**
8	b		**Ans:** $^{7}/_{30}$ •[1] find probability: $^{7}/_{30}$	**1**	1. Accept 7:30, 7 out of 30, 7 in 30, 7-30, 0·23(3…), 23(·3…)%	**1**
8	c		**Ans: 16·5** •[1] complete table: 140 125 495 •[2] know to divide Σfx by 30: 495 ÷ 30 •[3] correctly divide Σfx by 30: = 16·5	**3**	1. Award of 1st mark: 140, 125 and 495 need not appear in table but must be shown in working 2. 2nd mark may only be awarded for attempting ∑fx ÷ 30 3. <u>Answer</u> <u>With evidence for 1st mark</u> <u>Without evidence for 1st mark</u> 16·5 3/3✓✓✓ 2/3 ×✓✓ 99 [495 ÷ 5] 1/3 ✓×× 0/3 495 ÷ 3 × 10 [= 1650] 2/3 ✓✓× 1/3 ✓××	**3**

9	**10**	**a**		**Ans: 9 or -2** •[1] find hidden number: 9 or -2	**1**	1. Answer may appear on hidden card	**1**
	10	**b**		**Ans: 4** •[1] know that total = mean × 6: 5×6 •[2] find hidden number: $30 - (7 + 8 + 2 + 8 + 1) = 4$	**2**	1. 4 without working award 2/2 2. (a) $26 \div 6 = 4(\cdot\ldots) = 4$ award 0/2 (b) $26 \div 5 = 5(\cdot\ldots)$ then an answer of 4 award 2/2 3. Alternative strategy: •[1] two trials where second is better than first: •[2] find hidden number: 4 4. Answer may appear on hidden card	**2**

Section B – Paper 2 – Marking Scheme

Q		Marks
10		4

10	Ans: **Yes, the mean time of the 2nd semi-final was 0·01s less than the 1st**	
	•1 correct addition of 2nd semi-final times	•1 (10·21 + 10·04 + 9.92 + ...) = 79·76
	•2 knowing to divide answer to above by 8	•2 (79·76) ÷ 8
	•3 correct division	•3 9·97
	•4 correct response and reason	•4 Yes, the mean time of the 2nd semi-final was 0·01s less than the 1st **4R**

NOTES:

(i) The reason must include 0·01, 9·97 or 9·98 and comparative language. Eg the second semi-final was 9·97s which is quicker.

(ii) For the final mark a numerical comparison between mean and mode or mean and median may be acceptable.

11

Question No	Give 1 mark for each •	Illustrations of evidence for awarding each mark
13	**Ans: 71·6**	
	•1 completes Score × Freq column	•1
	•2 correct total of Score × Freq column	•2
	•3 correct division of above answer by 18	•3 Mean = 1289 ÷18 = 71·61
	•4 correct rounding	•4 71·6 **4K**

Frequency	Score x Frequency
3	207
2	140
4	284
4	288
2	146
1	74
2	150
Total	1289

NOTES:

(i) **Final answers** — **with working** — **without working**
71·6 — 4/4 — 3/4

(ii) For an answer of 184·1 the 3rd mark cannot be awarded.

4

12

7	**Ans: 3·3 (hrs)**	
	•1 calculate *fx*	•1 16, 24, 54, 44, 40, 36, 35
	•2 add *fx* column	•2 249
	•3 correctly divide answer to above by 76	•3 3·2763 ...
	•4 correct rounding	•4 3·3 (hrs) **4K**

4

13

10			**Ans: 600 (kg)**		**3**		
			•[1]	valid strategy		•[1]	15% = 90
			•[2]	correct use of valid strategy		•[2]	1% = 6 or equivalent
			•[3]	all calculations correct, must include a division		•[3]	(100% =) 600
					(RE)		

3

Notes:

(i) Alternative Strategy

- •[1] 15% = 90
- •[2] 100/15 = 6·66…
- •[3] 90 × 6·66… = 600

(ii)

Final Answers	with working	without working
600	3/3	2/3
257 (35% = 90)	2/3	0/3
300 (30% = 90)	2/3	0/3
450 (20% = 90)	2/3	0/3