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Reviewer: Dr Kinga Zaczek, Royal Holloway, University of London

Numeracy Reasoning
Practice Test 1 - Answers

Mark Scheme (1 mark for every correct answer)

Question Number	Correct Answer
1	A
2	E
3	C
4	E
5	C
6	D
7	E
8	B
9	A
10	A
11	C
12	D
13	C
14	A
15	E
16	A
17	B
18	D
19	A
20	E
21	E
22	C
23	B

Definitions and Formulae

Average (Mean)

To calculate the average of a set of data we must add up (sum) all of the data values and then divide the result by the number of values:

$$\text{average} = \text{sum of the data values} \div \text{number of values}$$

(Compound) growth/decay

To calculate the compound growth/decay the following formula is used:

$$N = N_0 \times (\text{multiplier})^n, \text{ where:}$$

N is the amount after n days/hours/years

N_0 is the initial amount

multiplier is the percentage change multiplier. Multiplier is obtained by adding (or subtracting) the percentage change value when there is an increase (or decrease) to (from) 100% and then changed into a decimal number.

n is the number of days/hours/years

Expressing one quantity as a percentage of another

To express one quantity (A) as a percentage of another (B), A should be divided by B and multiplied by 100, i.e. $\frac{A}{B} \times 100$.

Percentage change (increase or decrease)

To calculate a percentage change (increase or decrease) as a percentage, the following formula can be used: $\frac{\text{new number} - \text{original number}}{\text{original number}} \times 100$.

If the answer is negative then this is a percentage decrease, if positive then it is an increase.

Ratio

A ratio compares the amount of two items a and b and is written in the form a: b.

Guidance for Answering the Questions

Question 1

The number of new members needs to be added for each month:

February: $20 + 20 + 17 + 15 + 12 = 84$

March: $22 + 19 + 17 + 14 + 11 = 83$

April: $19 + 18 + 16 + 15 + 14 = 82$

May: $21 + 18 + 17 + 15 + 11 = 82$

June: $20 + 18 + 16 + 14 + 13 = 81$

February has the greatest number (84) of new members obtained.

The answer is A (84).

Question 2

If needed, please refer to the formula on expressing one quantity as a percentage of another on page 2.

The number of Super new members is 18.

The total number of new members in April is 82.

The percentage of new members in April that registered at Super is: $\frac{18}{82} \times 100 = 21.\dot{9}512\dot{1}\%$, this rounded to the nearest whole number is 22%.

The answer is E (22%).

Question 3

If needed, please refer to the formula on how to calculate the average of numbers on page 2.

Over 5 months there were $12 + 11 + 15 + 11 + 16 = 65$ new members.

The average number of Deluxe new members over the 5 month period is: $\frac{65}{5} = 13$.

The answer is C (13).

Question 4

If needed, please refer to the definition of ratio on page 2.

The number of Super new members in May is 21.

The number of Off Peak new members in May is 15.

The ratio of Super new members to Off Peak new members is $21:15$ which can be simplified to $7:5$ by dividing both numbers by 3.

The answer is E $(7:5)$.

Question 5

If needed, please refer to the definition and formula on how to calculate the percentage increase on page 2.

The number of Standard new members in February is 20.

The number of Standard new members in March is 22.

There is a $\frac{22-20}{20} \times 100 = 10\%$ percentage increase in Standard new members between February and March.

The answer is C (10%).

Question 6

The contribution value is calculated by multiplying the number of shares by the price per share. This is done for each company taking the price per share at 1st Jan:

Media: $8{,}000 \times 250p = £20{,}000$

Insurance: $6{,}500 \times 350p = £22{,}750$

Retail: $9{,}000 \times 440p = £39{,}600$

Energy: $13{,}500 \times 300p = £40{,}500$

Leisure: $20{,}000 \times 190p = £38{,}000$

The shares of Energy contribute the greatest values to the portfolio on the 1st January.

The answer is D (Energy).

Question 7

If needed, please refer to the definition and formula on how to calculate the percentage increase on page 2.

The price per share at 1st Jan and 31st Dec for each company is needed for the calculations. The percentage increases in the price per share for each company are as follows:

Media: $\frac{290-250}{250} \times 100 = 16\%$

Insurance: $\frac{380-350}{350} \times 100 = 8.6\%$

Retail: $\frac{510-440}{440} \times 100 = 15.9\%$

Energy: $\frac{355-300}{300} \times 100 = 18.3\%$

Leisure: $\frac{230-190}{190} \times 100 = 21.1\%$

Leisure produced the greatest percentage increase in the price per share over the year.

The answer is E (Leisure).

Question 8

Half the number of shares: $6{,}500 \div 2 = 3{,}250$.

Proceeds from half of the shares: $3{,}250 \times 402p = 130{,}6500p$.

The number of shares bought on the 31st December: $130{,}6500p \div 380p = 3{,}438.2 \approx 3{,}438$.

The total number of Insurance shares (held all year + bought on the 31st Dec): $3{,}250 + 3{,}438 = 6{,}688$.

The answer is B $(6{,}688)$.

Question 9

A fall of 10% in the price per share means that on the 1st May shares are worth 90% of their value on the 1st January: $90\%\ of\ 440p = 0.9 \times 440p = 396p$.

If needed, please refer to the definition and formula on how to calculate the percentage increase on page 2.

The price per share in Retail on the 1st May is $396p$.

The price per share in Retail on the 31st December is $510p$.

The percentage change between 1st May and 31st December in the price per share is:
$\frac{510-396}{396} \times 100 = 28.78\%$.

The answer is A (28.78%).

Question 10

If needed, please refer to the definition of ratio on page 2.

The number of shares held in Retail on the 1st January is $9{,}000$.

The number of shares held in Energy on the 1st January is $13{,}500$.

The ratio of the number of shares held in Retail and in Energy on the 1st January is:
$9{,}000: 13{,}500$ which simplified (both numbers divided by $4{,}500$) is the same as $2: 3$.

The answer is A $(2: 3)$.

Question 11

If needed, please refer to the definition and formula on how to calculate the percentage change on page 2.

The price per share of Leisure on the 1st January is $190p$.

The price per share of Leisure on the 31st December is $230p$.

The percentage change between 1st January and 31st December is $\frac{230-190}{190} \times 100 = 21\%$, which is also the annual percentage increase for the next two years.

The price per share increases each year and the next growth is calculated using the new price per share rather than the original value. There are two methods to finish answering this question:

Method 1

The price per share after 1 year (given in the question) is $230p$.

The price per share after 2 years: $230p + (21\%\ of\ 230p) = 230p + (0.21 \times 230p) = 278.179p$.

The price per share after 3 years: $278.179p + (21\%\ of\ 278.179p) = 278.179p + (0.21 \times 278.179p) = 336.59659p \approx 337p$.

Method 2

This method is much faster as it involves a single calculation.

If needed, please refer to the formula on how to calculate the (compound) growth/decay on page 2 and make the necessary substitutions.

The new, increased price per share: $N = N_0 \times (\text{multiplier})^n = 190p \times (1.21)^3 = 336.6p \approx 337p$ (by substituting $N_0 = 190p$, $\text{multiplier} = 1.21$, $n = 3$).

The answer is C (337).

Question 12

The profit for Team 1 in Year 1 is £35,000.

The profit for Team 1 in Year 2 is £45,000.

The profit for Team 1 in Year 3 is £55,000.

The profit for Team 1 in Year 4 is £60,000.

The total profit for Team 1 for the period Year 1 to Year 4 is: $£35{,}000 + £45{,}000 + £55{,}000 + £60{,}000 = £195{,}000$.

The answer is D $(£195{,}000)$.

Question 13

The difference between Team 1 and Team 2 profits in Year 1 is: $£45,000 - £35,000 = £10,000$.

The difference between Team 1 and Team 2 profits in Year 2 is: $£45,000 - £40,000 = £5,000$.

The difference between Team 1 and Team 2 profits in Year 3 is: $£55,000 - £40,000 = £15,000$.

The difference between Team 1 and Team 2 profits in Year 4 is: $£60,000 - £55,000 = £5,000$.

The difference between Team 1 and Team 2 profits in Year 5 is: $£50,000 - £45,000 = £5,000$.

The greatest difference between the profits of Team 1 and Team 2 is £15,000 (in Year 3).

The answer is C ($£15,000$).

Question 14

If needed, please refer to the formula on how to calculate the average of numbers on page 2.

The sum of the profits for Team 2 over the five year period is: $£45,000 + £40,000 + £40,000 + £55,000 + £50,000 = £230,000$.

The average of the profits for Team 2 over the five year period is $£230,000 \div 5 = £46,000$.

The answer is A ($£46,000$).

Question 15

If needed, please refer to the definition of ratio on page 2.

The profit of Team 1 in Year 2 is $£45,000$.

The profit of Team 2 in Year 4 is $£55,000$.

The ratio of profits between Team 1 in Year 2 and Team 2 in Year 4 is $45,000 : 55,000$. This can be simplified to $9 : 11$ by dividing both numbers by $5,000$.

The answer is E ($9 : 11$).

Question 16

If needed, please refer to the definition and formula on how to calculate the percentage increase on page 2.

The total profit in Year 2 is $£45,000 + £40,000 = £85,000$.

The total profit in Year 3 is $£55,000 + £40,000 = £95,000$.

The percentage increase in total profits between Year 2 and Year 3 is $\frac{95,000-85,000}{85,000} \times 100 = 11.8\%$ (rounded to 1 d.p.).

The answer is A (11.8%).

Question 17

If needed, please refer to the formula on expressing one quantity as a percentage of another on page 2.

Profit for Team 2 for each year as well as total profit for each year are needed for calculations. The percentage contributions made by Team 2 to the profit of that year are as follows:

Year 1: $\frac{£45,000}{£35,000+£45,000} \times 100 = 56.25\%$

Year 2: $\frac{£40,000}{£45,000+£40,000} \times 100 = 47.1\%$

Year 3: $\frac{£40,000}{£55,000+£40,000} \times 100 = 42.1\%$

Year 4: $\frac{£55,000}{£60,000+£55,000} \times 100 = 47.8\%$

Year 5: $\frac{£50,000}{£45,000+£50,000} \times 100 = 52.6\%$

The smallest percentage contribution made by Team 2 to the profit of that year is 42.1% in Year 3.

The answer is B (42.1%).

Note

Not all percentage contributions have to be calculated. By comparing the profits made by both teams for each year, one can see that in Year 2, 3, and 4, Team 2 contributed less than 50% (bar representing Team 2 is shorter than the one of Team 1). Moreover, in Year 3 the difference between the profits is the biggest. Therefore, only the percentage contribution made by Team 2 in Year 3 to the profit of that year could be calculated.

Question 18

This is a two stage question.

The first stage is to calculate the total profit (sum of the profits of Team 1 and Team 2) in Year 6.

If needed, please refer to the formula on how to calculate the (compound) growth/decay on page 2 and make the following substitutions:

N is what needs to be found (total profit in Year 6 = sum of profits for Team 1 and 2 in Year 6).

N_0 are £$45,000$ for Team 1 in Year 5 and £$50,000$ for Team 2 in Year 5.

$multipliers$ are 1.04 for Team 1 in Year 5 (because of the 4% increase) and 0.96 for Team 2 in Year 5 (because of the 4% decrease).

n is 1 for both teams.

The total forecasted profit in Year 6 is: $N = £45{,}000 \times (1.04)^1 + £50{,}000 \times (0.96)^1 = £46{,}800 + £48{,}000 = £94{,}800$

The second stage is to calculate the percentage increase in profits from Year 5 to Year 6.

If needed, please refer to the definition and formula on how to calculate the percentage increase on page 2.

The total profit in Year 5 is $£95{,}000$.

The total (forecasted) profit in Year 6 is $£94{,}800$.

The percentage change in total profits between Year 5 and Year 6 is $\frac{94{,}800-95{,}000}{95{,}000} \times 100 = -0.21\%$ (rounded to 2 d.p.).

The answer is D (-0.21%).

Question 19

The question of finding the highest rate of pay per hour suggests the calculation that should be performed, i.e. pay should be divided by hours. Gross pay should be used as it is not affected by deductions.

Important information necessary in answering this question is: 'any hours worked in excess of 35 are paid at "time and a half"'.

Firstly, for each person separately, any hours in excess of 35 need to be adjusted as they are paid at time and a half, and then the pay rate should be calculated:

Azhda

Hours $= 23$

Gross Pay $= £300$

Rate of pay $= £300 \div 23 = £13.04$ per hour

Bathusha

Hours $= 35 + 2 \times 1.5 = 35 + 3 = 38$

Gross Pay $= £400$

Rate of pay $= £400 \div 38 = £10.53$ per hour

Chris

Hours $= 35 + 5 \times 1.5 = 35 + 7.5 = 42.5$

Gross Pay $= £500$

Rate of pay $= £500 \div 42.5 = £11.76$ per hour

Dean

Hours $= 35 + 7 \times 1.5 = 35 + 10.5 = 45.5$

Gross Pay $= £520$

Rate of pay $= £520 \div 45.5 = £11.43$ per hour

Emily

Hours $= 33$

Gross Pay $= £380$

Rate of pay $= £380 \div 33 = £11.52$ per hour

Azhda is paid the highest rate of pay per hour.

The answer is A (Azhda).

Question 20

If needed, please refer to the formula on expressing one quantity as a percentage of another on page 2.

The values of Deductions and Gross Pay are needed for calculations. The percentage of deductions from gross pay for each employee are as follows:

Azhda: $\frac{£70}{£300} \times 100 = 23.3\%$

Bathusha: $\frac{£90}{£400} \times 100 = 22.5\%$

Chris: $\frac{£110}{£500} \times 100 = 22.0\%$

Dean: $\frac{£120}{£520} \times 100 = 23.1\%$

Emily: $\frac{£80}{£380} \times 100 = 21.1\%$

Emily had the smallest percentage deduction from gross pay.

The answer is E (Emily).

Question 21

If needed, please refer to the formula on expressing one quantity as a percentage of another on page 2.

The percentage of Net Pay to the Gross Pay for each employee are as follows:

Azhda: $\frac{£230}{£300} \times 100 = 76.7\%$

Bathusha: $\frac{£310}{£400} \times 100 = 77.5\%$

Chris: $\frac{£390}{£500} \times 100 = 78.0\%$

Dean: $\frac{£400}{£520} \times 100 = 76.9\%$

Emily: $\frac{£300}{£380} \times 100 = 78.9\%$

For all five employees Net Pay is less than 80% of their Gross Pay.

The answer is E (5).

Question 22

The total gross pay is $£300 + £400 + £500 + £520 + £380 = £2{,}100$.

The total deductions are $£70 + £90 + £110 + £120 + £80 = £470$.

The total net pay is $£230 + £310 + £390 + £400 + £380 = £1{,}630$.

If needed, please refer to the formula on how to calculate the (compound) growth/decay on page 2 and make the necessary substitutions.

The new, increased gross pay is $N = N_0 \times (\text{multiplier})^n = £2{,}100 \times (1.015)^1 = £2{,}131.5$ (by substituting $N_0 = £2100$, $\text{multiplier} = 1.015$, $n = 1$).

The new, increased, deductions are $N = N_0 \times (\text{multiplier})^n = £470 \times (1.02)^1 = £479.4$ (by substituting $N_0 = £470$, $\text{multiplier} = 1.02$, $n = 1$).

The new total Net Pay is $£2{,}131.5 - £479.4 = £1{,}652.1$.

If needed, please refer to the definition and formula on how to calculate the percentage change on page 2.

The old total Net Pay is $£1{,}630$.

The new total Net Pay is $£1{,}652.1$.

The percentage change in total net pays is $\frac{£1{,}652.1 - £1{,}630}{£1{,}630} \times 100 = 1.36\%$ (rounded to 2 d.p.).

The answer is C (1.36%).

Question 23

Azhda (Grade I worker) did not work any overtime.

Bathusha (Grade II worker) worked $37 - 35 = 2$ hours of overtime.

Chris (Grade I worker) worked $40 - 35 = 5$ hours of overtime.

Dean (Grade II worker) worked $42 - 35 = 7$ hours of overtime.

Emily (Grade I worker) worked no overtime.

If needed, please refer to the formula on expressing one quantity as a percentage of another on page 2.

The total number of overtime hours worked is $2 + 5 + 7 = 14$ and 5 of them were worked by a Grade I worker.

The percentage of overtime worked by Grade I workers to the total number of overtime hours is: $\frac{5}{14} \times 100 = 35.71\%$.

The answer is B (35.71%).

This resource was produced by the **sigma** Network Employability Special Interest Group whose members are:

- Dr Kinga Zaczek, Royal Holloway, University of London
- Frances Whalley, University of Hertfordshire
- David Faulkner, University of Hertfordshire
- Laura Hooke, Loughborough University London