Neap

Trial Examination 2022

Suggested Solutions

QCE General Mathematics Units 1&2

Paper 1

SECTION 1 – MULTIPLE CHOICE QUESTIONS

	A	B	C	D
1.	○	○	○	●
2.	○	○	●	○
3.	●	○	○	○
4.	○	○	●	○
5.	○	○	●	○
6.	○	●	○	○
7.	○	○	○	●
8.	○	●	○	○
9.	○	○	●	○
10.	●	○	○	○
11.	○	○	○	●
12.	○	○	○	●
13.	●	○	○	○
14.	○	●	○	○
15.	○	○	○	●
16.	○	●	○	○
17.	●	○	○	○
18.	○	●	○	○
19.	○	●	○	○
20.	○	○	●	○

QUESTION 1 C

C is correct.

$5(-2)^2 + 4 \times -2 - 7 = 5$

A is incorrect. This option keeps the negative sign when squaring x.

B is incorrect. This option forgets the negative sign for each substitution of x.

D is incorrect. This option forgets the negative sign for the bx term.

QUESTION 2 C

C is correct. The number of rows (3) are stated first, then the number of columns (2).

A and **D** are incorrect. The matrix is not a square matrix.

B is incorrect. This option gives the number of columns first, then the number of rows.

QUESTION 3 A

A is correct.

$$\sin(11) = \frac{x}{170}$$
$$x = 170 \times \sin(11)$$
$$= 32.4375$$
$$= 32 \text{ m (to the nearest metre)}$$

B is incorrect. This option uses the tan ratio instead of the sin ratio.

C is incorrect. This option uses the cos ratio instead of the sin ratio.

D is incorrect. This option rearranges the sin ratio form by dividing instead of multiplying.

QUESTION 4 C

C is correct.

$$\cos\theta = \frac{7^2 + 8^2 - 9.5^2}{2 \times 7 \times 8}$$
$$\theta = \cos^{-1} 0.203125$$
$$= 78.28°$$

A is incorrect. This option uses inverse sin instead of inverse cos.

B is incorrect. This option finds the smallest angle (opposite the 7 cm edge) instead of the largest angle.

D is incorrect. This option uses 9.5 in the denominator instead of 2.

QUESTION 5 C

C is correct. Sending a 2 kg parcel to regional Australia costs \$25 and sending a 5 kg parcel costs \$30. The total cost is \$55.

A is incorrect. This option states the cost of sending the 5 kg parcel.

B is incorrect. This option uses an incorrect cost for sending the 5 kg parcel.

D is incorrect. This option adds the correct cost of sending a 2 kg parcel with the incorrect cost of sending a 5 kg parcel.

QUESTION 6 B

B is correct.

$$\text{range} = \text{highest score} - \text{lowest score}$$
$$= 6 - 0$$
$$= 6$$

A is incorrect. This option states the range if the score of 6 was excluded.

C is incorrect. This option states the frequency of the score of 2.

D is incorrect. This option states the frequency of the score of 1.

QUESTION 7 D

D is correct. This network diagram shows that town P has two connections to town Q and two connections to town S. Town Q has two connections to town S and one connection to town R. Town S has two connections to town R.

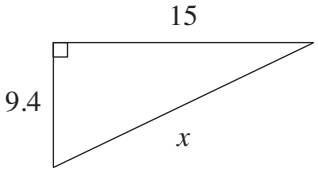
A is incorrect. This network diagram is missing the connections between towns R and S.

B is incorrect. This network diagram is missing the connections between towns P and S, and has an extra connection between towns P and R.

C is incorrect. This network diagram has incorrect connections between towns P and R, towns P and Q, towns R and S, and towns Q and S.

QUESTION 8 B

B is correct.



the direct path:

$$x^2 = 9.4^2 + 15^2$$
$$= 313.36$$
$$x = 17.7 \text{ m}$$

Therefore, the direct path is 17.7 m.

the path that Cristiano takes:

$$\text{crossing both roads} = 9.4 + 15$$
$$= 24.4$$
$$\text{the extra distance Cristiano walks} = 24.4 - 17.7$$
$$= 6.7 \text{ m}$$

A is incorrect. This option subtracts the direct path from only the 15 m road, not both roads that Cristiano must cross.

C is incorrect. This option states the distance of the direct path.

D is incorrect. This option states the distance of the path Cristiano takes.

QUESTION 9 D

Calculating the cost of each block per 100 g gives:

$$\frac{170}{3} = \frac{100}{1.76}$$
$$\frac{200}{3.50} = \frac{100}{1.75}$$
$$\frac{250}{4.80} = \frac{100}{1.92}$$
$$\frac{350}{6} = \frac{100}{1.71}$$

Therefore, the 350 g chocolate block is the best value as it has the cheapest price ($1.71) per 100 g.

QUESTION 10 A

A is correct. The responses are categorial as they use words, not numbers. The responses can be scaled, so they are ordinal.

B is incorrect. The responses are not nominal as they can be ordered.

C and **D** are incorrect. The responses are not numerical.

QUESTION 11 D

D is correct. The line goes through the *y*-axis at 1 and the gradient is $\frac{1}{2}$.

A and **C** are incorrect. These equations have a negative gradient; however, the line is sloping up.

B is incorrect. This equation has an incorrect gradient of $\frac{2}{1}$.

QUESTION 12 D

D is correct.

Item	electricity	rent	food	other
Cost ($)	270	590	150	85
Frequency	quarterly	fortnightly	weekly	weekly
Annual expenses	$270 \times 4 = 1080$	$590 \times 26 = 15\ 340$	$150 \times 52 = 7800$	$85 \times 52 = 4420$

$$\text{total} = 1080 + 15\ 340 + 7800 + 4420$$
$$= \$28\ 640$$

A is incorrect. This option adds the costs for each item together and multiplies the total by 12.

B is incorrect. This option uses monthly (multiplying the cost by 12) for the rent frequency instead of fortnightly (multiplying the cost by 26).

C is incorrect. This option multiplies the electricity cost of $270 by 3 instead of 4.

QUESTION 13 A

Let the number be x:

$$(x+6)\times 2 = 38$$
$$x+6 = 19$$
$$x = 19-6$$
$$= 13$$

QUESTION 14 B

$$SA = 3\pi r^2$$
$$= 3\times\pi\times 10^2$$
$$= 942.5 \text{ cm}^2$$

QUESTION 15 D

$$\$1149 = 70\%$$
$$\frac{1149}{70} = 1\%$$
$$16.4143 = 1\%$$
$$100\% = 16.4143\times 100$$
$$= \$1641.43$$

Therefore, the original price of the mobile phone is $1641, to the nearest dollar.

QUESTION 16 B

B is correct.

The data set is:

9, 10, 11, 12, 14, 15, 17, 18, 19, 20, 21, 21

median = 16

Q_1: 9, 10, 11, 12, 14, 15

$= 11.5$

Q_3: 17, 18, 19, 20, 21, 21

$= 19.5$

$$\text{IQR} = 19.5 - 11.5$$
$$= 8$$

A is incorrect. This option uses incorrectly rounded quartiles to determine the IQR.

C is incorrect. This option gives the range of the data.

D is incorrect. This option gives the median of the data.

QUESTION 17 A

$$\text{gradient} = \frac{15}{20}$$
$$= 0.75$$

Therefore, 0.75 L of water is lost each minute.

QUESTION 18 B

$$\text{actual length} = 7.2 \text{ cm} \times 50$$
$$= 360 \text{ cm}$$
$$= 3.6 \text{ m}$$

QUESTION 19 B

$$\text{scale factor} = \frac{32}{8}$$
$$= 4$$
$$h = 6 \times 4$$
$$= 24 \text{ m}$$

QUESTION 20 C

C is correct. The median for the post-topic test was at the upper quartile of the pre-topic test.

A is incorrect. The box plot for the post-topic test has a smaller range than the box plot for the pre-topic test.

B is incorrect. The IQR of each box plot looks approximately the same size; hence, they have a similar IQR.

D is incorrect. There is not enough information given in the box plot to determine this.

SECTION 2

QUESTION 21 (3 marks)

a) $15.6 \times 25 = \$390$

[1 mark]
1 mark for calculating the standard weekly wage.

b) $32 - 25 = 7$ hours overtime

additional wage $= 7 \times 15.6 \times 1.5$
$= \$163.80$

wage for a 32-hour week $= 390 + 163.80$
$= \$553.80$

[2 marks]
1 mark for calculating the additional wage for the extra hours worked. Note: This may be implied in subsequent working.
1 mark for giving the correct total for a 32-hour week.

QUESTION 22 (3 marks)

$$3 \times \begin{bmatrix} 4 & -6 \\ 3 & 2 \end{bmatrix} - 2 \times \begin{bmatrix} 5 & 1 \\ -2 & 0 \end{bmatrix} = \begin{bmatrix} 12 & -18 \\ 9 & 6 \end{bmatrix} - \begin{bmatrix} 10 & 2 \\ -4 & 0 \end{bmatrix}$$
$$= \begin{bmatrix} 2 & -20 \\ 13 & 6 \end{bmatrix}$$

[3 marks]
1 mark for providing the matrix 3A.
1 mark for providing the matrix 2B.
1 mark for solving to obtain the final matrix.

QUESTION 23 (4 marks)

a) $\text{mean} = \dfrac{(45.5 + 44.2 + 45.8 + 45.0 + 46.2 + 45.1 + 44.7 + 44.3 + 45.5 + 43.9)}{10}$

$= 45.02$

standard deviation:

x	$x - \bar{x}$	$(x - \bar{x})^2$
45.5	0.48	0.2304
44.2	–0.82	0.6724
45.8	0.78	0.6084
45	–0.02	0.0004
46.2	1.18	1.3924
45.1	0.08	0.0064
44.7	–0.32	0.1024
44.3	–0.72	0.5184
45.5	0.48	0.2304
43.9	–1.12	1.2544
		$\Sigma = 5.016$

$\text{standard deviation} = \sqrt{\dfrac{5.016}{10 - 1}}$

$= 0.747$ (correct to three decimal places)

[2 marks]
1 mark for stating the mean of the sample.
1 mark for stating the standard deviation of the sample.

b) Machine 1 has a mean that is almost equal to the packaged size of 45 g at 45.02 g, while the mean of machine 2 is overweight at 45.4 g. In addition, the standard deviation of machine 2 is almost double the standard deviation of machine 1, which means it is less consistent to the packaged size.

[2 marks]
1 mark for providing a valid comparison of the means.
1 mark for providing a valid comparison of the standard deviations.

QUESTION 24 (3 marks)

multiplying by 2: $4 - 7m = -6$

rearranging to get m on one side: $10 = 7m$

$$m = \frac{10}{7}$$

[3 marks]
1 mark for removing the denominator.
1 mark for collecting the constant terms together.
1 mark for stating the correct value for m (accept equivalent values).

QUESTION 25 (4 marks)

a) $C = \frac{5}{9}(F - 32)$

$$\frac{9}{5}C = F - 32$$

$$F = 32 + \frac{9}{5}C$$

[2 marks]
1 mark for transposing the fraction.
1 mark for transposing to make F the subject (accept equivalent formats).

b) $F = 32 + \frac{9}{5} \times 10$

$$= 32 + 18$$

$$= 50°\text{F}$$

[2 marks]
1 mark for substituting the values into the formula.
1 mark for calculating the value of F.
Note: Allow follow-through errors from part a).

QUESTION 26 (6 marks)

a) $V = \frac{1}{3}\pi r^2 h$

$= \frac{1}{3}\pi \times 3^2 \times 7$

$= 65.97 \text{ cm}^3$

$= 66 \text{ cm}^3$

[3 marks]
1 mark for substituting into the formula.
1 mark for providing the correct solution.
1 mark for rounding the solution.

b) $\frac{528}{66} = x^3$

$x = \sqrt[3]{\frac{528}{66}}$

$= 2$

[3 marks]
1 mark for stating the scale factor cubed.
1 mark for showing the cube root.
1 mark for solving for the length scale factor.
Note: Allow follow-through errors from part a).

QUESTION 27 (3 marks)

a) $\text{price per share} = \frac{1\,879\,561}{6\,580\,300}$

$= 0.2856$

$\approx \$0.29$ (correct to two decimal places)

$\text{total dividends received} = 0.29 \times 650$

$= \$188.50$

$= \$185.66$ (if used full value unrounded)

[2 marks]
1 mark for determining the dividend per share.
1 mark for calculating the dividend for 650 shares.

b) $\text{price-to-earnings ratio} = \frac{\text{market price per share}}{\text{annual earnings per share}}$

$= \frac{15.16}{1.4}$

$= 10.8$ (correct to one decimal place)

[1 mark]
1 mark for determining the price-to-earnings ratio.
Note: Allow answers correct to the nearest whole number. Accept equivalent values.

QUESTION 28 (4 marks)

$p = 6 - 8q$ (1)

$3p = 5 + 2q$ (2)

Sub (1) into (2):

$$3(6 - 8q) = 5 + 2q$$

$$18 - 24q - 2q = 5$$

$$18 - 26q = 5$$

$$26q = 13$$

$$q = \frac{1}{2}$$

Sub q into (1):

$$p = 6 - 8 \times \frac{1}{2}$$

$$= 2$$

$$\therefore p = 2,\ q = \frac{1}{2}$$

[4 marks]
1 mark for substituting one equation into the other.
1 mark for simplifying the new equation.
1 mark for determining the value of either p or q.
1 mark for substituting this value back into an equation to determine the value of the second variable.
Note: Allow follow-through errors to determine the second variable.

OR

Using the elimination method:

$p = 6 - 8q$ (1)

$3p = 5 + 2q$ (2)

$3p = 18 - 24q$ (3) $(1) \times 3$

$3p = 5 + 2q$ (2)

$0 = -13 + 26q$ $(2) - (3)$

$13 = 26q$

$$\frac{1}{2} = q$$

Substituting $p = \frac{1}{2}$ into (1):

$$p = 6 - 8 \times \frac{1}{2}$$

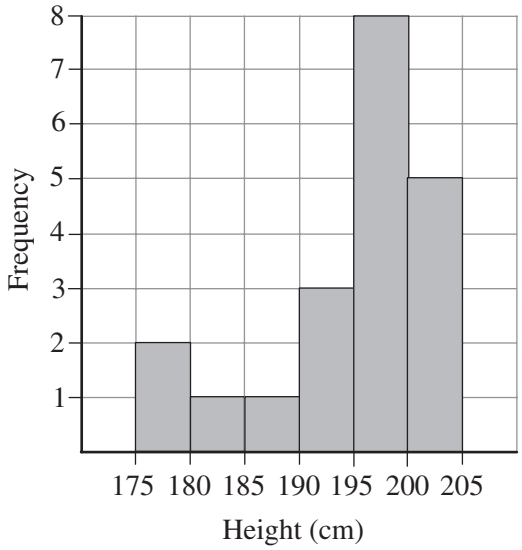
$$= 2$$

[4 marks]
1 mark for multiplying the equations to get the same coefficient for one variable.
1 mark for combining the equations together.
1 mark for determining the value of either p or q.
1 mark for substituting this value back into an equation to determine the value of the second variable.

QUESTION 29 (6 marks)

a) Constructing a frequency table to group the data:

Heights	Frequency
$175 \leq h < 180$	2
$180 \leq h < 185$	1
$185 \leq h < 190$	1
$190 \leq h < 195$	3
$195 \leq h < 200$	8
$200 \leq h < 205$	5



[4 marks]
1 mark for identifying the frequency of each interval. Note: This may be implied in subsequent working.
1 mark for labelling the axes with appropriate scaling.
2 marks for constructing the columns.

b) modal class = $195 \leq h < 200$

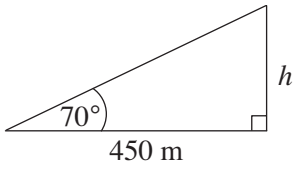
[1 mark]
1 mark for stating the modal class.
Note: Any relevant internal notation may be used.

c) negatively skewed

[1 mark]
1 mark for identifying the shape of the distribution.

QUESTION 30 (4 marks)

a)



$$\tan 70° = \frac{h}{450}$$

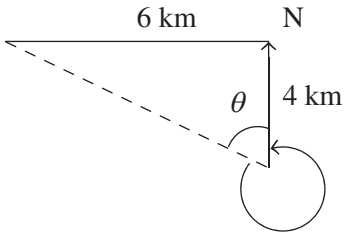
$$h = \tan 70 \times 450$$

$$= 1236.36 \text{ m}$$

$$= 1236 \text{ m (correct to nearest metre)}$$

[2 marks]
1 mark for substituting the values into the tan ratio.
1 mark for providing the correct solution.

b)



$$\tan\theta = \frac{6}{4}$$

$$\theta = \tan^{-1}\left(\frac{6}{4}\right)$$

$$= 56.3° \text{ (correct to one decimal place)}$$

$$\text{true bearing} = 360 - 56$$

$$= 304° \text{ T}$$

[2 marks]
1 mark for calculating the angle in the right triangle.
1 mark for calculating the bearing.