$\square$

Date - Not applicable
Duration - 1 hour 30 minutes

Fill in these boxes and read what is printed below.

Full name of centre

$\square$


## Forename(s)



Surname


Number of seat


Date of birth


## Total marks - 50

Attempt ALL questions.

## You may use a calculator.

To earn full marks you must show your working in your answers.
State the units for your answer where appropriate.
Write your answers clearly in the spaces provided in this booklet. Additional space for answers is provided at the end of this booklet. If you use this space you must clearly identify the question number you are attempting.
Use blue or black ink.
Before leaving the examination room you must give this booklet to the Invigilator; if you do not, you may lose all the marks for this paper.

## FORMULAE LIST

The roots of

Sine rule

Cosine rule

Area of a triangle

Volume of a sphere

$$
V=\frac{4}{3} \pi r^{3}
$$

Volume of a cone

Volume of a pyramid

$$
V=\frac{1}{3} A h
$$

Standard deviation $\quad s=\sqrt{\frac{\sum(x-\bar{x})^{2}}{n-1}}$
or $s=\sqrt{\frac{\Sigma x^{2}-\frac{(\Sigma x)^{2}}{n}}{n-1}}$, where $n$ is the sample size.


## Total marks - 50

Attempt ALL questions

1. Households in a city produced a total of 125000 tonnes of waste in 2017.

The total amount of waste is expected to fall by $2 \%$ each year.
Calculate the total amount of waste these households are expected to produce in 2020.
2. Expand and simplify $(2 x+3)\left(x^{2}-4 x+1\right)$.
3. Factorise fully $3 x^{2}-48$.
4. A school netball team recorded the number of sit-ups each player completed in a minute.

The numbers for the seven players were:

| 29 | 27 | 24 | 31 | 22 | 19 | 30 |
| :--- | :--- | :--- | :--- | :--- | :--- | :--- |

(a) Calculate the mean and standard deviation of the numbers of sit-ups.
4. (continued)

Some players in the school's hockey team also recorded the number of sit-ups they completed in a minute.
Their numbers gave a mean of 29 and a standard deviation of 3.2.
(b) Make two valid comments comparing the numbers of sit-ups of the players in the netball team and the hockey team.
5. The diagram below shows the position of three towns.

Lowtown is due west of Midtown.
The distance from:

- Lowtown to Midtown is 75 kilometres
- Midtown to Hightown is 110 kilometres
- Hightown to Lowtown is 85 kilometres.


Is Hightown directly north of Lowtown?
Justify your answer.
6. A theatre group sold 4830 tickets for their show.

This was $15 \%$ more than they sold last year.
How many tickets did they sell last year?
7. A set of stepladders has legs 150 centimetres and 140 centimetres long.


When the stepladder is fully open, the angle between the longer leg and the ground is $66^{\circ}$.


Calculate $x^{\circ}$, the size of the angle between the shorter leg and the ground.
8. A supermarket sells cylindrical cookie jars which are mathematically similar.


The smaller jar has a height of 15 centimetres and a volume of 750 cubic centimetres.

The larger jar has a height of 24 centimetres.
Calculate the volume of the larger jar.
9. Solve the equation $11 \cos x^{\circ}-2=3$, for $0 \leq x \leq 360$.
. Solve the equation $11 \cos x^{\circ}-2=3$, for $0 \leq x \leq 360$.
10. A traffic bollard is in the shape of a cylinder with a hemisphere on top. The bollard has:

- diameter 24 centimetres
- height 70 centimetres.


Calculate the volume of the bollard.
Give your answer correct to 3 significant figures.
11. Express $\frac{3}{a^{2}}-\frac{2}{a}, a \neq 0$, as a single fraction in its simplest form.
12. The diagram below shows the circular cross-section of a milk tank.


The radius of the circle, centre 0 , is 1.2 metres.
The width of the surface of the milk in the tank, represented by ML in the diagram, is 1.8 metres.
Calculate the depth of the milk in the tank.
13. Express $\sin x^{\circ} \cos x^{\circ} \tan x^{\circ}$ in its simplest form.

Show your working.

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14. In the diagram below:

- DE is perpendicular to AC
- $\mathrm{AD}=4$ centimetres
- $\mathrm{DB}=6$ centimetres
- $\mathrm{AE}=\mathrm{EC}=3$ centimetres.


Calculate the length of BC .
Give your answer correct to one decimal place.
15. The triangle $A B C$ is shown below

$\overrightarrow{A B}=\mathbf{u}$ and $\overrightarrow{A C}=\mathbf{t}$.
$G$ is the point such that $C G=\frac{1}{3} C B$.
Express $\overrightarrow{A G}$ in terms of $\mathbf{u}$ and $\mathbf{t}$.
Give your answer in simplest form.

## Marking Instructions

These marking instructions have been provided to show how SQA would mark this specimen question paper.

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## General marking principles for National 5 Mathematics

Always apply these general principles. Use them in conjunction with the detailed marking instructions, which identify the key features required in candidates' responses.

For each question, the marking instructions are generally in two sections:
generic scheme - this indicates why each mark is awarded
illustrative scheme - this covers methods which are commonly seen throughout the marking
In general, you should use the illustrative scheme. Only use the generic scheme where a candidate has used a method not covered in the illustrative scheme.
(a) Always use positive marking. This means candidates accumulate marks for the demonstration of relevant skills, knowledge and understanding; marks are not deducted for errors or omissions.
(b) If you are uncertain how to assess a specific candidate response because it is not covered by the general marking principles or the detailed marking instructions, you must seek guidance from your team leader.
(c) One mark is available for each • There are no half marks.
(d) If a candidate's response contains an error, all working subsequent to this error must still be marked. Only award marks if the level of difficulty in their working is similar to the level of difficulty in the illustrative scheme.
(e) Only award full marks where the solution contains appropriate working. A correct answer with no working receives no mark, unless specifically mentioned in the marking instructions.
(f) Candidates may use any mathematically correct method to answer questions, except in cases where a particular method is specified or excluded.
(g) If an error is trivial, casual or insignificant, for example $6 \times 6=12$, candidates lose the opportunity to gain a mark, except for instances such as the second example in point (h) below.
(h) If a candidate makes a transcription error (question paper to script or within script), they lose the opportunity to gain the next process mark, for example

This is a transcription error and so the mark is not awarded.

This is no longer a solution of a quadratic equation, so the mark is

$$
x^{2}+5 x+7=9 x+4
$$

not awarded.

The following example is an exception to the above

This error is not treated as a transcription error, as the candidate deals with the intended quadratic equation. The candidate has been given the benefit of the doubt and all marks awarded.
(i) Horizontal/vertical marking

If a question results in two pairs of solutions, apply the following technique, but only if indicated in the detailed marking instructions for the question.

## Example:

$$
\begin{array}{lll} 
& .5 & \bullet 6 \\
.5 & x=2 & x=-4 \\
.6 & y=5 & y=-7
\end{array}
$$

$$
\begin{array}{rll}
\text { Horizontal: } \bullet^{5} x=2 \text { and } x=-4 & \text { Vertical: } & \bullet^{5} x=2 \text { and } y=5 \\
\bullet^{6} y=5 \text { and } y=-7 & & \bullet^{6} x=-4 \text { and } y=-7
\end{array}
$$

You must choose whichever method benefits the candidate, not a combination of both.
(j) In final answers, candidates should simplify numerical values as far as possible unless specifically mentioned in the detailed marking instruction. For example
$\frac{15}{12}$ must be simplified to $\frac{5}{4}$ or $1 \frac{1}{4} \quad \frac{43}{1}$ must be simplified to 43
$\frac{15}{0.3}$ must be simplified to $50 \quad \frac{4 / 5}{3}$ must be simplified to $\frac{4}{15}$
$\sqrt{64}$ must be simplified to $8^{*}$
*The square root of perfect squares up to and including 144 must be known.
(k) Do not penalise candidates for any of the following, unless specifically mentioned in the detailed marking instructions:

- working subsequent to a correct answer
- correct working in the wrong part of a question
- legitimate variations in numerical answers/algebraic expressions, for example angles in degrees rounded to nearest degree
- omission of units
- bad form (bad form only becomes bad form if subsequent working is correct), for example

$$
\begin{aligned}
& \left(x^{3}+2 x^{2}+3 x+2\right)(2 x+1) \text { written as } \\
& \left(x^{3}+2 x^{2}+3 x+2\right) \times 2 x+1 \\
& =2 x^{4}+5 x^{3}+8 x^{2}+7 x+2 \\
& \text { gains full credit }
\end{aligned}
$$

- repeated error within a question, but not between questions or papers
(I) In any 'Show that...' question, where candidates have to arrive at a required result, the last mark is not awarded as a follow-through from a previous error, unless specified in the detailed marking instructions.
(m) You must check all working carefully, even where a fundamental misunderstanding is apparent early in a candidate's response. You may still be able to award marks later in the question so you must refer continually to the marking instructions. The appearance of the correct answer does not necessarily indicate that you can award all the available marks to a candidate.
(n) You should mark legible scored-out working that has not been replaced. However, if the scored-out working has been replaced, you must only mark the replacement working.
(o) If candidates make multiple attempts using the same strategy and do not identify their final answer, mark all attempts and award the lowest mark. If candidates try different valid strategies, apply the above rule to attempts within each strategy and then award the highest mark.

For example:

| Strategy 1 attempt 1 is worth 3 <br> marks. | Strategy 2 attempt 1 is worth 1 mark. |
| :--- | :--- |
| Strategy 1 attempt 2 is worth 4 <br> marks. | Strategy 2 attempt 2 is worth 5 <br> marks. |
| From the attempts using strategy 1, <br> the resultant mark would be 3. | From the attempts using strategy 2, <br> the resultant mark would be 1. |

In this case, award 3 marks.

## Marking Instructions for each question



| Question |  | Generic scheme | Illustrative scheme | Max mark |
| :---: | :---: | :---: | :---: | :---: |
| 4. | (a) | Method 1 <br> - ${ }^{1}$ calculate mean <br> -2 calculate $(x-\bar{x})^{2}$ <br> - ${ }^{3}$ substitute into formula <br> - ${ }^{4}$ calculate standard deviation <br> Method 2 <br> - ${ }^{1}$ calculate mean <br> -2 calculate $\sum x$ and $\sum x^{2}$ <br> - ${ }^{3}$ substitute into formula <br> - ${ }^{4}$ calculate standard deviation | $\begin{aligned} & \bullet 126 \\ & \bullet 9,1,4,25,16,49,16 \\ & \bullet \sqrt{\frac{120}{6}} \\ & \bullet 4.47(2 \ldots) \\ & \bullet \frac{26}{} \\ & \bullet^{2} 182,4852 \\ & \bullet^{3} \sqrt{\frac{4852-\frac{182^{2}}{7}}{6}} \\ & \bullet^{4} 4.47(2 \ldots) \end{aligned}$ | 4 |
|  | (b) | -5 valid comment comparing means <br> -6 valid comment comparing standard deviations | ${ }^{5}$ eg on average the hockey team recorded a higher number of sit-ups <br> ${ }^{6}$ eg the hockey team's numbers of sit-ups were more consistent | 2 |



|  | uestion | Generic scheme | Illustrative scheme | Max mark |
| :---: | :---: | :---: | :---: | :---: |
| 7. |  | - ${ }^{1}$ correct substitution into sin rule <br> - ${ }^{2}$ rearrange equation <br> - ${ }^{3}$ calculate $x$ | - $\frac{\sin x}{150}=\frac{\sin 66}{140}$ or $\frac{150}{\sin x}=\frac{140}{\sin 66}$ <br> - $2 \sin x=\frac{150 \sin 66}{140}$ <br> -3 $x=78(.18 . .$. | 3 |
| 8. |  | Method 1 <br> - ${ }^{1}$ linear scale factor <br> -2 know to multiply volume by cube of linear scale factor <br> - ${ }^{3}$ calculate volume (calculation must include a power of the linear scale factor) | - $\frac{24}{15}$ or equivalent $\begin{aligned} & \cdot 2\left(\frac{24}{15}\right)^{3} \times 750 \\ & \bullet^{3} 3072\left(\mathrm{~cm}^{3}\right) \end{aligned}$ | 3 |
| 9. |  | -1 rearrange equation <br> - ${ }^{2}$ find first value of $x$ <br> - ${ }^{3}$ find second value of $x$ | $\begin{aligned} & \cdot 1 \cos x=\frac{5}{11} \\ & \bullet^{2} 63 \\ & \cdot{ }^{3} 297 \end{aligned}$ | 5 |
| 10. |  | -1 correct substitution into formula for volume of sphere <br> $\bullet^{2}$ consistent substitution into formula for volume of cylinder <br> -3 know to add volume of hemisphere to volume of cylinder <br> - ${ }^{4}$ all calculations correct (must involve the sum or difference of two volume calculations involving $\pi$ ) <br> ${ }^{-5}$ round final answer to 3 significant figures and state correct units | - $\frac{4}{3} \times \pi \times 12^{3}$ <br> - $\quad \pi \times 12^{2} \times 58$ <br> - $\frac{1}{2} \times \frac{4}{3} \times \pi \times 12^{3}+\pi \times 12^{2} \times 58$ $\bullet^{4}(3619.1 \ldots+26238.5 \ldots)=29857 \ldots$ $\cdot^{5} 29900 \mathrm{~cm}^{3}$ | 3 |



[END OF SPECIMEN MARKING INSTRUCTIONS]

