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Government of Sāmoa

## Sāmoa Secondary Leaving Certificate

## MATHEMATICS

## 2019

## QUESTION and ANSWER BOOKLET

Time allowed: $\mathbf{3}$ hours \&10 minutes

## INSTRUCTIONS:

1. You have 10 minutes to read before you start writing.
2. Write your Student Education Number (SEN) in the space provided on the top left hand corner of this page.
3. Answer ALL QUESTIONS. Write your answers in the spaces provided in this booklet.
4. If you need more space for answers, ask the Supervisor for extra paper. Write your SEN on all extra sheets used and clearly number the questions. Attach the extra sheets at the appropriate places in this booklet.

NB: Formula Sheet is provided as a separate sheet.

| CURRICULUM STRANDS |  | Page | Time (min) | Weighting |  |  |  |  |
| :--- | :--- | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| STRAND 1: | ALGEBRA | 2 | 34 | 19 |  |  |  |  |
| STRAND 2: | COORDINATE GEOMETRY | 5 | 25 | 14 |  |  |  |  |
| STRAND 3: | GRAPHS AND FUNCTIONS | 8 | 25 | 14 |  |  |  |  |
| STRAND 4: | PROBABILITY | 12 | 25 | 14 |  |  |  |  |
| STRAND 5: | CALCULUS | 15 | 37 | 20 |  |  |  |  |
| STRAND 6: | TRIGONOMETRY | 20 | 34 | 19 |  |  |  |  |
| TOTAL |  |  |  |  |  |  | $\mathbf{1 8 0}$ | $\mathbf{1 0 0}$ |

The formula for converting temperature in degrees Fahrenheit ( $F$ ) to degrees Celcius (C) is

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

1. What is the subject of this formula?

2. Rearrange the formula above to make $F$ the subject.
$\square$
3. Use your rearranged formula in Number 2 to calculate degrees $F$ when $C=10$ degrees.
$\square$
4. $27 x^{2}-75$ is a quadratic expression. Circle your answer.

## True

False
5. Simplify the expression $\frac{(2 x+3)(x-2)}{x^{2}-x-2}$
6. Circle the cubic function.

$$
y=(1-x)^{2} \quad y=3 x-2 \quad y=x^{3}-12 x^{2}+48 x-64
$$

7. Determine the equation for the function below.

$\square$
8. If $(x-3)$ is a factor of $x^{3}+2 x^{2}-11 x-12$, find the other TWO factors.

9. State ONE basic law of logarithm.


On 1 January 2019, the population of the world was estimated to be $7,074,000,000=7.074 \times 10^{9}=A$
Assume that the population of the world ( $N$ ) is increasing at the rate of $3 \%$ per year, so that $N=A(1.03)^{t}$ after $t$ years.
10. Estimate what the population of the world will be on 1 January 2024.
$\square$

Tavita draws up a proposed driveway to his garage up on a hill, as below.


If you were to draw the above driveway plan on a $x y$-plane:
11. State possible co-ordinates for points D1 and D2.

12. What is the gradient of the proposed driveway?

13. What would be the equation of the driveway?

14. Use Pythagoras Theorem to calculate the length (in metres) of Tavita's driveway (round to 2 d.p.)

15. Identify ONE important feature of a circle.

16. Give the equation for the circle below.

$\square$
17. Use the below grid to transform the circle in Number 16 to become $(x-6)^{2}+(y-6)^{2}=9$. Clearly label the center and the radius points.

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18. Complete the below table of values for the function $y=x^{3}-1$

| $x$ | -2 | -1 | 0 | 1 | 2 |
| :--- | :--- | :--- | :--- | :--- | :--- |
| $y$ |  |  |  |  |  |

SL 1
19. What is the range of the function $y=x^{3}-1$ as in Number 18 above?

20. Plot the graph for $y=x^{3}-1$ from Number 18 .

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21. What are the coordinates of the point of inflection of the function $y=x^{3}-1$ from its graph in Number 20?

SL 1
$\square$
22. Draw the graph for the function $y=x^{2}-4$, where $-3 \leq x \leq 3$. Show clearly its intercepts.

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SL 4
$\square$
23. Which of these is a possible equation of the below graph?

Circle your answer.

$$
y=x^{2}-4 \quad y=\frac{1}{x} \quad y=(x-2)^{3}
$$


24. Give the equation for the inverse function of $y=\frac{1}{2} x+1$, using the method of interchanging $x$ and $y$.
25. Sketch the graph of the inverse function from Number 24. Show all appropriate labels.

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26. State the formula for determining the probability of equally likely events.
$\square$
$\square$
27. What does the letter $\boldsymbol{n}$ stand for in the probability formula?


To answer Number 28 and 29, the following coloured spinner is spun.

28. List all the possible outcomes for the event $\boldsymbol{A}=\{$ not green $\}$
$\square$
29. Find the probability $P(A)$ for the event $\boldsymbol{A}=\{$ not green $\}$
$\square$
30. The following is a graph of a standard normal distrubtion curve.

Circle your answer.


The variable in a standard normal distribution is always denoted by $z$.
31. What does the variable $\boldsymbol{z}$ represent?


A fruit grower produces mangoes whose weights are normally distributed with a mean of $\mathbf{1 8 5}$ grams and a standard deviation of $\mathbf{2 0}$ grams.

Mangoes whose weights exceed 209 grams are sold to hotels (e.g. Taumeasina Resort).

The rest of the mangoes are either sold to supermarkets or a Fugalei market.

32. Find the percentage of mangoes sold to hotels. Hint: $\mathrm{P}(x>209)$
$\square$

Mangoes below a certain weight are sold at Fugalei market.
33. If $67 \%$ of the fruit growers' mangoes are sold at Fugalei market, their weight would need to be below how many grams?

Hint: $\mathrm{P}(x<a)=0.67$, where $a=$ certain weight.
$\square$
34. The graph below has a negative rate of change between what points?


35. Find the derivative of the function $f(x)=2 x^{2}$ using the first principle.
36. Give the differentiation rule for finding the derivative of a polynomial.

37. What is the rule for the gradient of the stationary point of a function?

38. Identify the coordinates of ANY stationary point on the graph below.

$\square$

A golfer hits a ball and the equation of its path is given by $y=1.5+x-0.02 x^{2}$ where $x$ (metres) is the horizontal distance travelled by the ball, and $f(x)$ (metres) is the vertical height reached.
39. Use the rule of differentiation to derive the equation of the path travelled by the ball $y=1.5+x-0.02 x^{2}$
$\square$
40. Find the $x$ value, the horizontal distance, at which the maximum height is reached by the ball.
$\square$

A farmer wishes to fence off a rectangular block of land on a straight stretch of river so that only three sides of fencing are required.


It is known that the Perimeter for the three sides $(I+2 w)$ is $\mathbf{2 4 0}$ metres long. The function $A$, area of the block therefore, is given as $A=l \times w=(240-2 w) w$ OR $A=240 w-2 w^{2}$
41. Find the largest possible area of the paddock if 240 metres of fencing is available. Hint: Stationary point at $A^{\prime}(w)$, local maximum $\cong$ largest possible area.

42. State the rule for finding the anti-derivative of a function.

43. For the function $\int_{a}^{b} f(x), \boldsymbol{a}$ and $\boldsymbol{b}$ are called:

44. Use integration to calculate the area of the shaded region below.

$\square$

## STRAND 6:

45. Find the period and frequency of the function $y=\frac{2}{3} \sin (4 x)$.
$\square$
46. What does the term amplitude mean?

47. What would be the amplitude of the function $y=\frac{2}{3} \sin (4 x)$

48. Solve the trigonometric equation $\operatorname{Sin} 2 x=\frac{1}{\sqrt{2}}, 0^{\circ} \leq \theta \leq 360^{\circ}$
49. State ONE common trigonometric identity.

SL 1
50. Find the length $\boldsymbol{x}$ (in cm ) by using an appropriate trigonometric rule.

51. Prove that $\tan x \cdot \sin x+\cos x=\frac{1}{\cos x}$
$\square$
52. Convert $225^{\circ}$ degrees to radians.

53. The part of the circle labeled $s$, is called:

$\square$

## A pizza has a diameter of 14 cm .

54. Calculate the area of a slice of pizza when the chef made all the slices with an angle of $45^{\circ}$.


## Normal distribution

Each entry gives the probability that the standardised normal random variable, $Z$, lfes between 0 and $z$, shaded in the diagram.


| z | 0.00 | 0.01 | 0.02 | 0.03 | 0.04 | 0.05 | 0.06 | 0.07 | 0.08 | 0.09 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 0.0 | . 0000 | . 0040 | . 0080 | . 0120 | . 0160 | . 0199 | . 0239 | . 0279 | . 0319 | . 0359 | 4 | 8 | 12 | 16 | 20 | 24 | 28 | 32 | 36 |
| 0.1 | . 0398 | . 0438 | . 0478 | . 0517 | . 0557 | . 0596 | . 0636 | . 0675 | . 0714 | . 0754 | 4 | 8 | 12 | 16 | 20 | 24 | 28 | 32 | 36 |
| 0.2 | . 0793 | . 0832 | . 0871 | . 0910 | . 0948 | . 0987 | . 1026 | . 1064 | . 1103 | . 1141 | 4 | 8 | 12 | 15 | 19 | 22 | 27 | 31 | 35 |
| 0.3 | . 1179 | . 1217 | . 1255 | . 1293 | . 1331 | . 1368 | . 1406 | . 1443 | . 1480 | . 1517 | 4 | 8 | 11 | 15 | 19 | 22 | 26 | 30 | 34 |
| 0.4 | . 1554 | . 1591 | . 1628 | . 1664 | . 1700 | . 1736 | . 1772 | . 1808 | . 1844 | . 1879 | 4 | 7 | 11 | 14 | 18 | 22 | 25 | 29 | 32 |
| 0.5 | . 1915 | . 1950 | . 1985 | . 2019 | . 2054 | . 2088 | . 2123 | . 2157 | . 2190 | . 2224 | 3 | 7 | 10 | 14 | 17 | 21 | 24 | 27 | 31 |
| 0.6 | . 2258 | . 2291 | . 2324 - | . 2357 | . 2389 | . 2422 | . 2454 | . 2486 | . 2518 | . 2549 | 3 | 6 | 10 | 13 | 16 | 19 | 23 | 26 | 29 |
| 0.7 | . 2580 | . 2612 | . 2642 | . 2673 | . 2704 | . 2734 | . 2764 | . 2794 | . 2823 | . 2852 | 3 | 6 | 9 | 12 | 15 | 18 | 21 | 24 | 27 |
| 0.8 | . 2881 | . 2910 | . 2939 | . 2967 | . 2996 | . 3023 | . 3051 | . 3078 | . 3106 | . 3133 | 3 | 6 | 8 | 11 | 14 | 17 | 19 | 22 | 25 |
| 0.9 | . 3159 | . 3186 | . 3212 | . 3238 | . 3264 | . 3289 | . 3315 | . 3340 | . 3365 | . 3389 | 3 | 5 | 8 | 10 | 13 | 15 | 18 | 20 | 23 |
| 1.0 | . 3413 | . 3438 | . 3461 | . 3485 | . 3508 | . 3531 | . 3554 | . 3577 | . 3599 | . 3621 | 2 | 5 | 7 | 9 | 12 | 14 | 16 | 18 | 21 |
| 1.1 | . 3643 | . 3665 | . 3686 | . 3708 | . 3729 | . 3749 | . 3770 | . 3790 | . 3810 | . 3830 | 2 | 4 | 6 | 8 | 10 | 12 | 14 | 16 | 19 |
| 1.2 | . 3849 | . 3869 | . 3888 | . 3907 | . 3925 | . 3944 | . 3962 | . 3980 | . 3997 | . 4015 | 2 | 4 | 5 | 7 | 9 | 11 | 13 | 15 | 16 |
| 1.3 | . 4032 | . 4049 | . 4066 | . 4082 | . 4099 | . 4115 | .4131 | . 4147 | . 4162 | . 4177 | 2 | 3 | 5 | 6 | 8 | 10 | 11 | 13 | 14 |
| 1.4 | . 4192 | . 4207 | . 4222 | .4236 | .4251 | . 4265 | . 4279 | . 4292 | . 4306 | . 4319 | 1 | 3 | 4 | 6 | 7 | 8 | 10 | 11 | 13 |
| 1.5 | . 4332 | . 4345 | . 4357 | . 4370 | . 4382 | . 4394 | . 4406 | . 4418 | . 4429 | . 44 | 1 | 2 | 4 | 5 | 6 | 7 | 8 | 10 | 11 |
| 1. | . 44 | . 4463 | . 4474 | . 4484 | *. 4495 | . 4505 | .4515 | . $4525^{*}$ | . 4535 | . 4545 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| 1.7 | . 4554 | . 4564 | . 4573 | . 4582 | . 4591 | . 4599 | . 4608 | . 4616 | -. 4625 | . 4633 | 1 | 2 | 3 | ${ }^{4}$ | 4 | 5 | 6 | 7 | 8 |
| 1.8 | . 4641 | . 4649 | . 4656 | . 4664 | . 4671 | . 4678 | . 4686 | . 4693 | . 4699 | . 4706 | 1 | 1 | 2 | 3 | 4 | 4 | 5 | 6 | 6 |
| 1.9 | . 4713 | . 4719 | . 4 | . 4 | . 4 | . 4 | . 4750 | . 4756 | . 4761 | . 476 | 1 | 1 | 2 | 2 | 3 | 4 | 4 | 5 | 5 |
| 2.0 | . 4772 | . 4778 | . 4783 | . 4788 | .4793 | . 4798 | . 4803 | . 4808 | *. 4812 | . 4817 | 0 | 1 | 1 | \$ 2 | 2 | 3 | 3 | 4 | 4 |
| 2.1 | . 4821 | . 4826 | . 4830 | . 4834 | . 4838 | . 4842 | . 4846 | . 4850 | . 4854 | . 4857 | 0 | 1 | 1 | 2 | 2 | 2 | 3 | 3 | 4 |
| 2.2 | . 4861 | . 4864 | . 4868 | . 4871 | . 4875 | . 4878 | . 4881 | . 4884 | . 4887 | . 4890 | 0 | 1 | 1 | 1 | 2 | 2 | 2 | 3 | 3 |
| 2.3 | . 4893 | . 4896 | . 4898 | . 4901 | . 4904 | . 4906 | . 4909 | . 4911 | . 4913 | . 4916 | 0 | 0 | 1 | 1 | 1 | 2 | 2 | 2 | 2 |
| 2.4 | . 49 | . 492 | . 4922 | . 4925 | . 4927 | . 4929 | .4931 | . 4932 | .4934 | . 4936 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 2 | 2 |
| 2. | . 4938 | . 4940 | . 4941 | . 4943 | . 4945 | . 4946 | . 4948 | . 4949 | . 4951 | . 4952 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 |
| 2.6 | . 4953 | . 4955 | . 4956 | . 4957 | . 4959 | . 4960 | . 4961 | . 4962 | . 4963 | . 4964 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 |
| 2.7 | . 4965 | . 4966 | . 4967 | . 4968 | . 4969 | . 4970 | . 4971 | . 4972 | . 4973 | . 4974 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 |
| 2.8 | . 4974 | . 4975 | . 4976 | . 4977 | . 4977 | . 4978 | . 4979 | . 4979 | . 4980 | . 4981 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| 2.9 | . 4981 | . 4982 | . 4982 | . 4983 | . 4984 | . 4984 | . 4985 | . 4985 | . 4986 | . 4986 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| 3. | . 4987 | . 4987 | . 4987 | . 4988 | . 4988 | . 4989 | . 4989 | . 4989 | . 4990 | . 4990 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 3. | . 4990 | . 4991 | . 4991 | . 4991 | . 4992 | . 4992 | . 4992 | . 4992 | . 4993 | . 4993 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 3.2 | . 4993 | . 4993 | . 4994 | . 4994 | . 4994 | . 4994 | . 4994 | . 4995 | . 4995 | . 4995 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 3.3 | . 4995 | . 4995 | . 4995 | . 4996 | . 4996 | . 4996 | . 4996 | . 4996 | .4996 | . 4997 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 3.4 | . 4997 | . 4997 | . 4997 | . 4997 | . 4997 | . 4997 | . 4997 | . 4997 | . 4998 | . 4998 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 3.5 | . 4998 | . 4998 | . 4998 | . 4998 | . 4998 | . 4998 | . 4998 | . 4998 | . 4998 | . 4998 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 3.6 | . 4998 | . 4998 | . 4999 | . 4999 | . 4999 | . 4999 | . 4999 | . 4999 | . 4999 | . 4999 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 3.7 | . 4999 | . 4999 | . 4999 | . 4999 | . 4999 | . 4999 | . 4999 | . 4999 | . 4999 | . 4999 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 3.8 | . 4999 | . 4999 | . 4999 | . 4999 | . 4999 | . 4999 | . 4999 | . 5000 | . 5000 | . 5000 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 3.9 | . 5000 | . 5000 | . 5000 | . 5000 | . 5000 | . 5000 | . 5000 | . 5000 | . 5000 | . 5000 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |



## MATHEMATICS

## 2019

(For Scorers only)

| CURRICULUM STRANDS |  | Weighting | Scores | Chief <br> Scorer |
| :--- | :--- | :---: | :---: | :---: |
| STRAND 1: | ALGEBRA | 19 |  |  |
| STRAND 2: | COORDINATE GEOMETRY | 14 |  |  |
| STRAND 3: | GRAPHS AND FUNCTIONS | 14 |  |  |
| STRAND 4: | PROBABILITY | 14 |  |  |
| STRAND 5: | CALCULUS | 20 |  |  |
| STRAND 6: | TRIGONOMETRY | 19 |  |  |
|  | TOTAL | $\mathbf{1 0 0}$ |  |  |

