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Government of Sāmoa

## Samoa Secondary Leaving Certificate

## MATHEMATICS

## 2020

## 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 right 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 | 9 | 25 | 14 |
| STRAND 4: | PROBABILITY | 12 | 25 | 14 |
| STRAND 5: | CALCULUS | 15 | 37 | 20 |
| STRAND 6: | TRIGONOMETRY | 19 | 34 | 19 |
| TOTAL |  |  |  | $\mathbf{1 8 0}$ |

Check that this booklet contains pages 2-24 in the correct order and that none of these pages are blank. HAND THIS BOOKLET TO THE SUPERVISOR AT THE END OF THE EXAMINATION.

1. The expression $5(2 x-3) \geq 8 x+9$ is an example of a linear inequation. Circle your answer.

## True

## False

2. Solve for $x$ in $5(2 x-3) \geq 8 x+9$


SL 3
3. Give an example of an exponential function.

4. The function $y=x^{4}-x^{2}$ is an example of a cubic function. Circle your answer.
True False
5. Solve for $\boldsymbol{x}$ in the equation $2 x^{2}+10 x+12=0$

6. Use the Factor Theorem to check if $(x-4)$ is a factor of

$$
-2 x^{3}+9 x^{2}-x-12
$$


7. State ONE basic law of indices.

8. Find the value of $\boldsymbol{n}$ in $5^{2 n}=25$
$\square$
9. According to Logarithm laws, $\log _{a}(1)=$ $\qquad$
$\square$
10. Suppose return flight airfares (A) from Faleolo to Auckland since 2006 can be modelled by the function $A=400+50 \log _{10}(5 t+1)$ where $t$ is the number of years since 2006.

Estimate the cost of return flights to Auckland in the year 2022.
$\square$
$A B C D$ is a quadrilateral with known vertices $A(4,4), B(2,6)$ and $C(8,9)$. Side AB is parallel to CD and they have the same gradient; side AD is parallel to BC and they also have the same gradient.


Use the above diagram to answer Questions 11, 12 \& 13.
11. The above quadrilateral is a parallelogram.
True
False
12. Find the gradient of the side $A B$.
$\square$
13. Find the equation for the line AB .

14. Show that the two lines below intersect at a particular point.

$$
\begin{gathered}
x=2 y-3 \\
2 x-3 y=7
\end{gathered}
$$



The owners of a house at Vailima want to convert a stairway leading from the ground to their front doorway into a wheelchair ramp. According to Samoa's building regulations, the maximum gradient of any ramp
is $\frac{1}{14}$.

15. If a 0.5 metres high wheelchair ramp needs to be built, how long will it be? Round your answer to 2 decimal places. Hint: find the horizontal length first using the given gradient.
$\square$
16. Define parallel lines.
$\square$
17. Sketch a graph of the circle: $x^{2}+y^{2}=25$.

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18. The limit of the function, $y=x^{2}+3 x+2$ as $x$ approaches 0 is 2 . What does this mean?

19. The graph shown below is called a hyperbola and its equation is $y=\frac{1}{x}$
True
False


For Questions 20 and 21, consider the even function $y=x^{2}+1$ and its graph below.

20. Identify the symmetry line for the function.

21. What are the co-ordinates of its turning point?
$\square$
$\qquad$

SL 2
23. Sketch the graph of $f(x)=2^{x}$ showing any intercepts.


| SL 3 |
| ---: |
|  |

24. Which of the below is the inverse function of $f(x)=2^{x}$ ? Circle your answer.

$$
f^{-1}(x)=\frac{2}{x} \quad f^{-1}(x)=x^{2} \quad f^{-1}(x)=\log _{2} x
$$

A ball is projected vertically upwards from the top of a building 25 m high. Its position ( $p$ ) relative to the ground is given by the equation $p=25+20 t-5 t^{2}$, where $t$ is the time in seconds
25. Sketch a position-time graph for t ball showing clearly its turning point and intercepts.

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| SL 4 |
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26. Describe what independent event means.

27. Explain what equally likely event means.


A coin is tossed as a wheel that is coloured blue, white and yellow is spun. Use this information to answer Question 28 to Question 30.

28. Draw a probability tree diagram for the above experiment.

29. State ONE possible event from the experiment on page 12.

30. What is the probability of getting Tails and the colour Yellow?


SL 2
$\qquad$

SL 1

The results of a Year 12 Maths examination are known to be normally distributed with a mean of 70 and a standard deviation of 6 .
32. What approximate percentage of students sitting for this examination can be expected to achieve a score that is between 64 and $76 ? \mathrm{P}(64<\mathrm{X}<76)$
$\square$

Suppose Farmer Joe sells two different packed vegetables, Cucumbers and Tomatoes, for $\$ 5.00$ and $\$ 6.50$ respectively. A lot of people buy both products every week, with sales being normally distributed and averaging 2500 packs (standard deviation 700) for Cucumbers and 3000 packs (standard deviation 550) for tomatoes each week. It is company policy that if in any one week the sales for any of the vegetable packs fall below half the average, that vegetable pack is advertised as a 'special' the following week.
33. Find the probability, that both products will be advertised as 'special' next week.
$\square$
34. The gradient of the secant PQ on the below curve is $\frac{2}{5}$. What does this mean in terms of rate of change?


35. Calculate the gradient of the tangent below.


36. Complete the following differentiation rule for polynomials. If $f(x)=a x^{n}$ then $f^{\prime}(x)=$
37. Use the first principle to find the derivative for $f(x)=x^{2}+1$.
$\square$
38. State the rule of the second derivative that is used to determine the nature of the stationary point (maximum or minimum).

39. The coordinates for the stationary point in the below graph are $(-2,0)$ and $(2,0)$. Circle the correct answer.


False
True
False
40. For the function $(x)=x^{2}-2 x$, what is the value of its gradient $f^{\prime}(x)$ at its stationary point?

41. Find the equation of the tangent to the curve $f(x)=x^{2}+6 x-8$ at the point where the gradient has a value of 8 .
$\square$
42. Fill in the missing expression in rule for finding the anti-derivative of a function.

$$
\int a x^{n} d x=\ldots+c, n \neq-1
$$

SL 1
$\square$
43. Determine the anti-derivative of the function $f(x)=2 x^{3}+3 x$.
$\square$

The rate of change of the volume, $V$ litres, of a balloon at any time, $t$ seconds, after it is inflated beyond 6 litres is given by:

$$
\frac{d V}{d t}=3 t^{2}-8 t+1, t \in[0,3]
$$

44. Express $V$ as a function of $t$, and find the volume of the balloon in litres after one second $(t=1)$ when it is inflated.
$\square$
45. State the general equation of any of the trig functions.


Consider the below function for Questions 46 to 48.

46. What is its amplitude $x$ ?

47. What is its period?

48. The equation for the function is: Circle your answer.

$$
y=3 \operatorname{Sin}(x) \quad y=3 \operatorname{Sin}(2 x) \quad y=3 \operatorname{Cos}(2 x)
$$

Suppose the function $y=\sin x$ is translated to $y=\frac{2}{3} \operatorname{Sin}(4 x)$ for $\in[0,360]$.
49. Draw and label clearly both graphs showing appropriate shifts with appropriate labels across both axes.

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| SL 4 |
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50. Solve the trigonometric equation $\operatorname{Cos}\left(x+\frac{\pi}{6}\right)=\frac{1}{2}, 0 \leq x \leq 360$.


A rope, 4 m long, is attached to a vertical pole. The rope, held taut, is pegged into the ground 2 m from the base of the pole.
51. Label the known and unknown sides of the below right-angled triangle for the above scenario.


SL 1
$\square$
52. Use your labelled triangle in Question 51 to find the angle the rope makes with the ground.

53. Convert $120^{\circ}$ into radians.

54. A sector with a center angle $\frac{\pi}{3}$ radians has been removed from a circle. The radius is 2 cm . Calculate the area of the remaining (shaded) region.


## Normal distribution

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


Differences

| z | 0.00 | 0.01 | 0.02 | 0.03 | 0.04 | 0.05 | 0.06 | 0.07 | 0.0 | 0.0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
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| 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. | . 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 | . 43 | 1 | 3 | 4 | 6 | 7 | 8 | 10 | 11 | 13 |
| 1.5 | . 4332 | .4345 | .4357 | .4370 | . 4382 | . 4394 | . 4406 | . 4418 | . 4429 | . 4441 | 1 | 2 | 4 | 5 | 6 | 7 | 8 | 10 | 11 |
| 1.6 | . 4452 | . 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 | 3 | 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 | . 4726 | . 4732 | . 4738 | . 4744 | . 4750 | . 4756 | . 4761 | . 4767 | 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 | . 4918 | . 4920 | . 4922 | . 4925 | . 4927 | . 4929 | . 4931 | . 4932 | . 4934 | . 4936 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 2 | 2 |
| 2.5 | . 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 |
| 3.0 | . 4987 | . 4987 | . 4987 | . 4988 | . 4988 | . 4989 | . 4989 | . 4989 | . 4990 | . 4990 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 3.1 | . 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

(For Scorers only)

| CURRICULUM STRANDS | Weighting | Scores | Check <br> Scorer | Double <br> Entry <br> (AED) |
| :---: | :---: | :---: | :---: | :---: |
| 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 |  |  |  |  |

