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# Samoa Secondary Leaving Certificate

# MATHEMATICS

# 2020

# **QUESTION and ANSWER BOOKLET**

Time allowed: 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.

CUF	RICULUM 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		180	100

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.

False

#### **STRAND 1:**

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

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

True

Give an example of an exponential function. 3.

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

True

**SL 1** 







**SL 1** 



**SL 1** 

ALGEBRA

False

6. Use the Factor Theorem to check if (x - 4) is a factor of  $-2x^3 + 9x^2 - x - 12$ 



7. State ONE basic law of indices.

SL 1

8. Find the value of n in  $5^{2n} = 25$ 



9. According to Logarithm laws,  $\log_a(1) =$  \_\_\_\_\_

SL	1	

10. Suppose return flight airfares (A) from Faleolo to Auckland since 2006 can be modelled by the function  $A = 400 + 50 \log_{10}(5t + 1)$  where *t* is the number of years since 2006.

Estimate the cost of return flights to Auckland in the year 2022.

*ABCD* 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 AB.



SL 1	

SL 2

**13.** Find the equation for the line AB.

SL 2

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

$$x = 2y - 3$$
$$2x - 3y = 7$$

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.* 



**16.** Define parallel lines.

SL 1	



### 17. Sketch a graph of the circle: $x^2 + y^2 = 25$ .



**STRAND 3:** 

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

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





**SL 1** 

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.

	SL 1

10|SSLC

**21.** What are the co-ordinates of its turning point?

22. Suppose the basic quadratic function  $y = x^2$  is being translated and has become  $y = (x - 2)^2$ . Describe the translation involved.

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

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**SL 2** 

SL 3	



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

$$f^{-1}(x) = \frac{2}{x}$$
  $f^{-1}(x) = x^2$   $f^{-1}(x) = \log_2 x$ 

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  $p = 25 + 20t - 5t^2$ , where *t* is the time in seconds

#### 25. Sketch a position-time graph for t ball showing clearly its turning point and intercepts.





#### STRAND 4:

#### PROBABILITY

26. Describe what *independent event* means.

SL 1

**SL 1** 

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.

13|SSLC

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

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

**31.** Draw and label the normal probability curve with a mean  $\mu = 0$ .





<b>SL 1</b>	

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? P(64 < X < 76)

SL 3

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.

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SL 4
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#### STRAND 5:

**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.





Complete the following differentiation rule for polynomials. 36.

If  $f(x) = ax^n$  then f'(x) = \_\_\_\_\_

Use the first principle to find the derivative for  $f(x) = x^2 + 1$ . 37.

State the rule of the second derivative that is used to determine the nature of the stationary 38. 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.* 





- SL 1
- 40. For the function  $(x) = x^2 2x$ , what is the value of its gradient f'(x) at its stationary point?

**41.** Find the equation of the tangent to the curve  $f(x) = x^2 + 6x - 8$  at the point where the gradient has a value of 8.

SL 3	

**42.** Fill in the missing expression in rule for finding the anti-derivative of a function.

$$\int ax^n dx = \underline{\qquad} + c, \ n \neq -1$$

**43.** Determine the anti-derivative of the function  $f(x) = 2x^3 + 3x$ .

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:

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

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.





#### STRAND 6:

#### TRIGONOMETRY

**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?



SL 1	

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

$$y = 3 Sin(x)$$
  $y = 3 Sin(2x)$   $y = 3 Cos(2x)$ 

Suppose the function y = sin x is translated to  $y = \frac{2}{3} Sin (4x) for \in [0, 360]$ .

**49.** Draw and label clearly both graphs showing appropriate shifts with appropriate labels across both axes.



SL 4

**50.** Solve the trigonometric equation  $Cos\left(x+\frac{\pi}{6}\right) = \frac{1}{2}, 0 \le x \le 360.$ 



A rope, 4 m long, is attached to a vertical pole. The rope, held taut, is pegged into the ground 2m from the base of the pole.

**51.** Label the known and unknown sides of the below right-angled triangle for the above scenario.





52. Use your labelled triangle in Question 51 to find the angle the rope makes with the ground.



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

SL 2

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, lies between 0 and z, shaded in the diagram.



_			Ster Carrow										1	Diff	eren	ces			
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
).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
).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
L.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	.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
.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
.5	.4998	.4998	.4998	.4998	.4998	.4998	.4998	.4998	.4998	.4998	0	0	0	0	0	0	0	0	0
8.6	.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
.8	.4999	.4999	.4999	.4999	.4999	.4999	.4999	.5000	.5000	5000	0	0	0	0	0	0	.0	0	0
.9	.5000	.5000	.5000	.5000	.5000	.5000	.5000	5000	5000	5000	0	0	0	0	0	0	0	0	0

STUDENT EDUCATION NUMBER									

## MATHEMATICS

#### 2020

(For Scorers	only)
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CURRICULUM STRANDS	Weighting	Scores	Check Scorer	Double Entry (AED)
STRAND 1: ALGEBRA	19			
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STRAND 6: TRIGONOMETRY	19			
TOTAL	100			