GOVERNMENT OF SAMOA
MINISTRY OF EDUCATION, SPORTS AND CULTURE

STUDENT EDUCATION NUMBER									

Samoa Secondary Leaving Certificate

MATHEMATICS

2021

QUESTION and ANSWER BOOKLET

Time allowed: 3 Hours & 10 minutes

INSTRUCTIONS

1. You have 10 minutes to read **before** you start the exam.
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 paper to write your 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.

SECTIONS		Pages	Time (min)	Weighting
A	MULTIPLE CHOICE	2	25	14
B	EXTENDED RESPONSES	8	155	86
TOTAL			**180**	**100**

Check that this booklet contains pages 2-25 in the correct order and that none of these pages are blank.

HAND THIS BOOKLET TO THE SUPERVISOR AT THE END OF THE EXAMINATION.

SECTION A:	MULTIPLE CHOICE	WEIGHTING 14

Choose the BEST answer and write the correct letter in the box provided.

1. When factorizing $x^2 + 5x - 24$, the result will be:

   A. $(x - 3)(x + 8)$

   B. $(x + 3)(x - 8)$

   C. $(x + 4)(x - 6)$

   D. $(x - 2)(x + 12)$

	SL 1

2. One basic law of logarithm states that, $For\ all\ \ a > 0,\ \log_a a = ?$

   A. a

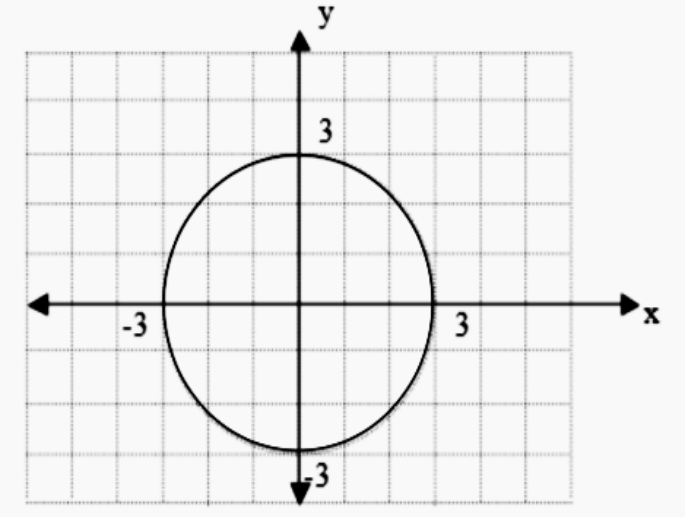
   B. 0

   C. -1

   D. 1

	SL 1

The graph below is that of a circle.



3. The equation for the circle *(page 2)* is:

A. $y^2 = x^2 + 3$

B. $y^2 + x^2 = 3$

C. $y^2 + x^2 = 3^2$

D. $(y-3)^2 + (x-3)^2 = 3^2$

	SL 1

4. For the function $y = e^x$, the corresponding y values for $x=0$ and $x=1$ are:

A. $x = 0,\ y = 0;$
$x = 1, y = 1$

B. $x = 0, y = 1,$
$x = 1, y = 0$

C. $x = 0, y = e\ (2.718\ldots)$
$x = 1, y = 1$

D. $x = 0, y = 1$
$x = 1, y = e\ (2.718\ldots)$

	SL 1

5. Which of the below is the inverse function $y = a^x$?

A. $y = mx + c$

B. $y = log_a x$

C. $y = ax^2 + bx + c$

D. $y = e^{ax}$

	SL 1

6. A finite geometric series is written as 1 + 3 + 5 + 7. In sigma notation, this series is written as:

A. $\sum_{n=1}^{4} 2n - 1$

B. $\sum_{n=1}^{4} 2n + 1$

C. $\sum_{n=1}^{4} n - 1$

D. $\sum_{n=1}^{4} n + 1$

	SL 1

7. Equally likely events are:

A. events that are likely to happen.

B. events that are unlikely to have the same theoretical probability.

C. events that have the same theoretical probability of occurring.

D. events to calculate the mean and standard deviation.

	SL 1

8. A bell-shaped curve that describes the distributions of data is a:

A. probability function curve.

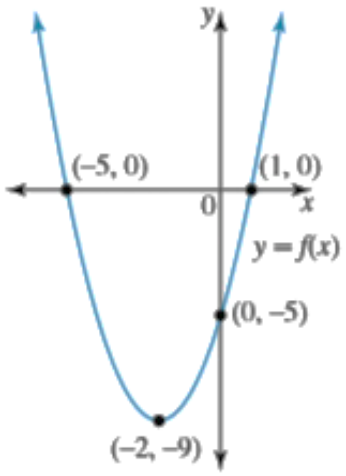
B. normal probability curve.

C. slanted curve.

D. raw scores curve.

	SL 1

9. The coordinates of the stationary point of the graph below are:



A. (-5, 0)

B. (1, 0)

C. (-2, -9)

D. (0, -5)

	SL 1

10. The rule for finding the anti-derivative of a function is given as:

A. $\int ax^n dx = \frac{ax^{n+1}}{n+1} + c, n \neq -1$

B. $\int ax^n dx = \frac{ax^{n-1}}{n-1} + c, n \neq -1$

C. $f'(x) = nax^{n-1}, \quad n \in R, a \in R$

D. $f'(x) = nax^{n+1}, n \in R, a \in R$

	SL 1

11. For the function $\int_a^b f(x)$, which of the below statement is **true** about ***a*** and ***b***?

A. a and b are called integrands.

B. a and b are called limits of integration.

C. a and b are called differentiation variables.

D. a and b are called limits of differentiation.

	SL 1

12. The amplitude for the function *f(x) = 2 sin (3x)* is:

A. 3

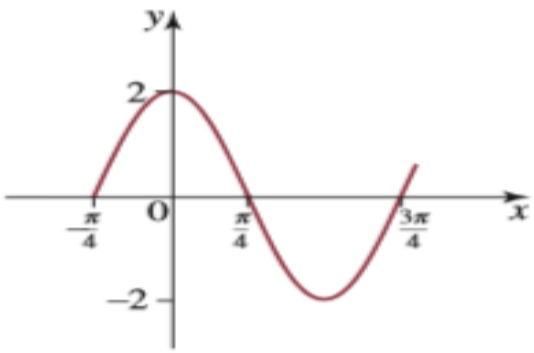
B. -3

C. -2

D. 2

	SL 1

13. The equation for the graph below could be:



A. $y = cos\ (2x) + 1$

B. $y = sin(\frac{x}{2})$

C. $y = 2\ Cos\ (2x)$

D. $y = 2\ sin\ (2x)$

	SL 1

14. Which of the following is TRUE about degrees and radians?

A. $\pi\ radians = 180^0$

B. $\pi\ radians = 210^0$

C. $\pi\ radians = 270^0$

D. $\pi\ radians = 360^0$

	SL 1

SECTION B: EXTENDED RESPONSES WEIGHTING 86

15. Solve for x in $4(x-3) < 6-2x$

SL 3

16. If $(x-1)$ is a factor of $f(x) = x^3 + 2x^2 - x - 2$, find the other two factors of the function.

SL 3

17. Use the quadratic formula to solve $3x^2 - 8x - 9$.

SL 2

18. Simplify $\frac{b^2-1}{b^2-b}$.

SL 2

19. Add and simplify the following expression:

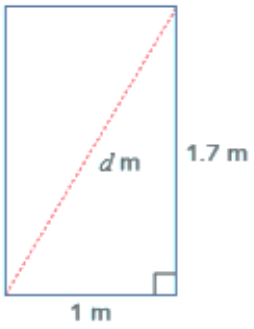
$$\frac{x-3}{2} + \frac{2x}{3}$$

SL 2

20. Initially there are 1000 bacteria in a given culture. The number of bacteria, *N,* is doubling every hour, so $N = 1000 \times 2^t$, where *t* is measured in hours.
How long is it until there are one million bacteria? Give your answer correct to 2 decimals.

SL 4

21. A door frame has height 1.7 m and width 1 m.
Could a square piece of board 2.2m by 2.2m pass through the doorway? Show all your working out.



SL 3

22. Find the equation of the line that passes through points (2 ,4) and (-6, 12)

SL 2

23. Find the midpoint of the line between the points (2, 4) and (-6, 12)

SL 2

24. $x = 2y - 3$ and $2x - 3y = 7$ are two straight lines. Find their point of intersection.

SL 3

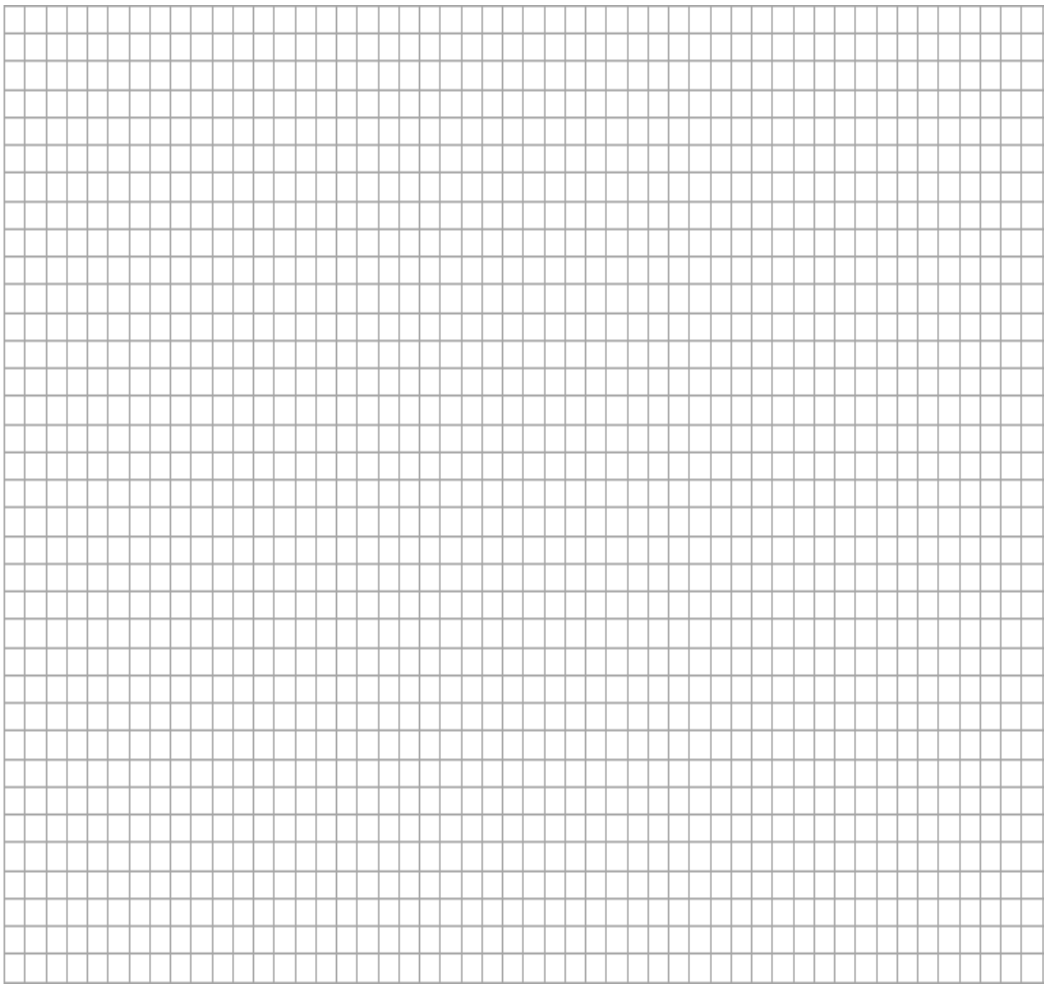
25. A circle has the equation $8x + x^2 - 2y = 64 - y^2$. Convert this equation to the standard form of circle equation.

SL 3

26. What would be the co-ordinates of the turning point for the function $f(x) = 5 + 4x - x^2$?

SL 2

27. Plot the graph of $f(x) = 5 + 4x - x^2$ labelling all intercepts and any turning point.



SL 4

28. Describe what happens to the function $f(x) = \frac{1}{x} + 1$, as the values of *x* increases. (as $x \to \infty$)

SL 2

29. This is a picture of the Gateway Arch in Missouri, United States. The line of the arch can be represented by the quadratic function, $y = \frac{-2}{95}(x - 95)^2 + 190$, where *y* is the height of the arch, at a horizontal distance x along the base (ground level), from one side of the arch to the other. Both x and y are in metres.

How wide is the arch at its base? *(hint: simplify the equation first)*

SL 4

30. In an arithmetic sequence, $t_5 = 6$ and $t_6 = 11$. Find the n^{th} term formula for the sequence.

SL 2

31. Suppose that in 2009, the number of tourists arriving in Samoa was 25,000. The number has been increasing by 10 percent every year. Estimate the total number of tourists that arrived in Samoa in the ten years starting from 2009. *(round to 2 decimal places)*

SL 3

Use the details below to answer Question 32.

A large number of asthma patients were asked to volunteer for the testing of a new medicine.
Only some of the volunteers were given the new medicine, but all of the volunteers were observed to see if they developed asthma on a cloudy day. The results are shown in the table below:

	Given Medicine	Not Given Medicine
Developed Asthma	148	59
Did not Develop Asthma	566	184

32. Given that a volunteer was given the new medicine, find the probability that they also developed asthma? *(Hint: Probability a volunteer was given new medicine=* $P(GM) = \frac{714}{957} = 0.746)$ (round to 2 decimal places)

SL 2

Refer to the details below to answer Questions 33 – 35.

Suppose a Tennis ball company makes tennis balls whose diameters are normally distributed with a mean of 70mm and a standard deviation of 1.5 mm. The tennis balls are packed and sold in cylindrical tins that each hold five tennis balls. A tennis ball fits in the tin if the diameter is less than 71.5 mm.

33. What is the probability that a randomly chosen tennis ball produced by the company has a diameter between 68.6 mm and 71.4 mm. *(round to 2 decimal places).*

SL 3

34. Suppose that 10 percent of tennis balls were below a certain diameter value, with z-score of -1.28. What diameter value would that be? *(round to 2 decimal places).*

SL 3

35. Suppose the company management now wants their engineers to change the manufacturing process so that 99.5% of all balls produced have a diameter between 68.6 mm and 71.4 mm. The mean is to stay at 70 mm but the standard deviation is to be changed.

What should the new standard deviation be, correct to 2 decimal places?

SL 4

36. If $f(x) = x^3 - 8$, find $f'(x)$ using the first principle.

SL 3

37. Find the derivative $f'(x)$ for the function $f(x) = \frac{4x^3+3x^2}{x}$

SL 2

38. Find the value $f'(4)$ for the function in Question 37.

SL 2

39. Draw the function $(x) = x^3 - x^2 - 8x + 8$, labelling all intercepts and stationary points.

SL 3

Refer to the details below to answer Questions 40 and 41.

Suppose that a Samoa road construction company is planning a proposed road through mountain Fao as shown on the right. The equation for the mountain is given as: $f(x) = (x + 2)(2 - x)$. The equation for the road is given as: $g(x) = x + 2$

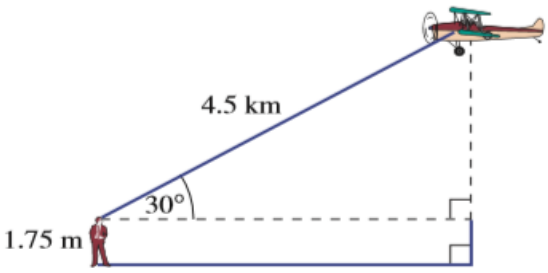
40. Draw both graphs *f(x) and g(x)* on the same axis clearly marking their points of intersection.

SL 3

41. Find the area bound between the mountain and the new road.

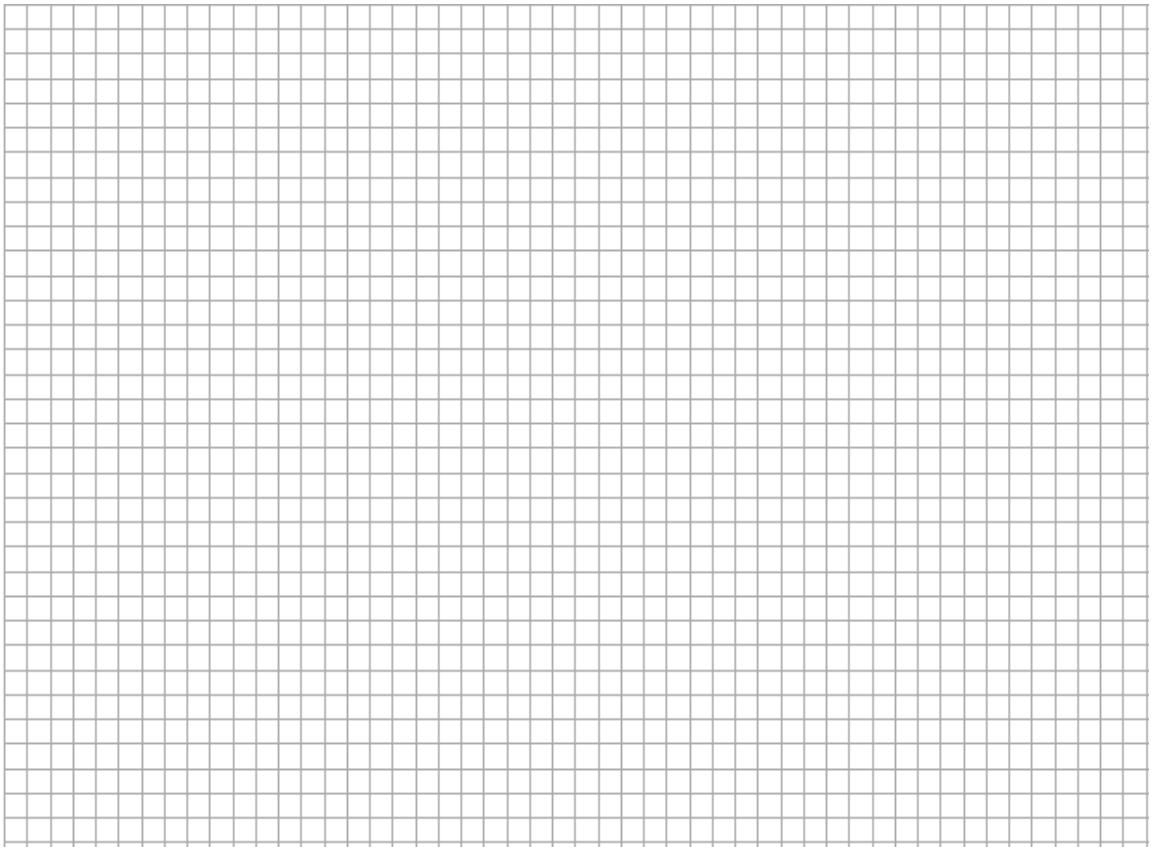
SL 4

42. The angle of elevation from an observer to an aircraft when it is 4.5 km away is 30°. How high is the aircraft above the ground if the observer's eye level is 1.75 m above the ground?



SL 2

43. Sketch the graph of $y = -4\,Sin(\frac{1}{2}x)$ over $[-2\pi, 4\pi]$



SL 3

44. Simplify the expression $\frac{cos^2 x}{1+\sin x}$

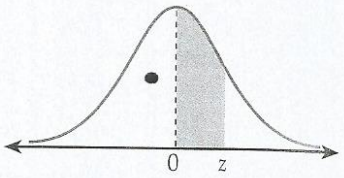
SL 2

45. Prove that $\frac{\cos\theta}{\sec\theta - tan\theta} = 1 + sin\theta$

SL 4

Normal distribution

Each entry gives the probability that the standardised normal random variable, Z, lies 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	Differences 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	.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

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MATHEMATICS

2021

(For Scorers only)

SECTIONS		Weighting	Scores	Check Scorer	AED Check
A	MULTIPLE CHOICE	14			
B	EXTENDED RESPONSES	86			
		100			