GOVERNMENT OF SAMOA

STUDENT EDUCATION NUMBER									

Samoa Secondary Leaving Certificate

MATHEMATICS

2024

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 to the appropriate places in this booklet.

STRANDS		Pages	Time (min)	Weighting
STRAND 1	NUMBER & OPERATION	2-3	23	13
STRAND 2	ALGEBRA	4-8	40	22
STRAND 4	MEASUREMENTS	9-12	31	17
STRAND 5	GEOMETRY	13-17	27	15
STRAND 6	TRIGONOMETRY	18-21	25	14
STRAND 7	RATE OF CHANGE & CALCULUS	22-27	34	19
TOTAL			**180**	**100**

Check that this booklet contains pages 2 - 29 in the correct order and that none of these pages are blank.

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

STRAND 1 **NUMBER AND OPERATION** **WEIGHTING 13**

For Questions 1 and 2, choose and write the LETTER of the correct answer in the box provided.

1. Which of the following statement is **INCORRECT**?

   A. A surd is a number that is written as a root.

   B. Every surd is an irrational number.

   C. A pure surd has only a single irrational number.

   D. A mixed surd has a mix of a rational number and an irrational number.

	SL 1

2. Which of the following is the correct simplification of $\sqrt{99}$?

   A. $9\sqrt{11}$

   B. $11\sqrt{9}$

   C. $3\sqrt{11}$

   D. $11\sqrt{3}$

	SL 1

3. Given $1152 = 4 \times 9 \times 16 \times 2$, simplify $\sqrt{1152}$.

SL 2

4. Evaluate $\sqrt{180} - \sqrt{20}$ leaving your answer in surd form.
(Do not use a calculator)

SL 2

5. Rationalise the denominator of $\frac{2}{\sqrt[3]{2}}$.

SL 3

6. Use the rules of surd to simplify the expression $6\sqrt{5} + \sqrt{80} = 22.36$ and $12\sqrt{5} + \sqrt{320} =$ ☐ . (Do not use a calculator)

SL 4

For Questions 7 and 8, choose and write the LETTER of the correct answer in the box provided.

7. Factors of $6x^2 + 13x - 5$ are:

A. $(3x + 5)$ and $(2x - 1)$

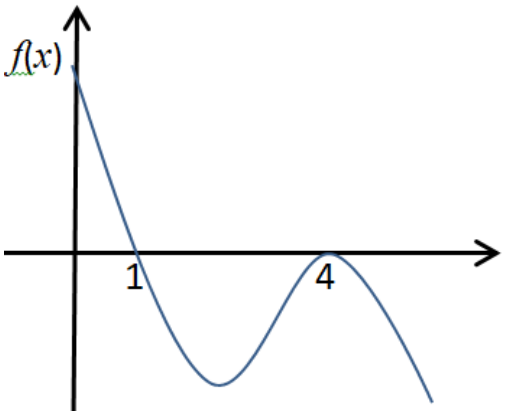
B. $(3x - 5)$ and $(2x + 1)$

C. $(3x - 1)$ and $(2x + 5)$

D. $(3x + 1)$ and $(2x - 5)$

	SL 1

8. A possible expression for the function $f(x)$ in the factorized form is:



A. $(x - 1)(x - 4)^2$

B. $(x + 1)(x + 4)^2$

C. $(x + 1)(x - 4)(x + 4)$

D. $(1 - x)(x - 4)^2$

	SL 1

9. Use laws of logarithm to simplify and evaluate $\log_3 162 - \log_3 2$

	SL 2

10. Simplify $\frac{4\,a^3\,b^6\,c^{-3}}{2\,a^4\,b\,c^2}$

SL 2

11. Find the gradient of a line perpendicular to the line $10x + 4y = 20$.

SL 2

12. **Circle A** is defined by the equation $(x + 1)^2 + (y - 3)^2 = 9$.

(a) **Circle B** has a radius of 3 and has the origin as its center. Give the transformation that maps **Circle A** to **Circle B**. **[1 mark]**

SL 3

(b) Give transformation that maps the unit circle $x^2 + y^2 = 1$ to **Circle A**.

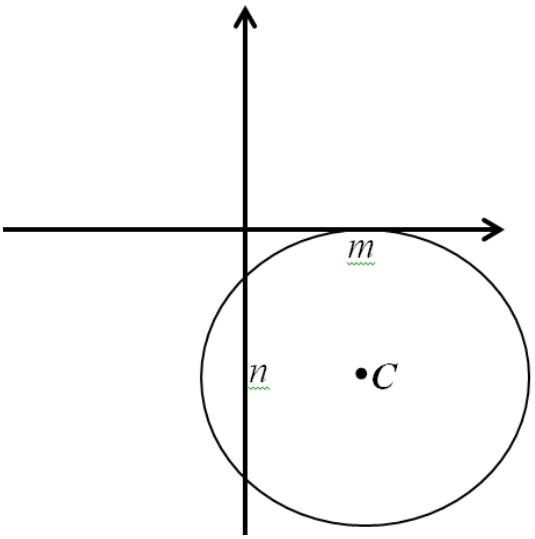
[1 mark]

(c) **Circle C** has the equation $(x - 6)^2 + (y + 1)^2 = 9$. Give the transformation that maps **Circle A** to **Circle C**. **[1 mark]**

13. Given $f(x) = 2x^3 + 7x^2 - 14x + 5$, solve $f(x) = 0$. [Hint: $f(-5) = 0$].

SL 3

14. The circle below has the equation $x^2 + y^2 - 4x + 6y + 4 = 0$. The coordinates of the center C, are (m, n). Give the translation that maps the given circle to a circle of the same radius BUT its center is the origin.



SL 4

15. Asotasi sold a pig and a cow for \$2,280, thereby making a profit of 20% on the pig and 10% on the cow. Later on he realized he would have earned \$40 more if he sold his animals for 10% profit on the pig and 20% on the cow. If x is the cost price of the pig and y is the cost price of the cow:

SL 4

(a) Give the two linear equations that model the above information. **[1 mark]**

(b) Solve the system of two linear equations obtained in (a). **[2 marks]**

(c) What does your result in (b) represent? **[1 mark]**

For Questions 16 to 18, choose and write the LETTER of the correct answer in the box provided.

16. The first term "a" and the common difference "d" of the infinite series $\sum(3n + 2)$ are:

A. a = 8 and d = 3

B. a = 5 and d = 3

C. a = 3 and d = 5

D. a = 3 and d = 8

	SL 1

17. Given the Geometric series 3 + 15 + 75 + 375 + . . . + t_n , the formula for t_n is:

A. $t_n = 5 \times 3^{n-1}$

B. $t_n = 5 \times 3^n$

C. $t_n = 3 \times 5^{n-1}$

D. $t_n = 3 \times 5^n$

	SL 1

18. The first 5 terms of the infinite series $\sum[5 - (2 - n^2)]$ where $n \in N$ are:

A. $4 + 3 + 4 + 7 + 12 + \ldots$

B. $3 + 4 + 7 + 12 + 19 + \ldots$

C. $4 + 7 + 12 + 19 + 28 + \ldots$

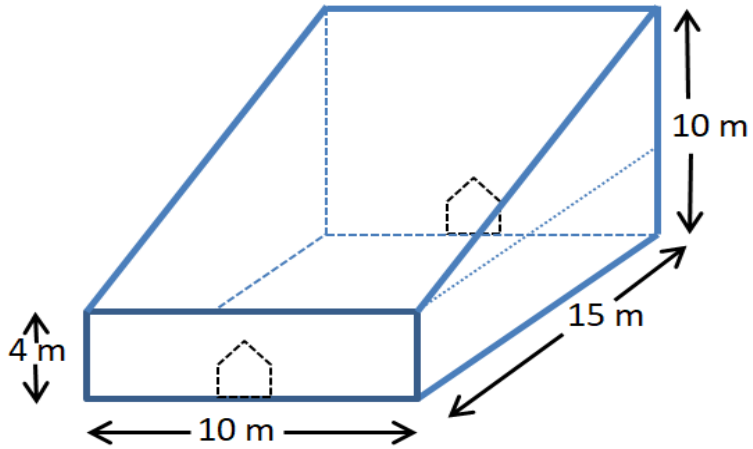
D. $3 - 4 - 7 - 12 - 19 - \ldots$

	SL 1

19. $9k^{-1},\ 15,\ 20k + 15, \ldots$ is a geometric sequence. Give the actual numerical values of the first three terms.

SL 3

20. Given below is a concept drawing of a solid block.



SL 2

Calculate the volume of the solid block.

21. This table converts inches to centimeters.

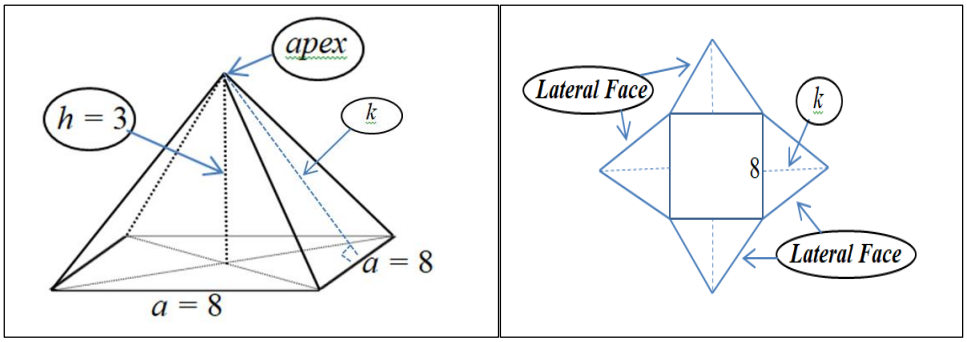
inches	1	2	3	4	5	6	…
centimeters	2.54	5.08	7.62	10.16	12.7	15.24	…

SL 2

Compare the equivalent values of the two units to estimate centimeter equivalent of 2.8 inches, 5.25 inches, 5.5 inches, and 5.75 inches.

22. Consider the pyramid with a square base, each side $a = 8$ (diagram on the left). The perpendicular height of the pyramid is $h = 3$ and the apex is directly above the center of the base. The surface of the pyramid can be modelled as a square of size 8 and four equal lateral faces of triangles with the sides of the square as their bases (diagram on the right).

PYRAMID **MODEL**

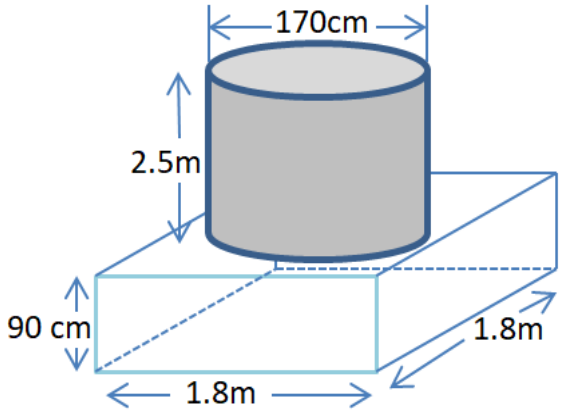


SL 3

(a) Calculate the value of k. **[1 mark]**

(b) Calculate the surface area of the pyramid. **[2 marks]**

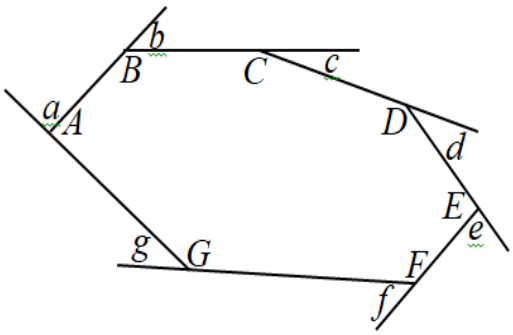
23. A cylindrical concrete water tank is built on a concrete block with a square base as in the model below. The diameter of the tank is 170 cm and its height is 2.5 m. The length of each side of the base is 1.8 m and its thickness is 90 cm. As a general guideline, paint coverage per litre is 6.5 metres squared for concrete surface. Calculate the amount of paint needed for the tank and its stand.



SL 4

For Questions 24 and 25, choose and write the LETTER of the correct answer in the box provided.

24. Use the properties of exterior and interior angles of polygons to identify the correct equation.



A. $a + b + c + d + e + f + g = 90°$

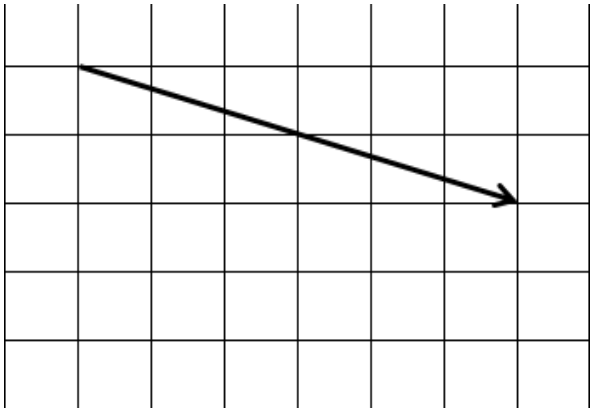
B. $a + b + c + d + e + f + g = 180°$

C. $A + B + C + D + E + F + G = 360°$

D. $A + B + C + D + E + F + G = 900°$

	SL 1

25. The vector on the grid below is best presented using the x and y coordinates as:



A. $\begin{pmatrix} 3 \\ 1 \end{pmatrix}$

B. $\begin{pmatrix} -6 \\ -2 \end{pmatrix}$

C. $\begin{pmatrix} 6 \\ 2 \end{pmatrix}$

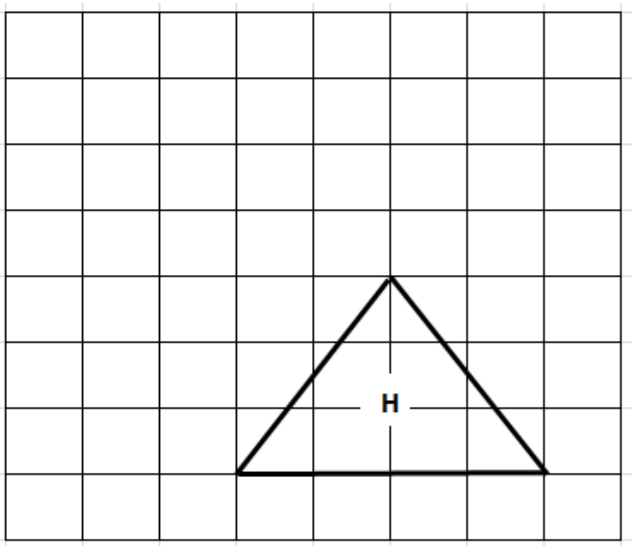
D. $\begin{pmatrix} 6 \\ -2 \end{pmatrix}$

	SL 1

26. Calculate the size of the angle between the line whose equation is $x + \sqrt{3}y + 1 = 0$ and the positive direction of x.

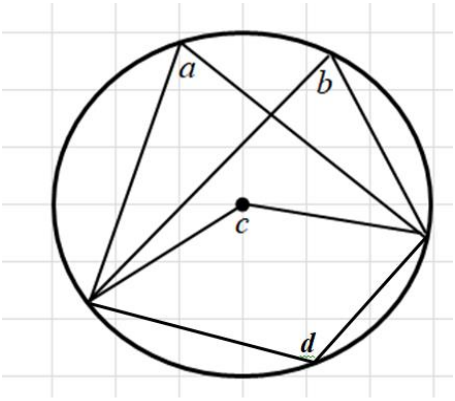
SL 2

27. Triangle H is translated to get triangle K. If the vector of displacement is $\begin{pmatrix} -2 \\ 3 \end{pmatrix}$, draw triangle K on the grid.



SL 2

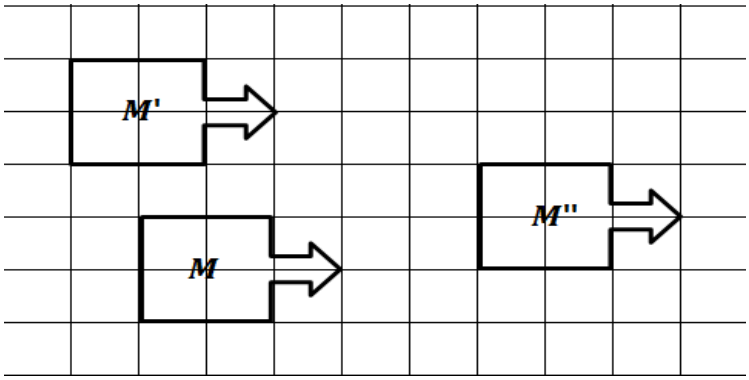
28. Consider the diagram below.



SL 3

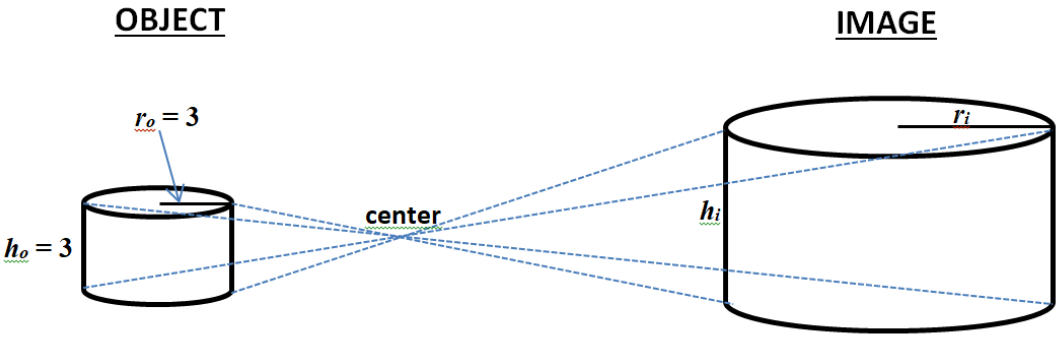
If $a + c = 75$, give the numerical values of *a, b, c,* and *d*.

29. On the diagram below, M' is the translation of M by vector ***p*** and M'' is the translation of M' by vector ***q***.
Use vector addition to find a single vector of translation that takes M to M''.
Show all work.



SL 3

30. Given here is a result of an enlargement with a scale factor of -2.



SL 3

The surface area of a cylinder is calculated using the formula $= 2\pi r(r + h)$.
Calculate the surface areas of both cylinders (Object and Image).

For Questions 31 to 33, choose and write the LETTER of the correct answer in the box provided.

31. The amplitude of $y = 2 + 1.7 \sin 2.5x$ is:

A. 1.7

B. 2.5

C. 2

D. 3.7

	SL 1

32. The period of $y = 2 + 1.7 \sin 2.5x$ is:

A. $\frac{\pi}{5}$

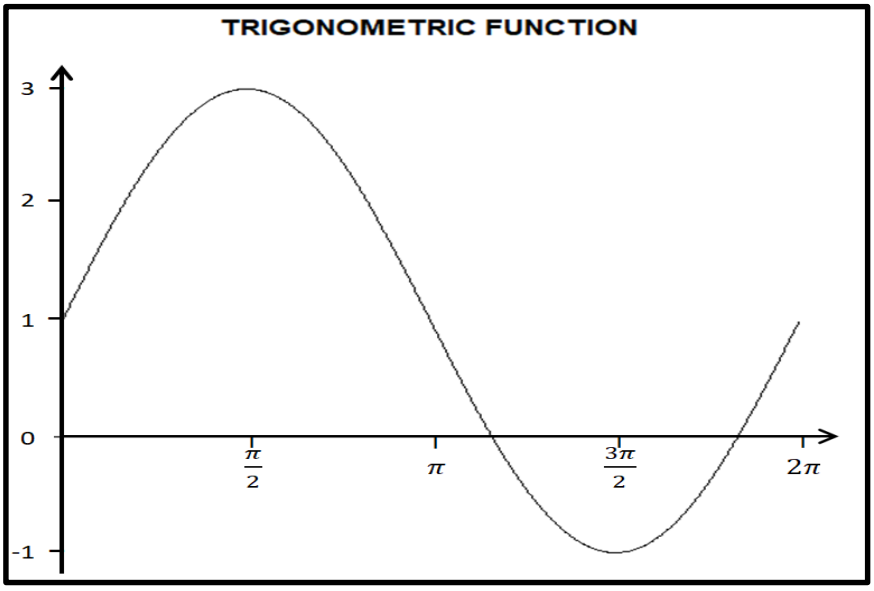
B. $\frac{2\pi}{5}$

C. $\frac{3\pi}{5}$

D. $\frac{4\pi}{5}$

	SL 1

33. This graph is a sketch of a trigonometry function.



The function whose graph shown above is:

A. $y = 2 + cos\left(x - \frac{\pi}{2}\right)$

B. $y = 1 + 2cos\left(x - \frac{\pi}{2}\right)$

C. $y = 2 + cos\left(x + \frac{\pi}{2}\right)$

D. $y = 1 + cos\left(x + \frac{\pi}{2}\right)$

	SL 1

34. Points A (4, -5) and B (-2, -7) defines the line segment AB. Find the coordinates of the midpoint of the line segment AB.

SL 2

35. Use trigonometric identities to prove that $\frac{\cos\theta}{1+sin\theta} = \frac{1-sin\theta}{cos\ \theta}$.

SL 2

36. Solve $5\sin(\theta - 30) = -3$ to obtain values for θ where $0^{\circ} \leq \theta \leq 360^{\circ}$.
Give your answers in three significant figures.

SL 3

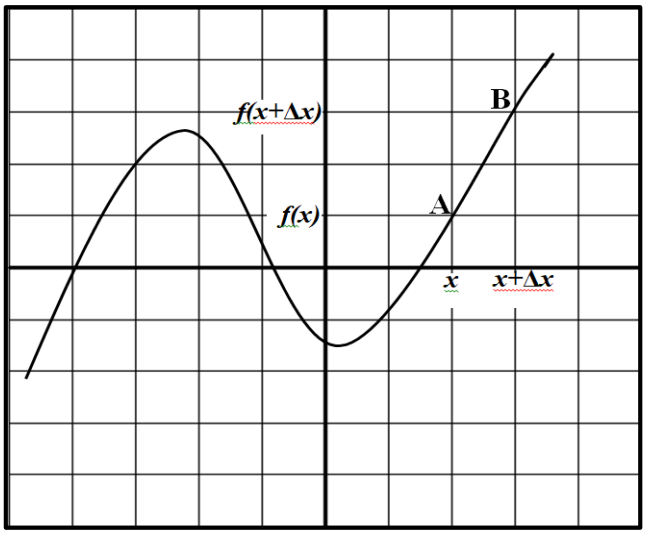
37. Use compound angles to find the value of $cos\,\frac{\pi}{12}$ in the form $\frac{\sqrt{k}+\sqrt{m}}{p}$, where $k \in I, m \in I$ and $p \in I$. $\left(hint: \ \frac{\pi}{12} = \frac{\pi}{3} - \frac{\pi}{4}\right)$.

$$\sin(A \pm B) = \sin A \cos B \ \pm cosA \sin B$$
$$\cos(A \pm B) = \cos A \cos B \ \mp \ \sin A \sin B$$

SL 4

For Question 38 to 41, choose and write the LETTER of the correct answer in the box provided.

Use this graph to answer Questions 38 and 39.



38. Which of the following best describes the gradient of the secant line AB?

A. $m = \dfrac{f(x) - f(x + \Delta x)}{\Delta x}$

B. $m = \dfrac{f(x) - f(x + \Delta x)}{-\Delta x}$

C. $m = \dfrac{f(x + \Delta x) - f(x)}{-\Delta x}$

D. $m = \dfrac{f(x) + f(x + \Delta x)}{\Delta x}$

	SL 1

39. Which of the following best describes what happens when B moves closer and closer to A?

A. $m = \lim\limits_{\Delta x \to 0} \dfrac{f(x+\Delta x) - f(x)}{-\Delta x}$

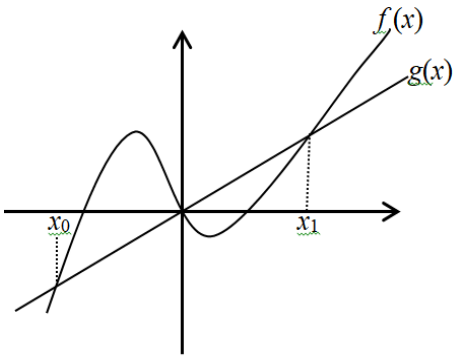
B. $m = \lim\limits_{\Delta x \to 0} \dfrac{f(x+\Delta x) - f(x)}{\Delta x}$

C. $m = \lim\limits_{\Delta x \to 0} \dfrac{f(x) - f(x+\Delta x)}{\Delta x}$

D. $m = \lim\limits_{\Delta x \to 0} \dfrac{f(x) + f(x+\Delta x)}{\Delta x}$

	SL 1

40. Below is a rough sketch of functions $f(x)$ and $g(x)$ on the same pair of axes.
Which of the following definite integrals best describes the area enclosed by the two functions f(x) and g(x)?



A. $A = \int_{x_0}^{x_1} (g(x) - f(x))dx$

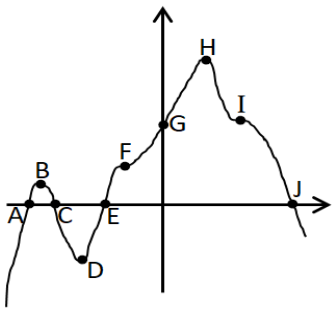
B. $A = \int_{x_0}^{0} (g(x) - f(x))dx + \int_{0}^{x_1} (g(x) - f(x))dx$

C. $A = \int_{x_0}^{0} (f(x) - g(x))dx + \int_{0}^{x_1} (g(x) - f(x))dx$

D. $A = \int_{x_0}^{0} (g(x) - f(x))dx - \int_{0}^{x_1} (g(x) - f(x))dx$

SL 1

41. Consider the diagram shown.
Half of the marked points on the given curve are stationary points. Which of the following is a set of all the stationary points?



A. {B, C, D, F, H, I}

B. {B, D, F, G, H}

C. {B, D, F, H, I}

D. {B, D, E, F, H}

SL 1

42. The gradient of $y = x^2 + x - 5$ at point (k, l) is -1. Find the value of k.

SL 2

43. The derivative of $f(x) = -x^4 - x^3 + 3x^2 + 5x + 2 = -(x + 1)^3(x - 2)$ is:

$$f'(x) = -4x^3 - 3x^2 + 6x + 5 = (x + 1)^2(5 - 4x).$$

Hence, stationary points of the graph of $f(x)$ are at $x = -1$ and $x = \frac{5}{4}$.

SL 3

(a) Give the two stationary points of $f(x)$. **[1 mark]**

(b) Determine the nature of your stationary points in (a) using $f''(x)$. **[2 marks]**

44. Give the equations of the tangent and the normal to the graph of $y = 2x^2 - 3x - 2$ at the point $\left(\frac{3}{2}, -2\right)$.

SL 3

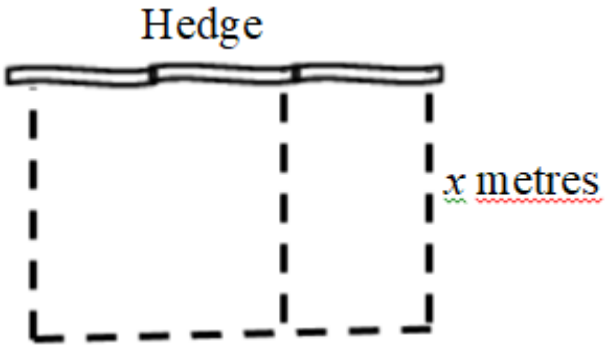
45.

Differentiate $f(x) = 2x^2 - 5x + 1$ using the First Principle;

$$f'(x) = \lim_{h \to 0} \frac{f(x+h) - f(x)}{h}$$

SL 3

46. Paulo plans to build two paddocks alongside a dense hedge, one for his cattle and one for his pigs. He wants to enclose the largest possible area with 2,000 metres of fencing material available for him. The model of his plan is given below.



(a) Give the expression of the area of Paulo's two paddocks in terms of x.

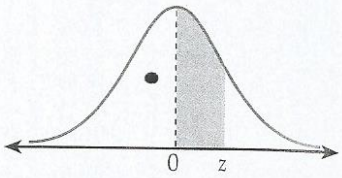
[1 mark]

(b) Calculate the maximum area of Paulo's two paddocks. **[3 marks]**

SL 3

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

STUDENT EDUCATION NUMBER									

SSLC MATHEMATICS

2024

(For Scorers only)

STRANDS		Weighting	Scores	Check Scorer	AED Check
STRAND 1	NUMBER AND OPERATION	13			
STRAND 2	ALGEBRA	22			
STRAND 4	MEASUREMENTS	17			
STRAND 5	GEOMETRY	15			
STRAND 6	TRIGONOMETRY	14			
STRAND 7	RATE OF CHANGE & CALCULUS	19			
TOTAL MARKS		**100**			