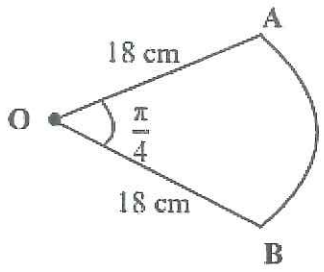
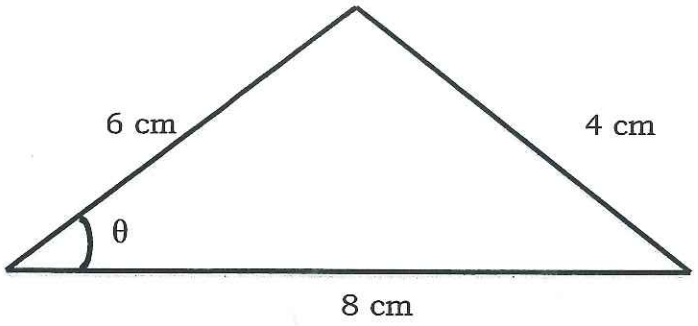
3. A garden in the form of a **sector** with centre **O**, radius 18cm and angle $\frac{\pi}{4}$ radians is shown below.



The garden is to be fenced on all sides. How much fencing wire will be needed?
(2 marks)

4. Solve the **trigonometry equation** $\sin(\theta + 45^0) = \frac{1}{3}$ for $0^0 \leq \theta \leq 360^0$
(2 marks)

5. Calculate the value of the side angle Θ shown in the triangle given below.



(2 marks)

6. Sketch the graph of $y = 2\sin(\theta + 90^0)$ for $0^0 \leq \theta \leq 360^0$ **(2 marks)**

STRAND 6 MATRICES AND TRANSFORMATION [7 marks]

- This strand has **2 Questions.**
- Choose the best answer and write the **letter** of your choice for **Question 1.**
- Show all working for **Question 2.**

1. Under **Reflection**, all points on the mirror line are **invariant.** The other invariant **features** are?

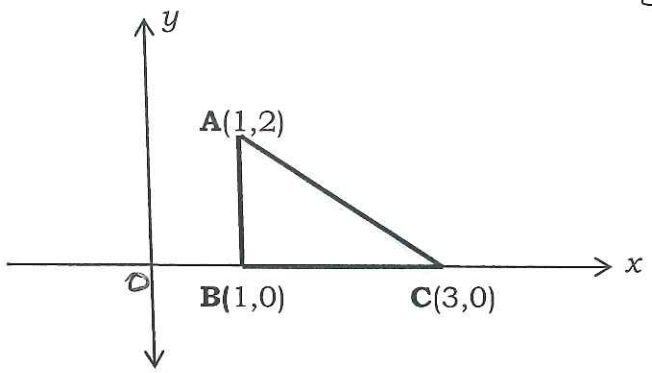
   A. length, angle, size and area.

   B. length, angle, orientation and area.

   C. length, angle, features and orientation.

   D. length, angle, shape and features. **(1 mark)**

2. Triangle **ABC** shown below is transformed by the matrix **M** = $\begin{bmatrix} 1 & 0 \\ 0 & -1 \end{bmatrix}$



The coordinates of **A'** = (1,-2) under the transformation by matrix **M**.

(i) Find the coordinates of **B'** and **C'** the images of **B** and **C** under the transformation by matrix **M**. **(2 marks)**

(ii) On a pair of axes given in the **Answer Booklet** draw and label the image **A'B'C'** on this triangle. **(2 marks)**

(iii) Describe **fully** the transformation represented by matrix N. **(1 mark)**

(iv) Give the coordinate of one of the **invariant points** under this transformation. **(1 mark)**

STRAND 7 STATISTICS [6 marks]

- This strand has **3 Questions.**
- Choose the best answer and write the **letter** of your choice for **Questions 1-2.**
- Show all working for **Question 3.**

1. In which of the following distributions do the **mode** and the **median** have the same value.

   A. 1, 1, 2, 2

   B. 1, 2, 3, 4

   C. 1, 4, 4, 9

   D. 3, 3, 6, 9, 11 **(1 mark)**

2. A set of scores has **standard deviation** of 3. If all the scores are **added** by 4, the **new standard deviation** will be

   A. 3

   B. 6

   C. 9

   D. 7 **(1 mark)**

3. The table below shows scores from a maths quiz.

x	f	fx	$(x - \bar{x})^2$	$f(x - \bar{x})^2$
1	1	4		4
2	4	8		
3	9	27	0	0
4	6	24	1	6
Total	**20**	**60**		

(i) Calculate the **mean** score. **(1 mark)**

(ii) Hence, complete the table by filling in the missing values in the boxes in the boxes in the **Answer Booklet**. **(2 marks)**

(iii) Calculate the **standard deviation**. **(1 mark)**

STRAND 8 PROBABILITY [10 marks]

- This strand has **5 Questions.**
- Choose the best answer and write the **letter** of your choice for **Questions 1-2.**
- Show all working for **Question 3 — 5.**

1. A set of quiz scores is **normally distributed** with mean = 15 and standard deviation = 3.

   A score selected at random is **very likely** to lie between

   A. 12 and 18

   B. 9 and 21

   C. 6 and 24

   D. 15 and 24 **(1 mark)**

2. The outcomes of a spinner with numbers 1 to 4 and a coin tossed together are shown below.

spinner

coin		1	2	3	4
	H	H,1	H,2	H,3	H,4
	T	T,1	T,2	T,3	T,4

What is the probability of getting a **head** and **an odd number**?

A. $\frac{1}{8}$

B. $\frac{2}{8}$

C. $\frac{3}{8}$

D. $\frac{4}{8}$ **(1 mark)**

3. The **lattice diagram** below shows the sample space of rolling two dice.

Die 2

Die 1	1	2	3	4	5	6
1	(1, 1)	(1, 2)	(1, 3)	(1, 4)	(1, 5)	(1, 6)
2	(2, 1)	(2, 2)	(2, 3)	(2, 4)	(2, 5)	(2, 6)
3	(3, 1)	(3, 2)	(3, 3)	(3, 4)	(3, 5)	(3, 6)
4	(4, 1)	(4, 2)	(4, 3)	(4, 4)	(4, 5)	(4, 6)
5	(5, 1)	(5, 2)	(5, 3)	(5, 4)	(5, 5)	(5, 6)
6	(6, 1)	(6, 2)	(6, 3)	(6, 4)	(6, 5)	(6, 6)

What is the probability of observing

(a) a **sum** of 7? **(1 mark)**

(b) an **odd number** on **die 1**? **(1 mark)**

4. A jar contains 4 red marbles and 3 blue marbles. Two marbles are drawn in succession from the jar **without replacement**.

What is the probability of picking 2 marbles of the **same colour**?

(2 marks)

5. The weights of Year 12A and Year 12C students are **normally distributed** with a mean of 70 kg and a standard deviation of 5 kg.

(a) What is the probability that a randomly selected Year 12A and Year 12C student weighs **more than** 63 kg? Give your answer to 4 **decimal places.**

(3 marks)

(b) From a sample of 100 Year 12A and Year 12C students, how many may be **expected** to weigh **more than** 63 kg? **(1 mark)**

STRAND 9 CALCULUS [18 marks]

- This strand has **6 Questions.**
- Choose the best answer and write the **letter** of your choice for **Questions 1-2.**
- Show all working for **Question 3 — 6.**

1. The derivative of a function $f(x)$ is given by $f'(x) = -2x$.

   For which values of x is the function $f(x)$ **decreasing**?

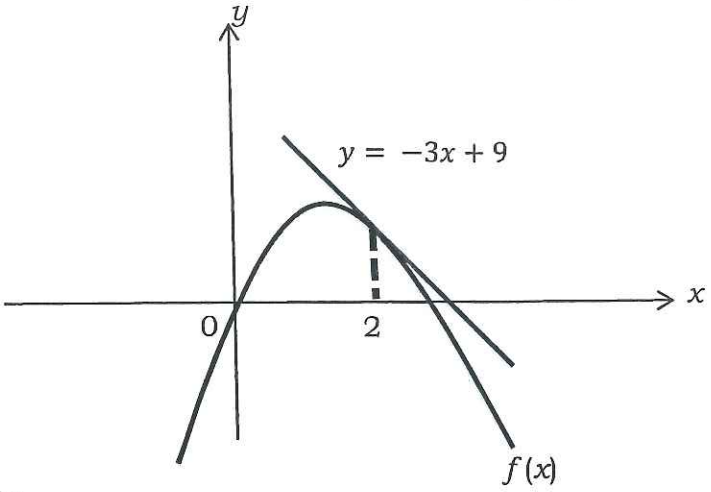
   A. $x < 0$

   B. $x > 0$

   C. $x \leq 0$

   D. $x \geq 0$ **(1 mark)**

2. The line $y = -3x + 9$ is **tangent** to the parabola $f(x)$ at $x = 2$



$f'(2)$ is equal to

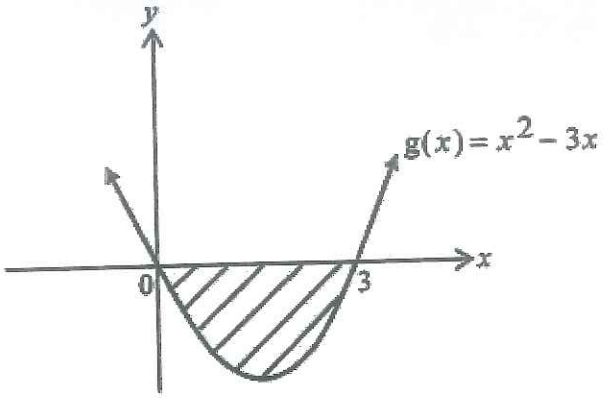
A. -6

B. 4

C. 2

D. -3 **(1 mark)**

3. The area bounded by the curve $g(x) = x^2 - 3x$ and the x-axis is shaded below.



Calculate the **area** of the shaded region. **(3 marks)**

4. A **cubic function** is given by the equation $y = x^3 + x^2 - 5x + 3$

(i) **Differentiate** to find $\frac{dy}{dx}$ **(2 marks)**

(ii) Hence, determine the coordinates of the **turning points**. **(3 marks)**

5. The **gradient** function of a curve is given by $\frac{dy}{dx} = 2x - 3$.
Find the equation of the curve given that it passes through the point (1, 5).
(3 marks)

6. A BLK factory produces rugby jerseys and **sells** them for \$85 each. The **cost**, in dollars, of making x jerseys is given by $C(x) = 4.2x^2 + x$

(a) What is the **cost** of making a set of jerseys for 25 players?
(1 mark)

(b) Find the formula for the **profit** made by selling x jerseys.
(2 marks)

(c) Determine the number of jerseys the factory should produce and sell to **maximize** its profit. **(2 marks)**

THE END

Formulae

Strand 1 - Basic Mathematics

Exponents

1. $a^m \times a^n = a^{m+n}$
2. $a^m \div a^n = a^{m-n}$; $a \neq 0$
3. $(a^m)^n = a^{mn}$
4. $(ab)^m = a^m b^m$
5. $a^0 = 1$; $a \neq 0$

Logarithms

1. $\log ab = \log a + \log b$
2. $\log \frac{a}{b} = \log a - \log b$
3. $\log x^n = n \log x$
4. $y = b^x \leftrightarrow \log_b y = x$
5. $y = e^x \leftrightarrow x = \ln y \quad (\ln y = \log_e y)$

Strand 2 - Algebra

Arithmetic Sequence

1. $T_n = a + (n-1)d$
2. $S_n = \frac{n}{2}[2a + (n-1)d]$

Quadratic Formula

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

Geometric Sequence

1. $S_n = \frac{a(1-r^n)}{1-r}$; $r \neq 1$
2. $T_n = ar^{n-1}$
3. $S_\infty = \frac{a}{1-r}$; if $|r| < 1$

Strand 3 - Graphs

Equation of a circle centre (a, b) with radius r is
$(x-a)^2 + (y-b)^2 = r^2$

Strand 4 - Coordinate Geometry

1. **Distance**

$$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$

2. **Equation** of the line through (x_1, y_1) and (x_2, y_2) is

$$y - y_1 = m(x - x_1)$$

3. **Gradient**

$$m = \frac{y_2 - y_1}{x_2 - x_1}$$

Strand 5 - Trigonometry

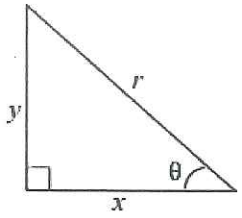
Area

1. Area of triangle $= \frac{1}{2}ab\sin C$
2. Area of Sector $= \frac{1}{2}r^2\theta$

Sine and Cosine Rules

1. $\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$
2. $a^2 = b^2 + c^2 - 2bc\cos A$

Basic Functions



1. $\sin\theta = \frac{y}{r}$
2. $\cos\theta = \frac{x}{r}$
3. $\tan\theta = \frac{y}{x} = \frac{\sin\theta}{\cos\theta}$
4. $\cot\theta = \frac{x}{y} = \frac{\cos\theta}{\sin\theta}$
5. $\sec\theta = \frac{r}{x} = \frac{1}{\cos\theta}$
6. $\operatorname{cosec}\theta = \frac{r}{y} = \frac{1}{\sin\theta}$

Basic Identities

1. $\cos^2\theta + \sin^2\theta = 1$
2. $\tan^2\theta + 1 = \sec^2\theta$

Strand 6 – Matrices and Transformation

If $M = \begin{pmatrix} a & b \\ c & d \end{pmatrix}$,

1. $\det M \ (|M|) = ad - bc$
2. $M^{-1} = \frac{1}{|M|}\begin{pmatrix} d & -b \\ -c & a \end{pmatrix}$

Strand 7 - Statistics

Individual Data

1. $\bar{x} = \frac{\sum x}{n}$
2. $s = \sqrt{\frac{\sum (x-\bar{x})^2}{n}}$

Grouped Data

1. $\bar{x} = \frac{\sum fx}{\sum f}$
2. $s = \sqrt{\frac{\sum f(x-\bar{x})^2}{\sum f}}$

Strand 9 - Calculus

Differentiation

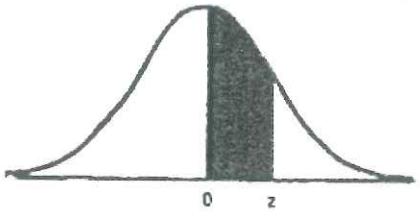
$\frac{d}{dx}(x^n) = nx^{n-1}$

Indefinite Integral

$\int x^n dx = \frac{x^{n+1}}{n+1}$

Strand 8 - Probability

AREAS UNDER NORMAL PROBABILITY CURVE



The tabulated value is the probability that the standardized normal variate Z (with μ=0, σ=1) lies between 0 and z.
e.g. P(0 < Z < 1.43) = 42.36%

z	0	1	2	3	4	5	6	7	8	9	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	.4736	.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	.4997	.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	.4999	.4999	.4999	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