TANGLIN SECONDARY SCHOOL
PRELIM EXAMINATION 2020
Secondary 4 Express & 5 Normal(Academic)

NAME _____

CLASS _____ **INDEX NO.** _____

ELEMENTARY MATHEMATICS 4048/01

Paper 1 **2 hours**

Candidates answer on the Question Paper.

Additional Materials: NIL

READ THESE INSTRUCTIONS FIRST

Write your index number and name on all the work you hand in.

Write in dark blue or black pen.You may use an HB pencil for any diagrams or graphs.

Do not use staples, paper clips, highlighters, glue or correction fluid.

Answer all questions on the answer spaces provided.

If working is needed for any question, it must be shown with the answer. Omission of essential working will result in loss of marks.

The use of an approved scientific calculator is expected, where appropriate.

If the degree of accuracy is not specified in the question, and if the answer is not exact, give the answer to three significant figures. Give answers in degrees to one decimal place.

For π, use either your calculator value or 3.142, unless the question requires the answer in terms of π.

For Examiner's Use	
Total	80

Calculator Model:

Mathematical Formulae

Compound Interest

$$\text{Total Amount} = P\left(1+\frac{r}{100}\right)^n$$

Mensuration

Curved surface area of a cone = $\pi r l$

Curved surface area of a sphere = $4\pi r^2$

$$\text{Volume of a cone} = \frac{1}{3}\pi r^2 h$$

$$\text{Volume of a sphere} = \frac{4}{3}\pi r^3$$

$$\text{Area of a triangle } ABC = \frac{1}{2}ab\sin C$$

Arc length = $r\theta$, where θ is in radians

$$\text{Sector area} = \frac{1}{2}r^2\theta, \text{ where } \theta \text{ is in radians}$$

Trigonometry

$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

$$a^2 = b^2 + c^2 - 2bc\cos A$$

Statistics

$$\text{Mean} = \frac{\sum fx}{\sum f}$$

$$\text{Standard deviation} = \sqrt{\frac{\sum fx^2}{\sum f} - \left(\frac{\sum fx}{\sum f}\right)^2}$$

Answer **all** the questions.

1 **(a)** Simplify $\left(x^{\frac{1}{3}}\right)^6$.

Answer (a)..... [1]

(b) Given that $3^x \div 3^{-3} = 3^{12}$, find the value of x.

Answer (b)..... [1]

---

2 Factorise completely $8xy - 1 - 2x + 4y$.

Answer ..... [2]

3 Express as a single fraction in its simplest form $\frac{2x}{3x-1}+\frac{(2-x)}{1-3x}$.

Answer ..... [2]

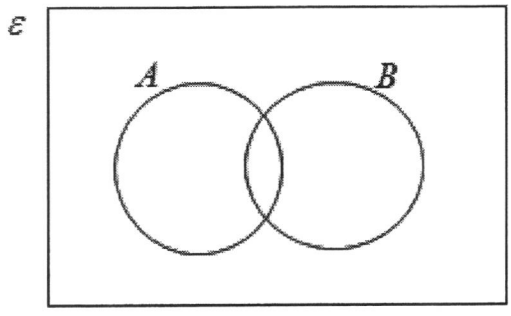
4 **(a)** Express 140 as a product of its prime factors.

Answer (a)..... [1]

(b) The number $140n$ is a perfect square. Find the smallest positive integer value of n.

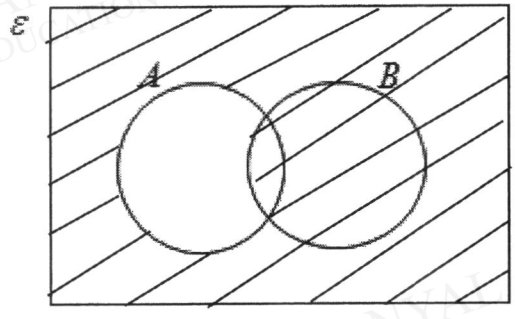
Answer (b).....[1]

5 **(a)** On the diagram below, shade the region representing $A' \cap B$.



[1]

(b) Write down the set represented by the following shaded region.



Answer (b)..... [1]

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6 Alice invested \$5 000 for 6 years.
The rate of compound interest was fixed at r % per annum.
At the end of the 6 years, there was \$6 955.

Find the value of r.

Answer ..... [2]

7 A bag contains 3 blue pens, 6 purple pens and 7 yellow pens.

(a) A pen is taken at random from the bag.

Find the probability that it is not yellow.

Answer (a) ..... [1]

(b) x purple pens are removed from the bag. The probability of choosing a blue pen is now $\frac{1}{4}$. Find the value of x.

Answer (b) ..... [1]

---

8 The number of people infected with a type of virus is given as 254 000 globally, correct to the nearest thousand in March 2020. Write down the

(a) minimum number of people, and

(b) the maximum number of people that could be affected globally.

Answer (a)..... [1]

(b) ..... [1]

9 Use factorisation to solve the following equation.

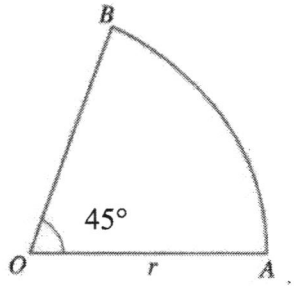
$$6x^2 - 7x - 20 = 0$$

Answer ..... [3]

10 The parking rate at a mall in Orchard Road is \$2.00 for the 1st hour and \$1.10 for subsequent 15 minutes or part thereof.
Form an inequality in x where x is the number of minutes the car has parked after the first hour and find the maximum number of minutes a car has been parked if the parking charge is more than \$9 but less than \$10.

Answer ..... [2]

11 The diagram shows a sector of a circle of centre O. The angle subtended at the centre of the circle is 45° and the area of the sector ABO is 10 cm^2.



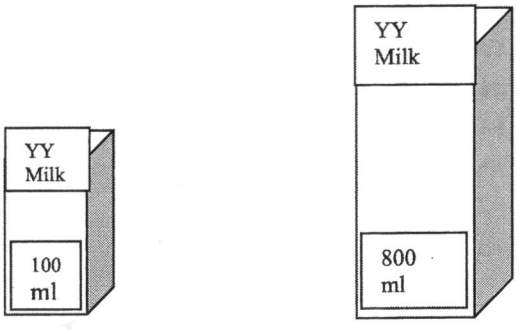
(a) Convert 45° to radians, leaving your answer in terms of π.

Answer ..... [1]

(b) Find the radius of the circle.

Answer ..... [2]

12 A manufacturer produces two geometrically similar cartons of milk. The volume of the smaller carton and the larger carton are 100 ml and 800 ml respectively.



(a) Find the ratio of height of smaller carton : height of larger carton.

Answer (a)..... : .....[2]

(b) The cost of paperboard to make each smaller carton of milk is 15 cents.
Does it cost eight times as much to make the larger carton? Explain your answer.

Answer (b)

.....

.....

.....

..... [2]

13 y is inversely proportional to the square of x.
It is given that $x = 2$ when $y = 9$.
When x is increased by 200%, find the percentage decrease in y.

Answer .....[3]

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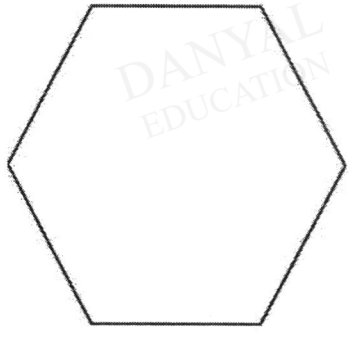
14 A pavilion is in the shape of a regular hexagon. The sides have length 4 m.



4 m

Calculate the area of the pavilion.

Answer .....m^2 [4]

---

15 **(a)** Sketch the graph of $y = (x-2)^2 - 1$.

Answer ..... [2]

(b) Write down the equation of the line of symmetry.

Answer ..... [1]

---

16 **(a)** Express $x^2 - 6x + 13$ in the form $(x-a)^2 + b$.

Answer ..... [2]

(b) State the coordinates of the turning point.

Answer ..... [1]

(c) Explain why $x^2 - 6x + 13 = 0$ has no solution. [1]

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17 The scale of a map is 1: 30 000.

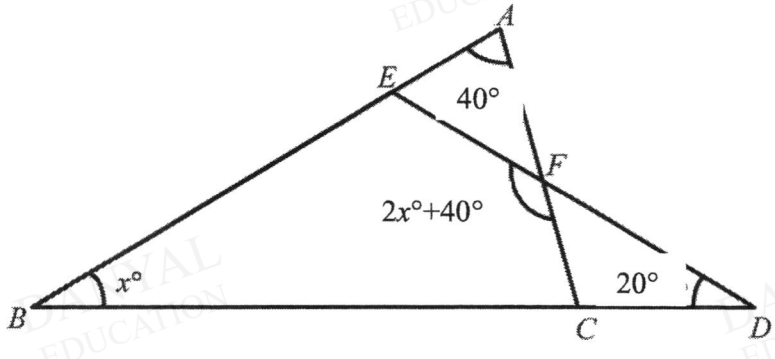
(a) The actual distance between two towns is 6 km, Find the distance of the two towns on the map in cm.

Answer ..... [2]

(b) The area of a field on the map is 200 cm^2. Find the actual area of the field km^2.

Answer ..... [2]

18



The diagram shows two triangles, ABC and BDE.
Angle $BAC = 40°$, angle $BDE = 20°$, angle $ABC = x°$ and angle $CFE = 2x° + 40°$.
Calculate

(a) Show that angle $AEF = 2x$. [2]

(b) Find x.

Answer ..... [2]

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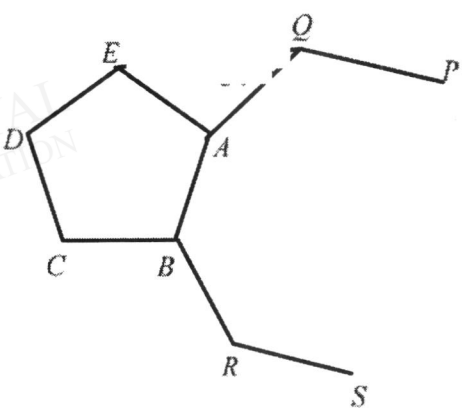
19 The diagram shows a regular pentagon $ABCDE$ and part of a regular polygon $PQABRS$ with n sides.

Given that angle $CBR = 112°$,

(a) find

(i) angle ABR,



Answer $\angle ABR =$ .....° [2]

(ii) the value of n.

Answer $n =$ ..... [1]

(b) Name the type of triangle CBR.

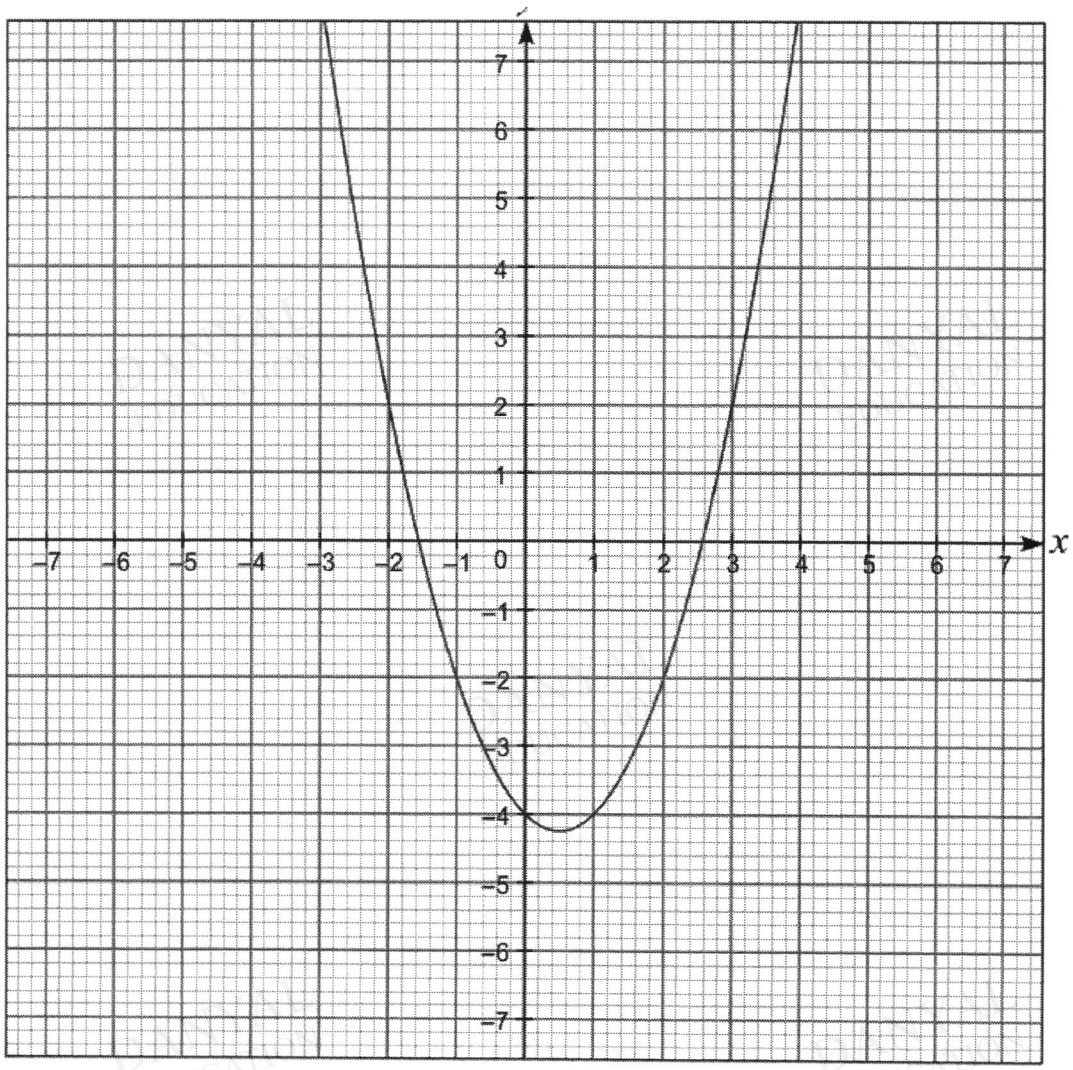
Answer .....[1]

---

20 Given the graph of the quadratic function $y = x^2 - x - 4$,

(a) draw a tangent at the point $x = 2$. [1]

(b) find the gradient of the tangent at $x = 2$.



Answer (b)..... [1]

(c) suggest a suitable straight line to draw so that you can solve the quadratic equation $x^2 - x - 4 = -2$ graphically.

Answer (c)..... [1]

(d) using **(c)** find the solutions for the equation $x^2 - x - 4 = -2$.

Answer (d) $x =$ ..... , ... [2]

21 The stem-and-leaf diagram shows the marks of 21 students who took a class test. The test was marked out of 100.

3	0 1 3 5
4	0 2 9
5	8
6	3 5
7	2 4 5 5 8
8	0 2 3 4 6 6

Key 3 | 0 means 30 marks

(a) Find the

(i) median mark.

Answer (a)(i).....[1]

(ii) interquartile range.

Answer (a)(i).....[1]

(b) A student said that the test was easy. Do you agree? Justify your answer. [2]

.....

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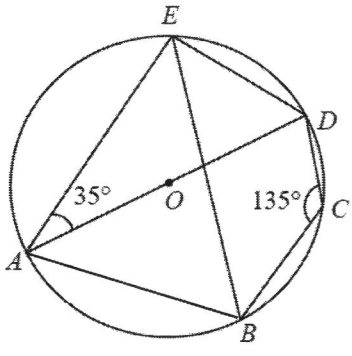
22 In the figure shown below, *A, B, C, D* and *E* are points on the circumference of a circle, with centre *O*. Angle $DAE = 35°$ and angle $BCD = 135°$.



(a) Stating all reasons clearly, find

(i) the angle *BAD*,

Answer (i).....[1]

(ii) the angle *ABE*.

Answer (ii).....[2]

(b) Show that triangle *ABD* is an isosceles triangle.

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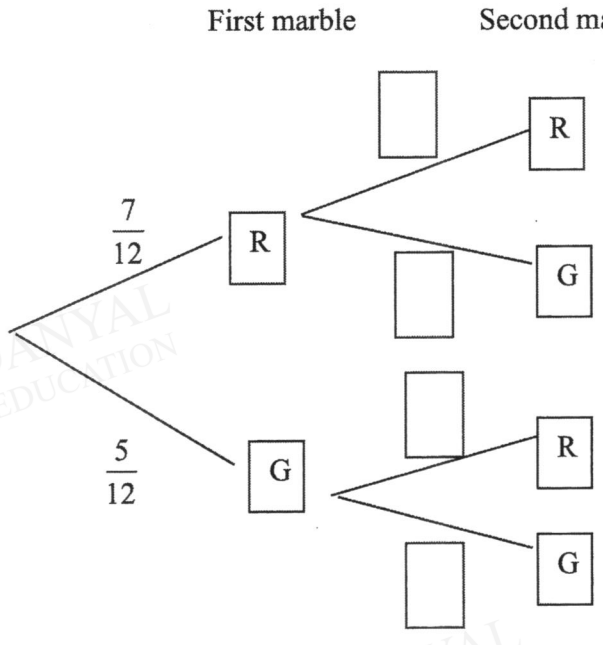
..... [2]

23 A bag contains 7 red marbles and 5 green marbles. Two marbles are taken out at random from the bag, one after another.

(a) Complete the tree diagram to show the probabilities of the possible outcomes. [2]



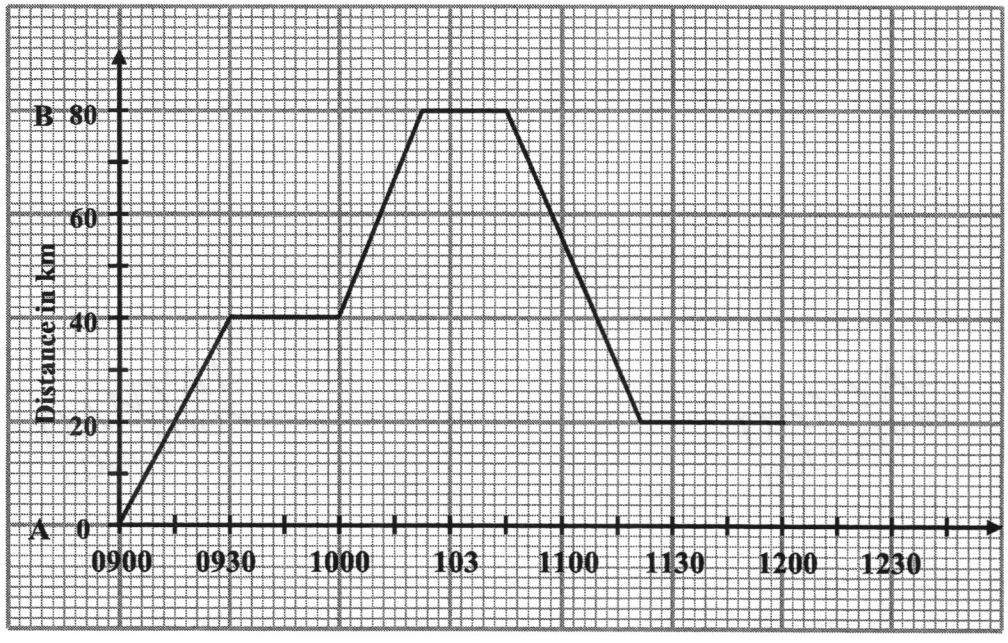
(b) Calculate the probability that the second marble selected is red.

Answer (b).....[2]

(c) If 3 green marbles are added to the bag, what is the probability of getting both marbles are green?

Answer (c).....[2]

24 The diagram is a distance-time graph for the journey of a vehicle from point A to point B and its journey back to A during a period of $3\frac{1}{2}$ hours.



(a) Find the distance the vehicle had travelled by 09 30.

Answer (a)..... [1]

(b) What was happening to the vehicle between 09 30 and 10 00.

Answer (b)..... [1]

(c) Calculate the speed that the vehicle must travel during the last part of its journey in order to return to its starting point by 12 30.

Answer (c)..... [2]

(d) A second vehicle leaves B for A at 10 00. It travelled at a constant speed of 80 km/h. By adding a straight line on the graph,

(i) show its distance-time graph. [1]

(ii) state an estimate of the time at which the two vehicles first met, giving your answers to the nearest minute.

Answer d(ii).....[1]

END OF PAPER

TANGLIN SECONDARY SCHOOL
PRELIMINARY EXAMINATION 2020
Secondary 4 Express & 5 Normal(Academic)

NAME _____

CLASS _____ **INDEX NO.** _____

MATHEMATICS 4048/02

Paper 2 **2 hours 30 minutes**

Additional Materials: NIL

READ THESE INSTRUCTIONS FIRST

Write your index number and name on all the work you hand in.

Write in dark blue or black pen. You may use a soft pencil for any diagrams or graphs.

Do not use staples, paper clips, highlighters, glue or correction fluid.

Answer all questions.

If working is needed for any question it must be shown with the answer.

Omission of essential working will result in loss of marks. The use of an approved scientific calculator is expected, where appropriate. If the degree of accuracy is not specified in the question, and if the answer is not exact, give the answer to 3 significant figures. Give the answers in degrees to 1 decimal place.

For π, use either your calculator value or 3.142, unless the question requires the answer in terms of π. At the end of the examination, fasten all your work securely together.

The number of marks is given in brackets [ ] at the end of each question or part question.

The total number of marks of this paper is 100.

Calculator Model:

For Examiner's Use	
Total	100

Mathematical Formulae

Compound Interest

$$\text{Total Amount} = P\left(1+\frac{r}{100}\right)^n$$

Mensuration

Curved surface area of a cone $= \pi r l$

Curved surface area of a sphere $= 4\pi r^2$

$$\text{Volume of a cone} = \frac{1}{3}\pi r^2 h$$

$$\text{Volume of a sphere} = \frac{4}{3}\pi r^3$$

$$\text{Area of a triangle } ABC = \frac{1}{2}ab\sin C$$

Arc length $= r\theta$, where θ is in radians

$$\text{Sector area} = \frac{1}{2}r^2\theta, \text{ where } \theta \text{ is in radians}$$

Trigonometry

$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

$$a^2 = b^2 + c^2 - 2bc\cos A$$

Statistics

$$\text{Mean} = \frac{\sum fx}{\sum f}$$

$$\text{Standard deviation} = \sqrt{\frac{\sum fx^2}{\sum f} - \left(\frac{\sum fx}{\sum f}\right)^2}$$

1 **(a)** Solve the equation $\frac{3x+2}{5}=4$.

Answer *(a)* $x=$ ..... [2]

(b) Solve the equation $\frac{x+1}{2}=\frac{3}{x-3}$.

Answer *(b)* $x=$ ..... [4]

(c) Express the following as a single fraction in its simplest form

(i) $\dfrac{75x^3}{16y^2} \div \dfrac{25x^5y^3}{(2xy^2)^3}$,

Answer *(c)(i)* ..... [2]

(ii) $\dfrac{2}{x^2+x-2} - \dfrac{1}{1-x}$.

Answer *(c)(ii)* ..... [3]

2 **(a)** A number pattern is shown below. The difference between every consecutive term is equal.

$x \quad 7 \quad y \quad z \quad 19$

(i) Find the values of x, y and z.

Answer *(a)(i)* $x =$ .....

$y =$ .....

$z =$ ..... [2]

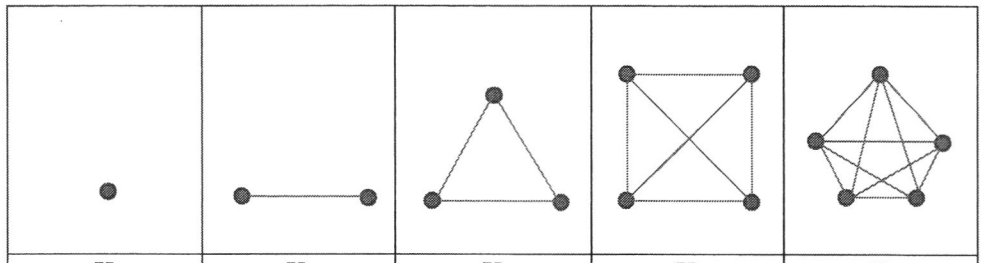
(ii) Find an expression for the n^{th} term.

Answer *(a)(ii)* ..... [2]

(iii) Find the 109^{th} term of the sequence.

Answer *(a)(iii)* ..... [1]

(b) Every pair of the dots in a sequence are connected by lines between them as shown in the diagram below.



K_1	K_2	K_3	K_4	K_5

(i) State the number of lines connected to every dots in K_6.

Answer (b)(i) ..... [1]

(ii) State the number of lines in K_6.

Answer (b)(ii) ..... [1]

(iii) Find the number of lines, in tems of n, connecting to each dot in K_n.

Answer (b)(iii) ..... [1]

(iv) Find the number of lines in K_{256}.

Answer (b)(iv) ..... [1]

(v) Explain why the sequence can never contain 71 lines.

Answer (b)(v) .....

.....

..... [1]

3 **(a)** A camera was listed for sale at $2 720 during a store-wide 15% sale. Find the original price of the camera.

Answer *(a)* $ . . . . . [2]

(b) During the Black Friday sale, a further 15% discount was given on the camera. Find the new sale price of the camera.

Answer *(b)* $ . . . . . [2]

(c) Bella has a $120 voucher for use at the shop and she decides to buy the camera.

(i) Find the amount of money she paid for the camera.

Answer *(b)(i)* $ . . . . . [1]

(ii) Find the amount of discount she gets from the original price.

Answer *(b)(ii)* $ . . . . . [2]

(d) Bella wishes to pay for the camera over 24 months. BDS Bank credit card charges a 4% processing fee on the transaction amount and a further 5% per annum. Find the installment she has to pay per month.

Answer *(d)* $ . . . . . [3]

4 Patrick wishes to drive to Genting Highland from Singapore with his family. The distance between Genting and Singapore is 400 km and he drives at x km/h.

(a) Write an expression to describe the time taken in hours to reach Genting.

Answer (a) ..... [1]

On the way back to Singapore, Patrick drove slower by 20 km/h.

(b) Write an expression to describe the time taken in hours to reach Singapore from Genting.

Answer (a) ..... [1]

(c) Given that the total time of driving is 9 hours, form an expression in terms of x and show that it reduces to $9x^2 - 980x + 8000 = 0$. [3]

(d) Solve the equation and explain why one of the solution must be rejected.

Answer (d) $x =$ ..... or $x =$ ..... [4]

(e) Find the average speed of the whole journey.

Answer (e) ..... km/h [1]

5 The two tables below shows the information relating to the lifetime of 200 light bulbs, in hours, manufactured by Brand *A*.

Brand *A*:

Lifetime (t)	$500 < t \leq 600$	$600 < t \leq 700$	$700 < t \leq 800$	$800 < t \leq 900$	$900 < t \leq 1000$
Frequency	25	40	68	43	24

The information below are the mean and standard deviation for the lifetime of 200 light bulbs manufactured by Brand B.

Mean	720
Standard Deviation	45

(a) State the modal class of the distribution for Brand *A*.

Answer *(a)* ..... [1]

(b) Estimate the mean lifetime of Brand *A*.

Answer *(b)* ..... hours [1]

(c) Estimate the standard deviation of Brand *A*.

Answer *(c)* ..... [2]

(d) Find the probability of getting a light bulb with lifetime of 700 hours and below.

Answer *(a)* ..... [2]

(e) Two light bulbs are selected at random.

(i) Find the probability that both light bulbs can last more than 900 hours.

Answer (e)(i) ..... [2]

(ii) Explain why brand *A* performs better.

Answer (e)(ii) .....

.....

..... [1]

6 **(a)** Find the matrix A such that $4\mathbf{A}+\begin{pmatrix}2 & -3\\ -2 & 4\end{pmatrix}=\begin{pmatrix}4 & 3\\ 6 & 8\end{pmatrix}$.

Answer (a) ..... [2]

(b) Given that $\mathbf{D}=\begin{pmatrix}3 & -4\\ 0 & 2\end{pmatrix}$, $\mathbf{E}=\begin{pmatrix}1 & 0\\ 0 & 1\end{pmatrix}$ and $\mathbf{F}=\begin{pmatrix}-2 & -1\\ 1 & 4\end{pmatrix}$,

evaluate **2D + E – 3F.**

Answer (b) ..... [2]

(c) Two cafés sell coffee from different countries. The sale and price of the coffee at the two cafés are shown in the table below.

	Ethiopia ($8)	Myanmar ($6)	Colombia ($7)
Café A	18	9	10
Café B	15	7	24

(i) Represent the information above by a 2×3 matrix **C**.

Answer *(c)(i)* ..... [1]

(ii) Evaluate the matrix $\mathbf{S} = \mathbf{C}\begin{pmatrix}1\\1\\1\end{pmatrix}$.

Answer *(c)(ii)* ..... [1]

(iii) Explain what the elements of **S** represent.

Answer *(c)(iii)* .....

.....

..... [1]

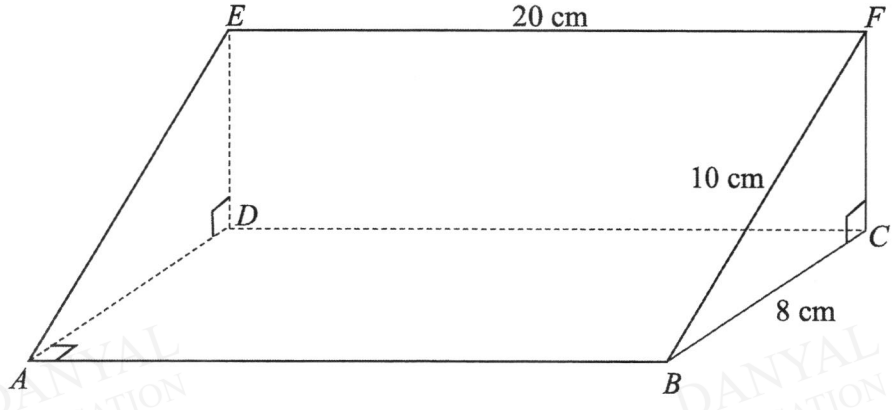
(iv) Represent the price of the coffee using matrix **P**.

Answer *(c)(iv)* ..... [1]

(v) Using the matrix **C** and **P**, find the total sales T by each café.

Answer *(c)(v)* ..... [2]

7 The diagram shows a ramp in the shape of a right-angled triangular prism.
$EF = 20$ cm, $BC = 8$ cm, $BF = 6$ cm.



(a) Find the length of CF.

Answer *(a)* ..... cm [2]

(b) Find the volume of the solid.

Answer *(b)* ..... cm^3 [2]

(c) Find the total surface area of the solid.

Answer *(c)* ..... cm^2 [3]

(d) Find angle DBE.

Answer *(d)* ..... ° [3]

8 **(a)** Three points A, B and C have coordinates $A(2, 3)$, $B(5, -9)$, $C(-2, 5)$.

(i) Find the gradient of line AB.

Answer *(a)(i)* ..... [1]

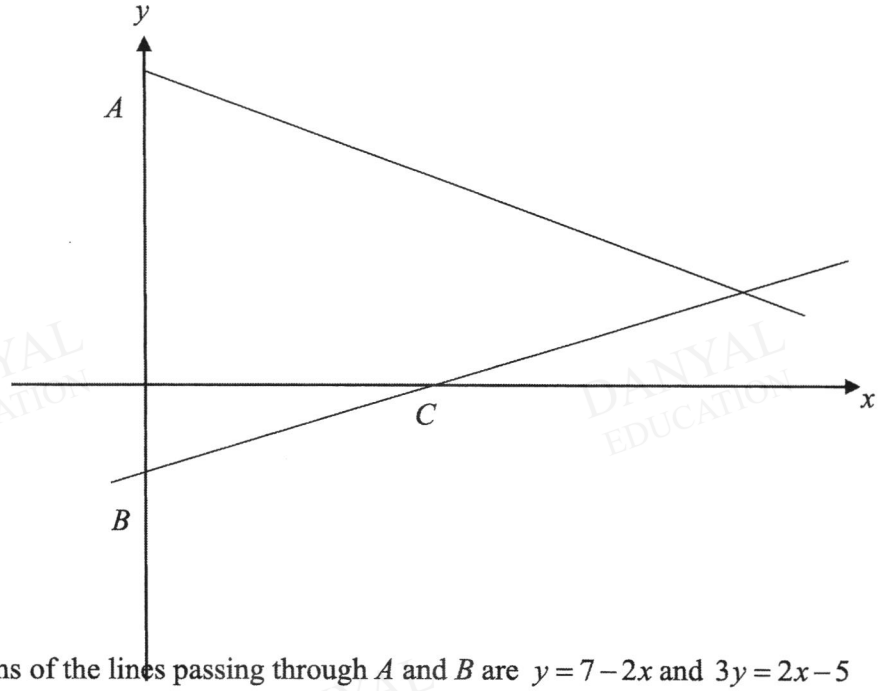
(ii) Find the equation of the line AB.

Answer *(a)(ii)* ..... [2]

(iii) Find the length of BC.

Answer *(a)(iii)* ..... units [2]

(b) Two lines intersect the y-axis as shown in the diagram below at point A and B. The two lines intersect at point C.



The equations of the lines passing through A and B are $y = 7 - 2x$ and $3y = 2x - 5$ respectively.

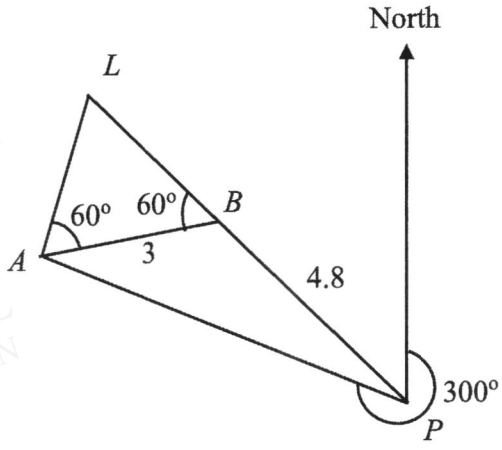
(i) Find the coordinates of point C.

Answer *(b)(i)* ..... [3]

(ii) Find the area of the triangle ABC.

Answer *(b)(ii)* ..... units^2 [2]

9 The diagram shows the positions of a pier, P, a lighthouse, L and two ships A and B. LBP is a straight line. The bearing of A from P is 300°. The distance between ship A and B is 3 km. $BP = 4.8$ km and angle $ABL = 60°$.



(a) Find the distance between ship A and the pier P.

Answer *(a)* ..... km [3]

(b) Calculate the area of triangle PAB.

Answer *(b)* ..... km^2 [2]

(c) Find the bearing of B from P.

Answer *(c)* ..... ° [2]

Given that the angle of elevation of the top of light house from ship A is 3.5°,

(d) find the angle of elevation of the top of the light house from pier P.

Answer *(d)* ..... ° [3]

10 Insurance company Anova is offering life insurance priced at $50 000 which covers a person for life. A client has the option of paying the insurance over 15 years at an annual simple interest rate of 3%.

(a) Calculate the amount of money Mr Tan has to pay over 15 years.

Answer *(a)* $ ..... [2]

Anova is offering an insurance savings plan which pays out an interest rate of 5.6% compounded annually. Mr Tan decides to invest $27 500 in the insurance savings plan at the age of 44 and the amount in the savings plan will commence paying off his premium at the age of 59.
He further decides to invest a certain sum of money in a foreign Government Bond which pays out 2% compounded annually over the next 20 years.

(b) Calculate the amount in his insurance savings plan after 15 year.

Answer *(b)* $ ..... [1]

The insurance savings plan can be used to pay the insurance premium of the client after 15 years. The insurance premium paid for year is shown in the table below. The insurance premium will commence deduction from the amount in the savings plan at the 15th year (on 1st January). After the amount in the insurance savings plan is used up, the client can top up with their own money to continue funding the insurance premium.

A client born in 1976 is taken to be 44 years old on 1st January 2020 regardless of date of birth.

Age Range	Premium Per Year ($)
40-44	4 000
45-49	4 250
50-54	4 500
55-59	4 750
60-64	5 000
65-69	5 250
70-74	5 500
75-79	5 750
80-84	6 000
85-89	6 250

To insure himself, Mr Tan can either take up

Option 1: the life insurance plan

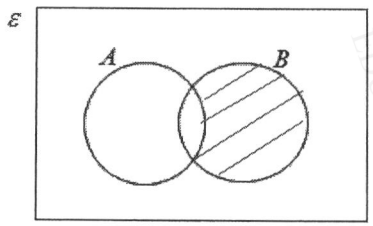
or Option 2: take up the insurance savings plan on top of investing in the foreign Government Bond.

The average life expectancy of a male in Singapore is reported to be 81 years.

(c) By working out the amount of money Mr Tan has to invest in the foreign Government Bond, provide a reasonable financial advice to Mr Tan on which option he should take up to insure himself up to his expected lifespan. [7]

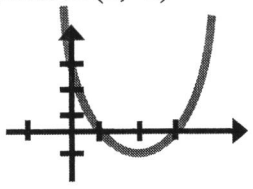
END OF PAPER

Qn	Worked Solution	Marks Allocation	Total	Remarks
1(a)	x^2	B1	2	
1(b)	$x = 9$	B1		
2	$8xy - 1 - 2x + 4y$ $= 8xy - 2x + 4y - 1$ $=2x(4y -1) +(4y -1)$ $=(2x +1)(4y - 1)$	M1 A1	2	
3	$\frac{x}{3x-1}+\frac{(2-x)}{1-3x}$ $= \frac{x}{3x-1}-\frac{(2-x)}{3x-1}$ $= \frac{2x-2}{3x-1}$	M1 A1	2	Changing to same denominator $3x$ -1. If used $(3x-1)(1-3x)$ in denominator and able to derive final answer, accept the M1

4 a	$2^2 \times 5 \times 7$	B1		
4 b	35	B1		
5 a		A1	2	
5b	A' ∪B.	A1		
6	$6955 = 5000\,(1+\frac{r}{100})^6$ $1+\frac{r}{100} = \sqrt[6]{\frac{6955}{5000}}$ $r = 5.65$	M1 A1		
7 a	$\frac{9}{16}$	B1	2	
7(b)	$\frac{3}{16-x} = \frac{1}{4}$ $x = 4$	B1		
8 a	253 500	B1	2	
8 b	254 499	B1		

9	$6x^2 - 7x - 20 = 0$ $(2x - 5)(3x + 4) = 0$ $x = \frac{5}{2}$ or $x = -\frac{4}{3}$	M1 A1;A1	3
10	$9 < 2 + \frac{1.1}{15}x < 10$ $7 < \frac{1.1}{15}x < 8$ $95\frac{5}{11} < x < 109\frac{1}{11}$ $x = 15 \times 7 = 105$ Max minutes = 105 + 60 =165 mins	B1 A1	2
11(a) 11(b)	0.25π radians $R = = \sqrt{\frac{10}{\left(\frac{1}{2}\right)(0.25\pi)}}$ = 5.05 cm	M1 M1 A1	3
12a	$\left(\frac{\text{height of samller bottle}}{\text{height of larger bottle}}\right)^3 = \frac{100}{800}$ $\frac{\text{height of smaller bottle}}{\text{height of larger bottle}} = \sqrt[3]{\frac{100}{800}}$ Height of smaller bottle : height of larger bottle = 1:2	M1 A1	2

12b	Let cost of paperboard for larger carton be x cents. $\frac{x}{15} = \left(\frac{2}{1}\right)^2$ $x = 4 \times 15$ $= 60$ No, it only cost 4 times as much as the smaller carton. Or No, the cost of the larger carton is not 8 times the ost of the smaller carton.	M1 A1		
13	$y = \frac{k}{x^2} \quad \Rightarrow \quad k = 9(2)^2 = 36$ $y = \frac{36}{x^2}$ When x is increased by 200%, $x = 6$. When $x = 6$, $\quad y = \frac{36}{6^2} = 1$ Percentage decrease $= \frac{9-1}{9} \times 100\% = 88.9\%$	M1 M1 A1		

14	Let h be the height of the small triangle tan 30 = 2/h h = 2/tan 30° Area of pavilion = (½ x 4x 2/tan 30)x 6 = 42.0 m ^{2}	M1 M1 M1 A1		
15(a)	Parabola through y-intercept at (0,3) Turning point at (2, -1) 	B1 B1		
15(b)	$x = 2$	A1	3	
16(a)	$x^2 - 6x + 13 = x^2 - 6x + (\frac{-6}{2})^2 - (\frac{-6}{2})^2 + 13$ $= (x-3)^2 + 4$	M1 A1		
16(b)	(3, 4)	M1	4	
16(c)	The graph does not intersect the x-axis for all values of x as $y = (x-3)^2 + 4 > 0$ Hence $y = x^2 - 6x + 13$ does not have any real roots	A1		

17(a)	0.3 km---1cm 1 km---- $3\frac{1}{3}$ cm 6 km ----- $3\frac{1}{3}\times 6 = 20\text{cm}$	M1 A1	4	
17(b)	$1\ \text{cm}^2$----$0.09\ \text{km}^2$ $200\ \text{cm}^2$---18 km	M1 A1		
18(a)	$\angle EFA = 180° - (2x° + 40°)$ (*adjacent angles on a straight line*) $\angle EFA = 140° - 2x°$ $\angle AEF = 180° - 40° - (140° - 2x°)$ (*angle sum of triangle*) $\angle AEF = 2x°$	M1 A1	4	
18(b)	$2x° = x° + 20°$ (*exterior angle of triangle*) $x = 20^0$	M1 A1		
19(a) (i)	$\angle ABC = \frac{(5-2)\times 180°}{5}$ $\angle ABR = 360° - 108° - 112°$ ($\angle$s at a point) $= 140°$	M1 A1	3	
(ii)	$n = \frac{360°}{180° - 140°}$	A1		

	= 9			
19(c)	Isosceles triangle	B1		
20(a) 20(b) 20(c) 20(d)	Draw tangent Gradient = 3 Draw the line y = - 2 x = 2 or -1	B1 : Draw tangent B1 :Find gradient B1 : Draw the line y = -2 B2 (B1 for each solution)		
21(a)(i)	Median = 72 marks	B1		
21(a)(ii)	IQR = 81 – 41 = 40 marks	B1		
21(b)	The test is easy as the median mark is 72 marks or more than 50% of the students passed the test.	B1 ; B1		

22(a)	*Angle BAD* = 180° -135°(opp angles in a cyclic quad) = 45°	A1		
22(b)	Angle *EBD* = 35°(angles in the same segment) Angle *ABD* = 90° (in a semi-circle) Angle *EBD* + Angle *ABE* = Angle *ABD* Angle ABD = 90° – 35° = 55°	M1 A1		
22(c)	Angle *ADB* = 180°- 45°-90°(sum of angles of triangle) = 45°	B1		
23(a)	$\frac{6}{11},\frac{5}{11},\frac{7}{11},\frac{4}{11}$ in that order	B2; Minus 1 mark for each wrong answer	6	
23(b)	$\left(\frac{7}{12}\times\frac{6}{11}\right)+\left(\frac{5}{12}\times\frac{7}{11}\right)$ $=\left(\frac{42}{132}\right)+\left(\frac{35}{132}\right)$ $=\frac{77}{132}$	M1 A1		
23(c)	$\frac{8}{15}\times\frac{7}{14}$ $=\frac{4}{15}$	M1 A1		
24(a)	40 km	B1	6	

24(b)	The vehicle was at rest/stationary. (o.e.)	A1		
24(c)	Distance to travel = 20 km Time left to complete journey $= \frac{1}{2}$ h . $\therefore$ speed it must travel at $= \frac{20}{0.5}$ $= 40$km/h	M1 A1		
24(d)	(i) Straight line graph (ii) 1012	B1 A1		

TANGLIN SECONDARY SCHOOL
MATHS PAPER 2
PRELIMINARY EXAMINATION 2020
SECONDARY 4 EXPRESS MARKERS' REPORT

Qn		Workings	Marks	Remarks
1	(a)	$3x+2=20$ $x=6$	M1 A1	
	(b)	$(x+1)(x-3)=6$ $x^2-2x-9=0$ $x=\frac{-(-2)\pm\sqrt{(-2)^2-4(1)(-9)}}{2}$ $=\frac{2\pm\sqrt{40}}{2}$ $=4.16$ or -2.16	M1 M1 M1 A1	
	(ci)	$\frac{75x^3}{16y^2}\times\frac{(2xy^2)^3}{25x^5y^3}$ $=\frac{3xy}{2}$	M1 A1	
	(cii)	$\frac{2}{(x+2)(x-1)}+\frac{1}{x-1}$ $=\frac{2}{(x+2)(x-1)}+\frac{x+2}{(x+2)(x-1)}$ $=\frac{x+4}{(x+2)(x-1)}$	M1 M1 A1	
2	(ai)	$x=3$ $y=11$	B1 B2	If 1 wrong

		$z = 15$		If all correct
	(aii)	$T_n = 3 + 4(n-1)$ $= 4n - 1$	M1 A1	
	(aiii)	435	B1	
	(bi)	5	B1	
	(bii)	15		
	(biii)	$n-1$	B1	
	(biv)	$\frac{n(n-1)}{2} = \frac{256 \times 255}{2} = 32640$	B1	
	(bv)	Because the only factorisation for 71 is 1×71 and 2×71 can never be a product of consecutive integers (i.e. $n(n-1)$)	B1	
3	**(a)**	$\frac{2720}{85} \times 100$ $= \$3200$	M1 A1	
	(b)	2720×0.85 $= \$2312$	M1 A1	
	(ci)	$2312 - 120 = 2192$ (\$)	B1	
	(cii)	$3200 - 2192$ $= 1008$(\$)	M1 A1	
	(d)	Amount after processing fee $= 2192 \times 1.04 = \$2279.68$ Amount to be paid over 24 months $= \frac{2279.68 \times 5 \times 2}{100} + 2279.68$ $= \$2507.648$ Amount to be paid a month $= \$2507.648 \div 24$ $= \$104.49$	M1 M1 A1	

4	**(a)**	$\frac{400}{x}$	B1	
	(b)	$\frac{400}{x-20}$	B1	
	(c)	$\frac{400}{x}+\frac{400}{x-20}=9$ $\frac{400(x-20)+400x}{x(x-20)}=9$ $800x-8000=9x^2-180x$ $9x^2-980x+8000=0$	M1 M1 A1	
	(d)	$x=\frac{-(-980)\pm\sqrt{(-980)^2-4(9)(8000)}}{2(9)}$ $=\frac{980\pm\sqrt{672400}}{18}$ $=100$ or $8\frac{8}{9}$ $8\frac{8}{9}$ should be rejected as the speed of return journey would be negative.	M1 M1 A1 B1	
	(e)	$88\frac{8}{9}$ km/h	B1	
5	**(a)**	$700 < t \leq 800$	B1	
	(b)	750.5 hours	B1	
	(c)	$\text{SD}=\sqrt{\frac{115440000}{200}-\left(\frac{150100}{200}\right)^2}$ $=118$	M1 A1	

	(d)	P(getting a light bulb with lifetime of at most 700 hours) $=\frac{25+40}{200}$ $=\frac{13}{40}$ or 0.325	 M1 A1	
	(ei)	P(getting two light bulbs that can last more than 900 hours) $=\frac{24}{200}\times\frac{23}{199}$ $=\frac{69}{4975}$	 M1 A1	
	(eii)	The mean life time of light bulbs made by brand A is longer.	B1	
6	**(a)**	$4\mathbf{A}=\begin{pmatrix}2 & 6\\ 8 & 4\end{pmatrix}$ $\mathbf{A}=\begin{pmatrix}\frac{1}{2} & \frac{3}{2}\\ 2 & 1\end{pmatrix}$	M1 A1	
	(b)	$2\begin{pmatrix}3 & -4\\ 0 & 2\end{pmatrix}+\begin{pmatrix}1 & 0\\ 0 & 1\end{pmatrix}-3\begin{pmatrix}-2 & -1\\ 1 & 4\end{pmatrix}$ $=\begin{pmatrix}6 & -8\\ 0 & 4\end{pmatrix}+\begin{pmatrix}1 & 0\\ 0 & 1\end{pmatrix}-\begin{pmatrix}-6 & -3\\ 3 & 12\end{pmatrix}$ $=\begin{pmatrix}13 & -5\\ -3 & -7\end{pmatrix}$	M1 M1 A1	
	(ci)	$\mathbf{C}=\begin{pmatrix}18 & 9 & 10\\ 15 & 7 & 24\end{pmatrix}$	B1	

	(cii)	$\mathbf{S}=\begin{pmatrix}18 & 9 & 10\\15 & 7 & 24\end{pmatrix}\begin{pmatrix}1\\1\\1\end{pmatrix}$ $=\begin{pmatrix}37\\46\end{pmatrix}$	B1	
	(ciii)	37 and 46 represents total cups of coffee sold at café A and B respectively.	B1	
	(civ)	$\mathbf{P}=\begin{pmatrix}8\\6\\7\end{pmatrix}$	B1	
	(cv)	$\mathbf{T}=\begin{pmatrix}18 & 9 & 10\\15 & 7 & 24\end{pmatrix}\begin{pmatrix}8\\6\\7\end{pmatrix}$ $=\begin{pmatrix}268\\330\end{pmatrix}$	M1 A1	
7	**(a)**	$CF=\sqrt{10^2-8^2}$ $=6$ cm	M1 A1	
	(b)	$V=\frac{1}{2}(8)(6)\times 20$ $=480$ cm^3	M1 A1	
	(c)	Area of triangular cross section faces $=2\times\frac{1}{2}(8)(6)$ $=48$ cm^2 Area of rectangular faces	M1	

		$= 20(10) + 20(6) + 20(8)$ or $20(10 + 6 + 8)$ $= 480\ \text{cm}^2$ Total Surface Area $= 528\ \text{cm}^2$	M1 A1	
	(d)	$BD = \sqrt{464} = 21.54065923\ \text{cm}$ $\tan DBE = \dfrac{6}{\sqrt{464}}$ Angle $DBE = 15.6^\circ$ (to 1 d.p.)	M1 M1 A1	
8	**(ai)**	-4	B1	
	(aii)	$y = -4x + c$ $3 = -4(2) + c$ $c = 11$ $y = -4x + 11$	 M1 A1	
	(aiii)	$L = \sqrt{(5+2)^2 + (-9-5)^2}$ $= 15.7\ \text{unit}^2$	M1 A1	
	(bi)	$y = 7 - 2x$ --- (1) $3y = 2x - 5$ --- (2) Sub equation (1) into equation (2) $3(7-2x) = 2x - 5$ $21 - 6x = 2x - 5$ $8x = 26$ $x = 3\dfrac{1}{4}$ $y = \dfrac{1}{2}$ Coordinates of C is $\left(3\dfrac{1}{4}, \dfrac{1}{2}\right)$ or $\left(\dfrac{13}{4}, \dfrac{1}{2}\right)$	 M1 M1 A1	 For correct x coordinates

	(bii)	Area of triangle $=\frac{1}{2}\left(\frac{13}{4}\right)\left(7+\frac{5}{3}\right)$ $=14\frac{1}{12}$ unit^2	 M1 A1	
9	**(a)**	Distance between ship A and pier P $D^2=3^2+4.8^2-2(3)(4.8)\cos 120°$ $D=\sqrt{3^2+4.8^2-2(3)(4.8)\cos 120°}$ $=6.27694=6.28$ km	 M1 M1 A1	
	(b)	$A=\frac{1}{2}(3)(4.8)\sin 120°$ $=6.24$ km^2	 M1 A1	
	(c)	$\frac{\sin BPA}{3}=\frac{\sin 120°}{6.27694}$ Angle $BPA=24.5°$ Bearing $=324.5°$	 M1 A1	
	(d)	$AL=3$ $h=3\tan 3.5°$ $=183.48786$ m Let the angle of elevation of top of light house from P be x $\tan x=\frac{183.48786}{7800}$ $x=1.3°$	 M1 M1 A1	

10	**(a)**	Amount he has to pay over 15 years $= 50000 + \frac{50000 \times 3 \times 15}{100}$ $= \$72500$	 M1 A1	
	(b)	Amount in his savings plan after 15 years $= 27500\left(1 + \frac{5.6}{100}\right)^{15}$ $= \$62271.81$	 B1	
	(c)	<u>Duration the savings plan can pay the premium</u> $\$62271.81 - 4750 - 5(5000) - 5(5250) - 5500 = \$771.81$ Means can pay until 70 years old with a remaining amount of $771.81 (Student assumes Mr Tan will live till 81 years old) Remaining amount of premium to be paid till Mr Tan dies at 81 years old $= 4(5500) + 5(5750) + 2(6000)$ $= \$62750$ Amount he needs to invest in the foreign government bond $= \$62750 - \$771.81$ $= \$61978.19$ $P(1+0.02)^{20} = 61978.19$ $P = \$41709.55$	M1 A1 B1 B1 B1 B1	Show reasonable calculation why it can pay till 72 years old

		Total amount of money invested in insurance savings plan and foreign bonds = $27500 + $41709.55 = $69209.55 He should go for <u>insurance savings plan</u> since he pays less than life insurance.	B1	