TONBRIDGE SCHOOL

Specimen paper for entry into Year 12

Maths

Name:……

School:……

Answer **all** questions in Section A and
either question 13 or 14 in Section B.

Do all your workings in the spaces provided.

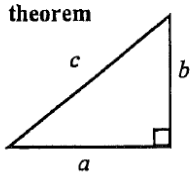
Marks for Section A: 60
Marks for Section B: 20

Time allowed : 75 minutes.

You are allowed to use a calculator in this exam.
A list of useful formulae will be found on page 2.

Useful Formulae

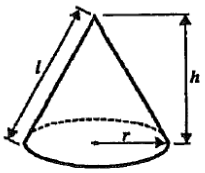
Pythagoras' theorem



$a^2+b^2=c^2$

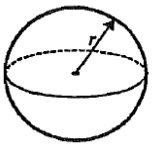
Volume of cone $= \frac{1}{3}\pi r^2 h$

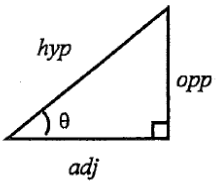
Curved surface area of cone $= \pi r l$



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

Surface area of sphere $= 4\pi r^2$





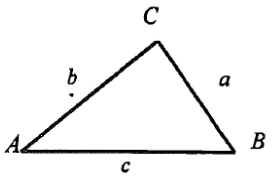
adj = hyp × cos θ
opp = hyp × sin θ
opp = adj × tan θ

or $\sin\theta = \dfrac{\text{opp}}{\text{hyp}}$

$\cos\theta = \dfrac{\text{adj}}{\text{hyp}}$

$\tan\theta = \dfrac{\text{opp}}{\text{adj}}$

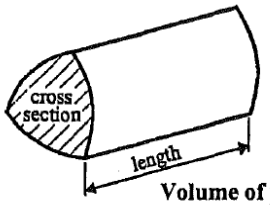
In any triangle ABC



Sine Rule $\dfrac{a}{\sin A} = \dfrac{b}{\sin B} = \dfrac{c}{\sin C}$

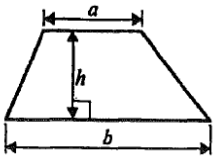
Cosine Rule $a^2 = b^2 + c^2 - 2bc\cos A$

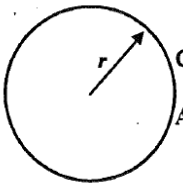
Area of triangle $= \frac{1}{2}ab\sin C$



Volume of prism = area of cross section × length

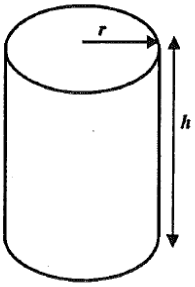
Area of trapezium $= \frac{1}{2}(a+b)h$





Circumference of circle $= 2\pi r$

Area of circle $= \pi r^2$



Volume of cylinder $= \pi r^2 h$

Curved surface area of cylinder $= 2\pi r h$

The quadratic equation
The solutions of $ax^2 + bx + c = 0$ where $a \neq 0$, are given by

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

Section A

1. Solve the simultaneous equations

$$2x - 3y = 3$$
$$3x + 6y = 1$$

$x =$……

$y =$……

(Total 3 marks)

2. Jothi bought a car. Later he sold the car for £2125. He made a loss of 15%. Work out the original price of the car.

£ ……

(Total 3 marks)

Turn over

3. (a) Expand and simplify $(p + 7)(p - 4)$

……
(2)

(b) Simplify $4x^3y^5 \times 3x^2y$

……
(2)

(c) Factorise $x^2 - y^2$

……
(1)

(d) Factorise completely $(c + d)^2 - d^2$

……..
(2)

(e) Factorise $2w^2 + w - 3$

……..
(2)
(Total 9 marks)

4.

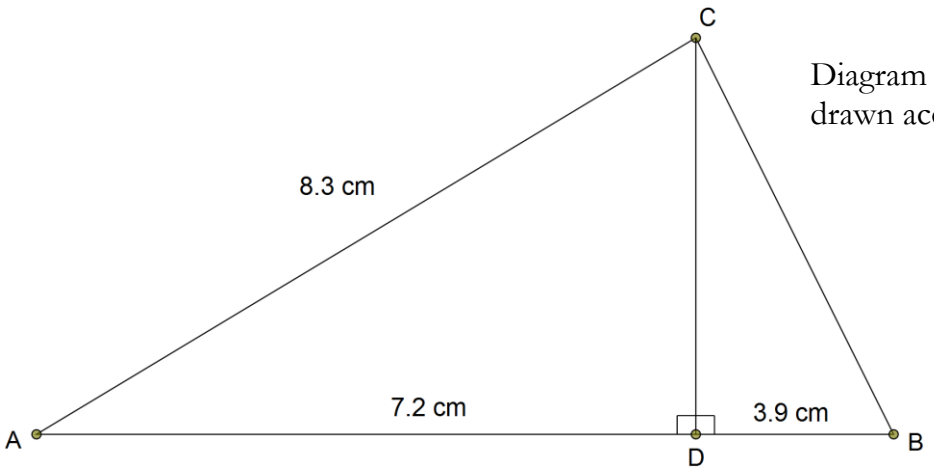


Diagram **NOT** drawn accurately

ABC is a triangle.
D is a point on AB.
CD is perpendicular to AB.
AD = 7.2 cm, DB = 3.9 cm, AC = 8.3 cm.

Calculate the size of angle DBC.
Give your answer correct to 1 decimal place.

…….°

(Total 5 marks)

Turn over

5. Each time Jeni plays a computer game the probability that she will win is $\frac{2}{3}$

Jeni plays the computer game 3 times.

Calculate the probability that Jeni will win

(a) all 3 games,

……

(2)

(b) exactly 2 out of the 3 games.

……

(3)

(Total 5 marks)

6.

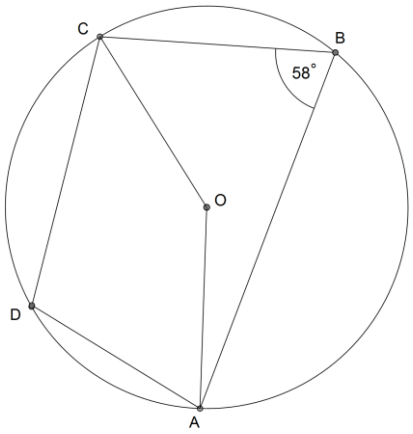


Diagram **NOT** drawn accurately

A, B, C and D are points on a circle, centre O.
Angle ABC = 58°.

(a) (i) Calculate the size of angle AOC.

……°

(ii) Give a reason for your answer.

……

……

(2)

(b) (i) Calculate the size of angle ADC.

……...°

(ii) Give a reason for your answer.

……...

……...

(2)

(Total 4 marks)

Turn over

7. The diagram shows the position of two ships, A and B, and a lighthouse L.

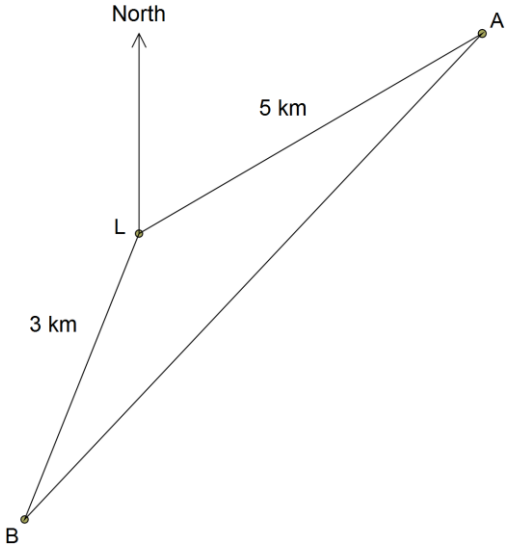


Diagram **NOT** drawn accurately

Ship A is 5 km from L on a bearing of 070° from L.
Ship B is 3 km from L on a bearing of 210° from L.
Calculate the distance between ship A and ship B.
Give your answer to 3 significant figures.

……. km
(Total 3 marks)

8. In the diagram, a sector of a circle of radius 12cm is shaded.
The area of the sector is 112π cm^2.
Calculate the value of x.

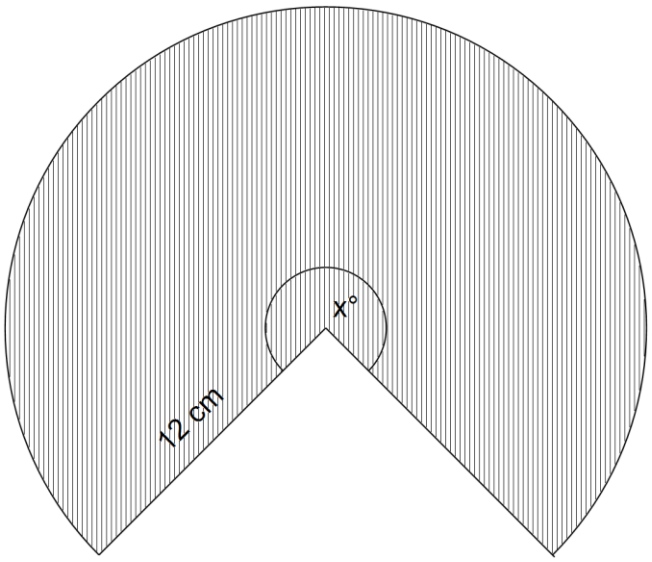


Diagram **NOT** drawn accurately

$x =$ …….

(Total 4 marks)

Turn over

9. (a) Simplify $\frac{x^2}{x^2-2x}$

…….

(2)

(b) Simplify $\frac{2}{2x-1} - \frac{1}{x+1}$

…….

(4)

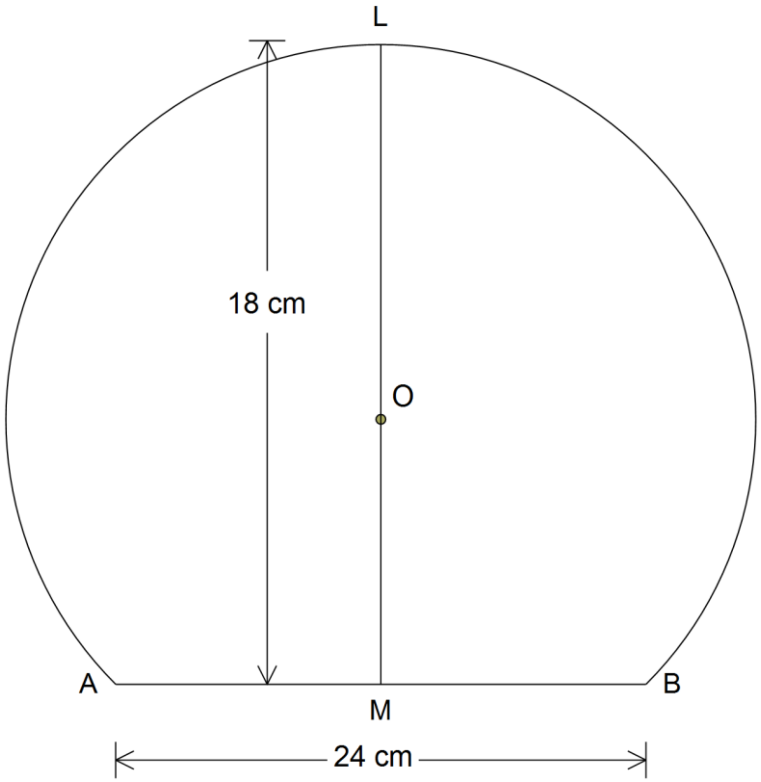
(c) Make e the subject of the formula $T = \frac{n(1+e)}{(1-e)}$

e =……..

(4)

(Total 10 marks)

10.



A, B and L are points on a circle, centre O.
AB is a chord of the circle. M is the midpoint of AB. LOM is a straight line.
AB = 24 cm. LM = 18 cm.

Calculate the diameter of the circle.

…… cm
(Total 4 marks)

Turn over

11. Solve the simultaneous equations

$$y - 3x = 4$$
$$x^2 + y^2 = 34$$

……..

(Total 6 marks)

12. (a) $(\sqrt{a})^7 = k\sqrt{a}$, where $k = a^n$

Find the value of n.

$n =$.....

(2)

(b) Express $\frac{1}{2\sqrt{2}}$ as a power of 2

.....

(2)

(Total 4 marks)

Turn over

Section B

Answer EITHER question 13 on pages 14, 15 and 16 OR question 14 on page 17. Both questions are worth 20 marks.

13. (a) Find the equation of the perpendicular bisector of the line segment joining the points A (-1, 1) and B (3, 9).

……..

(4)

(b) If $y = 7x - x^2 - 6$, find $\frac{dy}{dx}$ and hence find the equation of the tangent to the curve at the point on the curve where $x = 2$.

……

(5)

(c) (i) Express $x^2 - 6x + 2$ in the form $(x - a)^2 - b$.

……..

(2)

(ii) State the coordinates of the turning point on the graph of $y = x^2 - 6x + 2$.

……

(2)

(d) You are given $f(x) = 2x^3 + 7x^2 - 7x - 12$.

(i) Given that $f(-4) = 0$, express $f(x)$ in fully factorised form.

$f(x) =$…….

(4)

Turn over

(ii) Show that $f(x-4) = 2x^3 - 17x^2 + 33x$.

(3)
(Total 20 marks)

14. A small goat is tethered by a rope to a point at ground level on a side of a square barn which is in a large horizontal field of grass. The sides of the barn are of length $2a$ and the rope is of length $4a$. Let A be the area of the grass that the goat can graze. Prove that $A \leq 14\pi a^2$ and determine the minimum value of A.

(Total 20 marks)

End of Questions

Question 14 is the final question. Use as much of the remaining space as you need for your solution to Question 14.