16+

IB ENTRANCE EXAMINATION

2017-18

MATHEMATICS

ONE HOUR

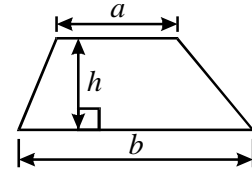**A calculator is allowed**
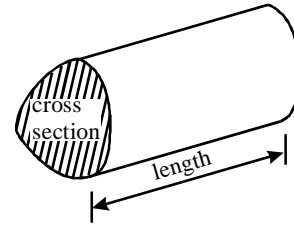
Name: ………………………………………………………

School: …………………………………………………………

Total: 80 marks

Formulae sheet

Area of trapezium $= \dfrac{1}{2}(a+b)h$
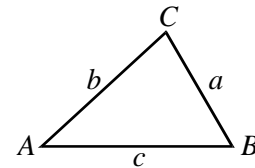
Volume of prism = area of cross section × length

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 $= \dfrac{1}{2}ab \sin C$

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

Surface of sphere $= 4\pi r^2$
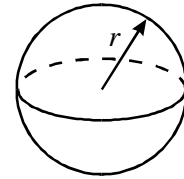
Volume of cone $= \dfrac{1}{3}\pi r^2 h$

Surface of sphere $= \pi r l$
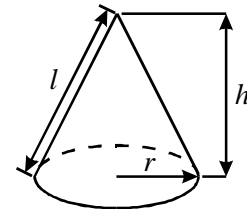
The Quadratic Equation

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

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

This examination will try to test what you have been taught.
Answer all questions in **Section 1.** Marks will be given for method, so you must show all your working each time. You might not have covered all the work, just do your best.

Section 1

1. (a) Solve.

$$4x - 7 < 15$$

....
[2]

(b) Represent your solution on the number line.

[1]

2. Simplify fully:

(i) $4(m + 3) + 3(2m - 5)$

Answer ....

(2)

(ii) $\dfrac{28x^6 y^4}{35xy^{-6}}$

Answer ....

(3)

(iii) $(2g^2 h^4) \times (3g^3 h)$

Answer...

(2)

(iv)   Multiply out and simplify.

           $(x - 3y)(5x - 3y)$

Answer ....

(3)

3. The value of a computer was £800 on 1st January 2003.
Every three months, the value of the computer decreased by 6% of its value at the start of that three months.

What was the value of the computer on 1st January 2004?

Answer £ ....

(3)

4. In 2003 the State Pension was increased by 2% to £78.03
What was the State Pension before this increase?

Answer £ ....

(3)

5. (i) Factorise $x^2 + 6x - 16$

Answer ....
(2)

(ii) Factorise fully $\quad 2x^2 - 50y^2$

Answer ....
(3)
(Total 5 marks)

6. Make c the subject of the formula $\quad d = \dfrac{c}{5} + e$

Answer ....
(2)

7. Solve the following equations, taking care to show your algebraic method:

    (i) $5(x-3)=4$

Answer ....

(2)

    (ii) $\dfrac{1}{4}(2x-5)=3x-1$

Answer ....

(3)

    (iii)   Solve the equation $\dfrac{x+1}{3}+\dfrac{x+2}{5}=1$

    You must show your working.

Answer $x=$..

(4)

8. (a) You are given that $\sqrt{12} + \sqrt{27} = a\sqrt{3}$ where *a* is an integer.

Find the value of *a*.

Answer ....

(2)

(b) Find the value of $(m + p)^2$ when $m = \sqrt{2}$ and $p = \sqrt{8}$

Answer ....

(2)

(4marks)

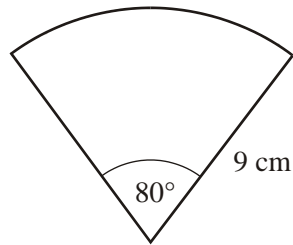**9.** Solve the equation $2x^2 - 6x - 1 = 0$

Give your answers to two decimal places. You **must** show your working.

Answers…………………………………………………

(3)

10. The diagram shows a sector of a circle of radius 9 centimetres.

Not drawn accurately

9 cm

80°

Find the perimeter of the sector.
Give your answer in terms of π.

Answer .... cm

(3)

11. (a) *ABC* is a right-angled triangle.
AC = 19 cm and *AB* = 9 cm.

A

Not to scale

19 cm

9 cm

B   C
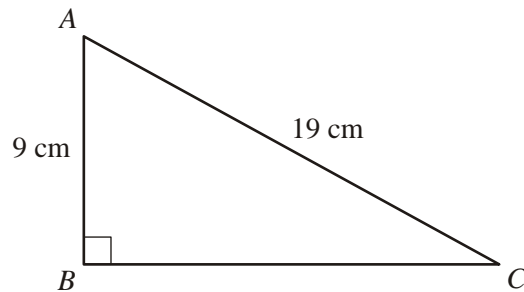
Calculate the length of *BC*.

Answer .... cm

(2)

(b)   *PQR* is a right-angled triangle.
      $PQ = 11$ cm and $QR = 24$ cm.

P

Not to scale

11 cm

Q   24 cm   R
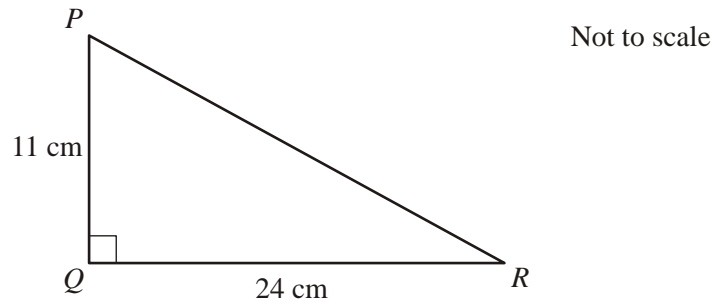
Calculate the size of angle *PRQ*.

Answer .... degrees

(2)

(Total 4 marks)

12. (a)   Complete the table of values for $y = 2x^2 - 4x - 1$

x	−2	−1	0	1	2	3
y	15		−1		−1	5

(2)

(b)   On the grid, draw the graph of $y = 2x^2 - 4x - 1$ for values of x from $- 2$ to $+3$.
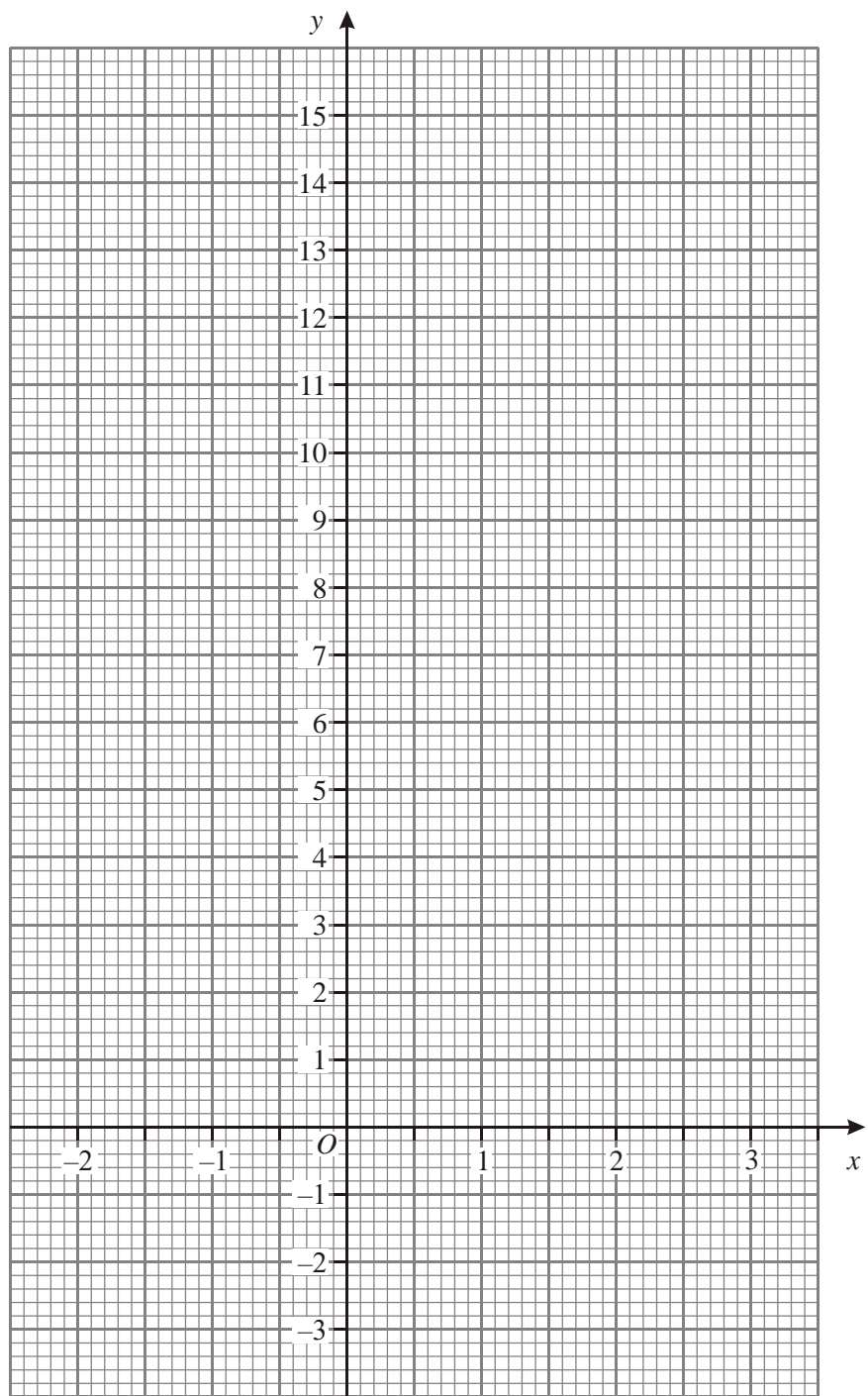
(2)

12. (c)   An approximate solution of the equation $2x^2 - 4x - 1 = 0$ is $x = 2.2$

(i)   Explain how you can find this from the graph.

....

....

(1)

(ii)   Use your graph to write down another solution of this equation.

Answer $x = $ ....

(1)

(Total 6 marks)

13.   Ashfield School sells tickets for a show.
The school sells a adult tickets and c child tickets.
Altogether the school sells 370 tickets.

This can be written as an equation.

$a + c = 370$

(a)   Each adult ticket costs £8 and each child ticket costs £5.
The total takings are £2300.

Write down an equation to represent this information.

....

[1]

(b)   Solve algebraically the simultaneous equations to find the values of a and c.

$a = $ ....

$c = $ ....

[3]

14. Simplify $\dfrac{5x^2-7x-6}{x^2-4}$

Answer ....

(4)

15. (a) Sketch the graph of $y = \sin x$ for values of x from $0°$ to $360°$.
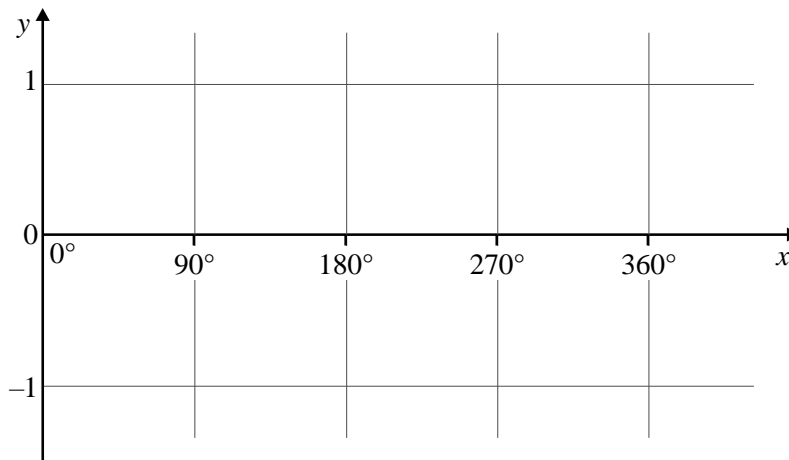
(2)

(b) One solution of the equation $\sin x = 0.92$ is $x = 67°$.

Use your sketch graph to find another solution of this equation.

Answer .... degrees

(1)

(c) Use your sketch graph to work out the value of $\sin 293°$.

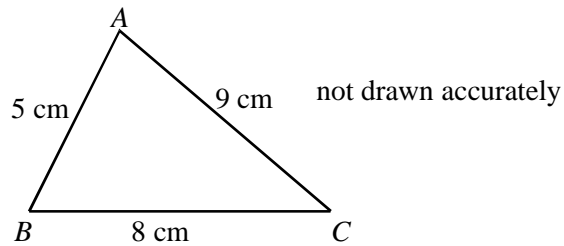Answer ....

(1)

(Total 4 marks)

Section 2

NOTE: For the following two questions you can answer EITHER question A or question B. Do not answer BOTH questions. Two questions should be completed in total.
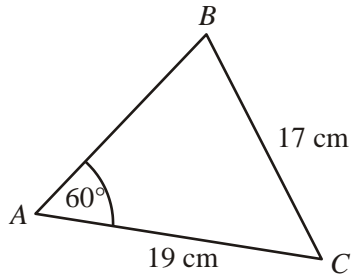
_____

Either Qu1A

(i) In triangle *ABC, AB* = 5 cm, *BC* = 8 cm and *AC* = 9 cm.

Use the cosine rule to show that triangle *ABC* does **not** contain an obtuse angle.

(4)

(ii) *ABC* is a triangle.
$AC = 19$ cm, $AC = 17$ cm and angle $BAC = 60°$

B

17 cm

60°

A

19 cm

C

Not drawn accurately

Calculate the size of angle *ABC*.

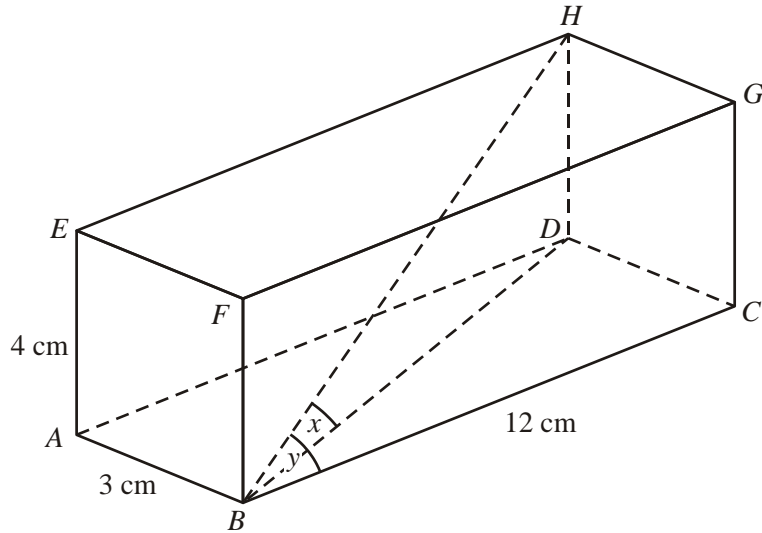Answer .... degrees

(3)

(Total 7 marks)

Or Qu 1B

The diagram shows a cuboid.
$AB = 3$ cm, $AE = 4$ cm, $BC = 12$ cm.

Not drawn accurately

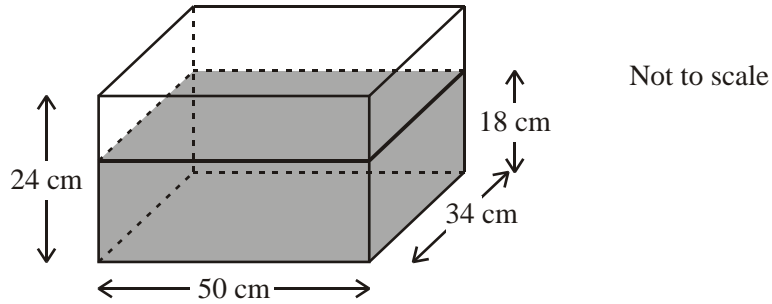(a) Find the length of *BH*.

Answer .... cm

(3)

(b)   The angle between *BH* and *BD* is *x* and the angle between *BH* and *BC* is *y*.

Which angle is bigger, *x* or *y*? You **must** show your working.

Answer ....

(4)

(Total 7 marks)

Either Qu 2A

A water tank is 50 cm long, 34 cm wide and 24 cm high.
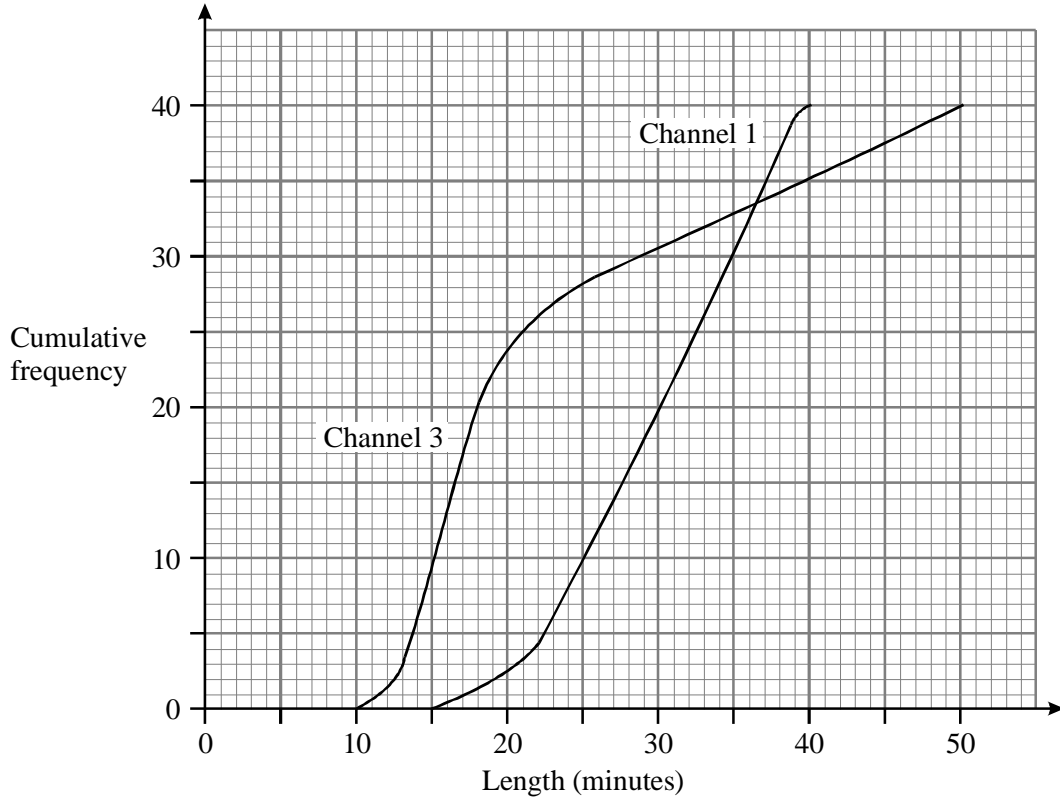It contains water to a depth of 18 cm.

Not to scale

Four identical spheres are placed in the tank and are fully submerged.
The water level rises by 4.5 cm.

Calculate the radius of the spheres.

Answer .... cm

(Total 6 marks)

Or Qu 2B

The cumulative frequency graphs represent the lengths of 40 programmes on Channel 1 and 40 programmes on Channel 3.

(b) What is the difference between the median programme lengths for the two channels?

Answer .... minutes

(2)

(b) How many programmes in total were more than 25 minutes long?

Answer ....

(3)

(Total 6 marks)