CHELTENHAM COLLEGE

16+ Entrance Examination Paper
2015 - 2016

Mathematics

Time allowed: 1 hour

Instructions

- Use **black** ink or ball-point pen.
- Put your answers on a named separate piece of paper
- **Concentrate on Section A first and then do as much as you can of Section B**
- **You are not expected to finish all the questions**
- **Calculators must NOT be used**

Information

- The marks for **each** question are shown in brackets
  - use this as a guide as to how much time to spend on each question.

Advice

- Read each question carefully before you start to answer it.
- Keep an eye on the time.
- Try to answer every question. Show all workings
- Check your answers if you have time at the end.

Candidate's name: _____

Section A:

1. Increase 200 by 25% [1]

2. What number when increased by 20% gives 600? [2]

3. A number is increased by 10%, then the answer is decreased by 10%.
   What is the overall percentage change? [3]

4. $x = 3$ and $y = -2$, find the value of

   a) xyx [1]

   b) $x + y + 5$ [1]

   c) $5y^2 + x$ [1]

   d) y^x [1]

   e) x^y [1]

5. Work out the following, you must show all your workings:

   a) $\frac{1}{2} + \frac{3}{4}$ b) $\frac{1}{2} \times \frac{4}{3}$ c) $1\frac{2}{3} \div 3\frac{4}{5}$ [5]

6.

   a) What is the mean of 1,2,3,4,5 [1]

   b) N is an integer (whole number). The means of 1,2,3,4,5,….N is 180.5
   What is N? [1]

7. Simplify the following expressions:

   $a)\ 2x - 3x + y$ $b)\ 4x \times 5x$ $c)\ (7x)^2$ $d)\ -3(x - 7)$ [4]

   $e)\ (x + y)^2$ $f)\ \frac{x^2 - 1}{x^2 + x}$ $g)\ \frac{x^2 x^5}{x^3}$ $h)\ (x^{-y})^{-y}$ [4]

8. Solve:

$a)\ 6x - 3 = 15$ $b)\ 0.2x + 1 = 5.2$ $c)\ 6x - 5 = 2 - x$ [6]

$d)\ x^2 - x = 2$ $e)\ \frac{1}{x+1} = \frac{3}{x+2}$ $f)\ 5^x = 125$ [5]

$g)\ \frac{x+1}{2} = 5$ $h)\ \frac{x}{2} + 1 = 5$ $i)\ \frac{x+1}{2} = \frac{2}{x+1}$ [6]

9. A rectangle, R, has dimensions 4cm by 3cm:

a) Find the area of R [1]
b) Find the perimeter of R [1]
c) Find the length of the diagonal of R [2]
d) The largest possible square is cut from R.
The remaining shape is called S.
The largest possible square is cut from S. What is the area of the remaining shape now? [2]

10. What is the angle between the hour hand and the minute hand on a clock when the time is:

$a)\ 3:00$ $b)\ 1:00$ $c)\ 2:30$ $d)\ 3:25$ [7]

Section B:

Only do some of section B when you have done as much as possible from Section A

11. If $a * b = \frac{a}{a+b}$, then simplify:

$a)\ 5 * 3$ $b)\ x * x$ $c)\ (y * y) * (x * x)$ [5]

12. Solve the following equations:

$a)\ 2^{3x+2} = 16$ $b)\ 5^{2+x} = 0.2$ $c)\ x^{73} = -1$ [5]

13. Consider the following two sequences:
A: 2016, 2029, 2042, 2055,…
B: 2016, 2027, 2038, 2049,…

2016 appears in both A and B. What is the next number that will appear in both A and B*?*
(i.e. what is the next number that both sequences have in common)
[2]

14 Carina and Josie have some money. They worked out that if Carina gave Josie £5, then Josie would have five times as much as Carina. Also, if Josie gave Carina £5 then Carina would have five times as much as Josie. How much money do each of them have? [3]

15. a) Call an integer good if it is one more than a multiple of 6. Show that the square of all good numbers is another good number. [2]

b) Show that the remainder when a square number is divided by 6 can never be 2. [3]

16. Four of the following points lie on a straight line, which one does not?
(-3, -3) (-2,-1) (2,5) (4,11) (5, 13) [2]

17. A pin code consists of a four-digit number e.g. 3015.
What is the probability that a randomly chosen pin code does not contain the digit "3"? Give your answer in the form:

$$\left(\frac{m}{n}\right)^k$$

where m,n and k are integers. [2]

18. A regular hexagon of side 1m is rotated about a line that passes through the midpoints of two opposite edges. What is the volume that is created? Give your answer in terms of π. [3]

19. A cube exactly fits inside a sphere and another sphere fits exactly inside this cube. What is the ratio of the volumes of the two spheres? [3]

END