The Haberdashers' Aske's Boys' School

Elstree, Herts

13+ Entrance Examination 2014

MATHEMATICS

Time : 1 hour

Full Name   ....

Exam Number   ....

Please follow these instructions

- Do not open this paper until you are told to do so.

- No calculators are allowed

1. Simplify each of the following expressions fully

a. $2a + 5 + 3b + 5ab - 5$

Answer=..

b. $\dfrac{(2x)^2}{8x}$

Answer=..

2. You are given that $x = -3$. Find the value of

a. $2x^2$

Answer=..

b. $3x - 6$

Answer=..

3. Simplify each of the following.

a. $24 - (-29) - 5 + (-3)$

Answer=..

b. $(-9)^2 \times -4$

Answer=..

c. $13 \times (-2) \times 0 \times (-4)$

Answer=..

d. $3 + (-2) \times 4$

Answer=..

4. Showing full working, solve the equation

$$3x + 11 = 56$$

$x =$...............

5. Find the value of 0.3×0.2.

$0.3 \times 0.2 =$................................

6. Find the value of $3 \div 0.02$

$3 \div 0.02 =$......................

7. A shape has 4 straight sides. Any two opposite sides are parallel and all of the sides are the same length. There are no right-angles in the shape. What is the name of this shape?
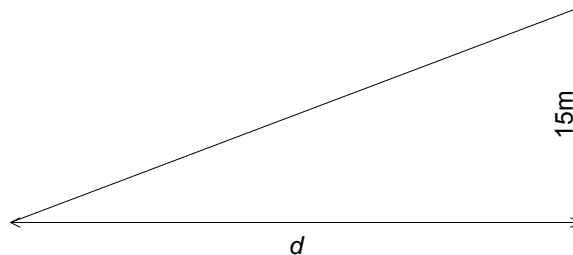
The shape is a................................

8. Find the next three terms in the sequence. Write your answers in the dotted spaces

17   14.5   12   9.5   ....

9. A farmer wants to buy some pigs and some goats. The farmer is told that 3 pigs and 1 goat will cost a total of £440, and also that one 1 pig and 2 goats will cost a total of £280. The farmer decides to buy 5 pigs and 5 goats. How much will he pay? You must show your working clearly.

Total cost = £…………………………………

10. The diagram shows a slope with gradient ¾ on the side of the hill. I walk straight up the slope and find that I have risen vertically by 15m. Calculate the *horizontal* distance that I have walked, shown as *d* on the diagram.
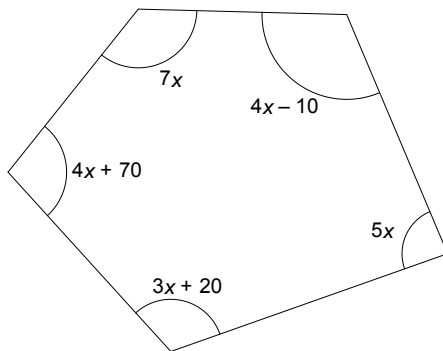

d = …………………………………………………m

11. One side of a regular hexagon measures $3\frac{3}{4}$ inches in length. Showing full working find the total **perimeter** of the hexagon, giving your answer in feet and inches.

Perimeter = ………………………………… inches

12. The shape shown is a pentagon. It is not drawn to scale. Find the value of x and hence find the smallest angle in the pentagon
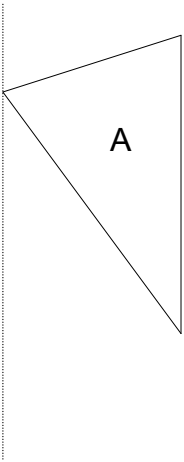

$7x$
$4x - 10$
$4x + 70$
$5x$
$3x + 20$

$x =$…………………………

Smallest angle = …………………..

13. Find the 100th term in the sequence

3   7   11   15   …….

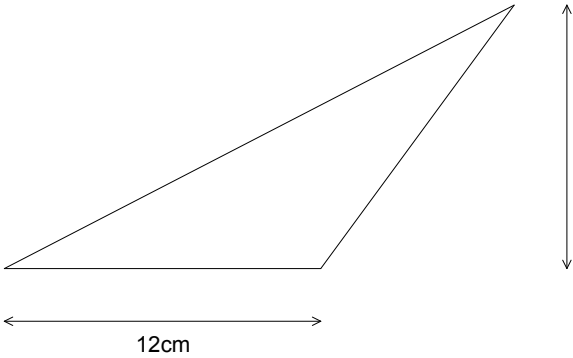100th term=……………………………….

14. Reflect the triangle A in the dotted line.

A

15. Write the number 24 as a product of prime numbers.
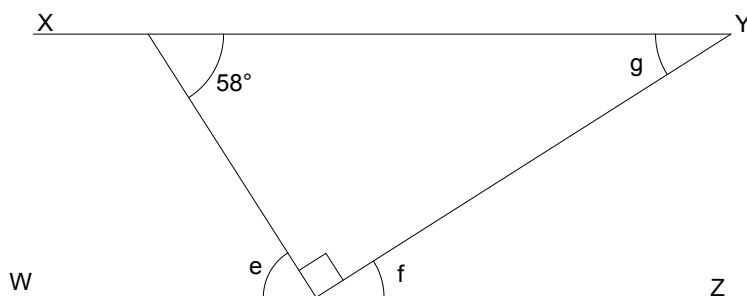
24=…………………………………………..

16. Find the area of the triangle shown in the diagram.

12cm

Area=……………………………..cm^2

17. In the diagram shown below XY is parallel to WZ. Angle ACB = 90°. Find the angles marked *e, f*, and *g*.

e=…………………………………….°

f=…………………………………….°

g=…………………………………….°

18. In how many *different* ways can the letters in the word *BARB* be arranged?

Answer=……………………………..

19. The area of a circle is 16π cm^2. Showing all working clearly find the **diameter** of the circle.

Diameter = ………………………………………..cm

20. Find the median of all even numbers between 13 and 27.

Median = …………………………………………………..

21. The three angles in a triangle are A, B and C. Angle A is twice as large as angle B, and Angle B is three times as large as angle C. Showing all working clearly find angles A, B and C.

A=………..degrees

B=………..degrees

C=……….degrees

22. Solve the following equation for x, showing all working clearly

$$3(x-4) - 2(x+7) = -20$$

$x =$…………………..

23. Peter and Simon stand facing one another. At exactly the same instant Peter and Simon then start to turn steadily on the spot. Peter turns 9 times in the same time that Simon takes to turn 12 times. How many times will Simon have turned before both boys will be facing one another for the first time after starting the game?

Answer…………………….turns

24. A rectangle ABCD is drawn so that A, B, C and D are placed points with the following co-ordinates:

A(1, 1)
B(1, 7)
C(6, 7)
D(6, 1)

The rectangle is rotated through 90˚ anticlockwise about the point (0, 0) and labelled A'B'C'D'. Find the co-ordinates of A', B', C' and D'.

A'…………

B'…………

C'…………

D'………..

25. What is the largest prime factor of 128?

Answer =.………………………………………

26. I drop a ball so that it bounces on the spot. The ball is dropped from 36cm above the ground, and each time the ball bounces it reaches ¾ of the previous height. To what height will the ball rise above the ground after the 3rd bounce?

Height = .……………………cm

27. Solve the following equation, showing all working

$$\frac{3 - 4x}{x} = 5$$

$x =$.…………………….

28. Showing full working, find 5% of 30% of 150. Give your answer as a decimal.

Answer = …………………………………….

29. An aircraft flies at an average speed of 400km per hour for $1\frac{3}{4}$ hours. For the next $2\frac{1}{4}$ hours the aircraft flies at an average speed of 460km per hour. Showing all working clearly calculate the average speed for the whole journey, giving your answer as a mixed fraction.

Average speed = ……………………….…..km per hour

30. The diagram shows a rectangle, whose lengths are shown in centimetres. Find the values of x and y.

$4y$

$y + 2$ $x + 1$

$2x+y$
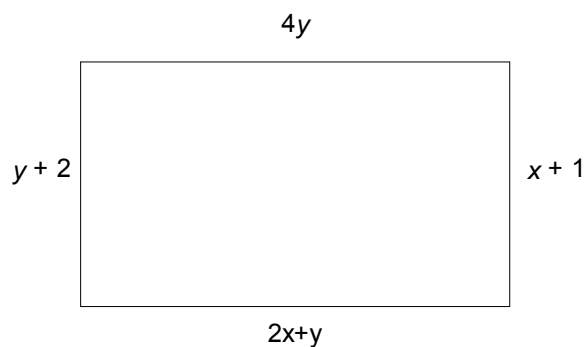
x =……………………

y =……………………

31. A man pulls a cart a distance of d m along a straight, horizontal road. During the journey the wheel turns n times. Find the radius of the wheel, giving your answer in terms of d, n and π.

Radius = ………………………………….m

32. I start a sequence with the number 3. To obtain each term I double the previous term and add 1 to the result. **By considering the differences between consecutive terms** or otherwise, find the difference between the 13th and 14th terms.

Difference = ………………………………………….

33. Solve the following equation, showing all working clearly.

$$(x-4)(x-7) = (x+3)(x-1)$$

$x =$ ……………….

34. Solve the following equation, showing all working clearly.

$$\sqrt{\frac{3 + 2x}{9 - x}} = 4$$

$x =$....................

35. Six integers have mean 7, median 8, mode 9 and range 10. Find a possible set of six numbers for which this is true. Write your answers in the space below.

Answers   ____   ____   ____   ____   ____   ____

A sequence has first term $-\frac{1}{2}$. If any term in the sequence is x then the next term is $\frac{1}{1-x}$. Showing full working, find the next second and third terms in the sequence.

Second term= ………………………..

Third term =. ………………………

36. x is a number between 0 and 1. Arrange the following in order of size from smallest to largest:

$$\frac{1}{x} \qquad \frac{1}{x^2} \qquad \sqrt{x} \qquad x^2 \qquad x^3$$

In order……………………………………………………………………………………

37. Solve the following equation, showing full working:

$$\frac{x-5}{2} = \frac{2x+1}{3} - 1$$

$x =$……………………………..

38. The author of a Mathematics textbook will be n years old at the beginning of the year n^2 (where n is a whole number). How old was he at the start of 2009?

Age = …………………………………

39. A cube has edges of length 4cm, and a cuboid has edges of length 6cm, 8cm and 4cm. What is the surface area of the cuboid as a percentage of the surface area of the cube?

Answer=…………………………….%