

SHERBORNE SCHOOL.

ENTRANCE SCHOLARSHIP EXAMINATION, 1956.

Mathematics II.

(2 hours).

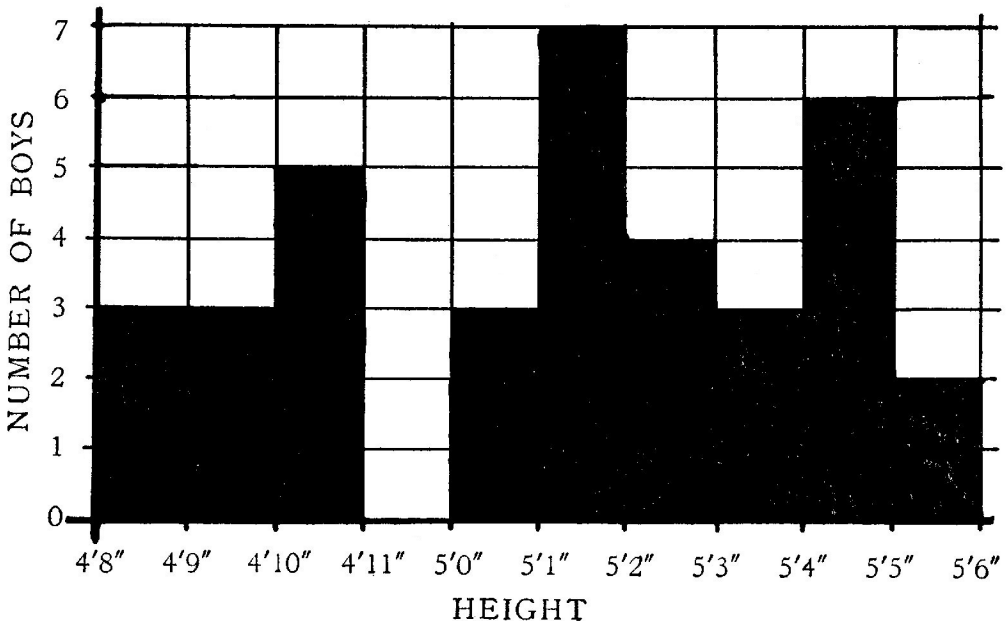
1. In a form of 16 boys, 1 boy is 12.8 (i.e. 12 yrs. 8 mths.), 2 boys are 12.9, 1 is 12.10, 2 are 12.11, 1 is 13.0, 2 are 13.2, 3 are 13.3, 3 are 13.4, and 1 is 13.5. Complete the following table for the deviations of their ages from 13.0.

Deviation in months from 13.0	−4	−3		+5		
Number of boys	...	...	1	2		1

Find the average deviation and so the average age.

The diagram shows the heights of another form. For example, the rectangle between 5' 3" and 5' 4" is 3 units high; this means there are 3 boys with heights between these limits, say 5' 3½" tall on the average.

- (i) How many boys are there in the form?
- (ii) Make a table showing the deviations from 5 ft. 0½ ins., as before.
- (iii) Find the average height of the form.



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2. You are given that if two triangles on the same base and on the same side of it are equal in area, then the line joining their vertices is parallel to the base. Prove that if *each* diagonal of a quadrilateral divides it into two triangles of equal area, then it is a parallelogram. Is it necessarily a parallelogram if *one* diagonal divides it into two *congruent* triangles?

If $AB = CD$, and $AC = BD$, must $ABCD$ be a parallelogram?

Illustrate your answers by figures.

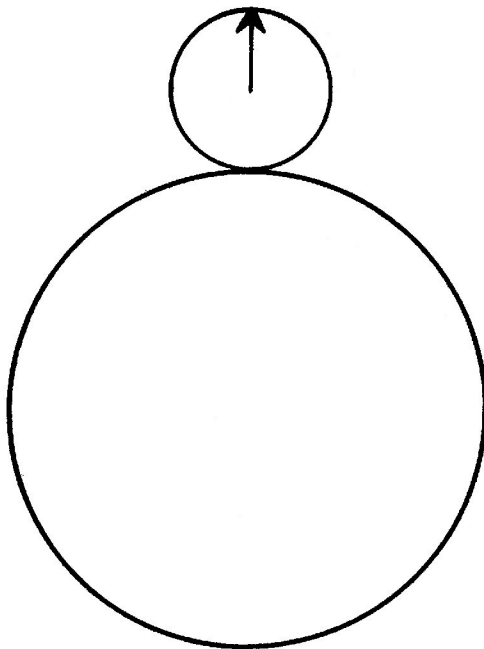
3. Solve the simultaneous equations :

$$(x - 4y)(y + 3) = 0, \quad (x - y)(4x - y - 15) = 0.$$

Give all solutions, and pair off carefully corresponding values of x and y .

4. A man buys 575 cigarettes to divide equally between a gang of men and their foreman. He then learns that it is customary to give the foreman three times as much as an ordinary man. He finds that he can divide them just as well in this way without remainder. How many more will the foreman get than if they had been divided equally?

5. In the diagram, the small circle has one-third the radius of the large circle, and rolls without slipping on the outside of the large circle, which is fixed, until it returns to its present position again. How many times will the arrow-point touch the large circle? Sketch the path of the arrow-point. How many times will the arrow point straight up? Show in a sketch where the circle is when this happens.



6. If $x = p^2 + q^2$, $y = r^2 + s^2$, prove that $xy = (pr + qs)^2 + (ps - qr)^2$.

Given that $5 = 1^2 + 2^2$, $13 = 2^2 + 3^2$, $41 = 4^2 + 5^2$, use this result to express 65 ($= 5 \times 13$) in *two* ways as the sum of two squares, and 2665 ($= 5 \times 13 \times 41$) in *four* ways as the sum of two squares.

7. A ladder has 24 rungs, equally spaced. The space between either end of the ladder and the end rung is the same as the distance between rungs. The ladder rests against a wall and the seventh rung from the top is marked. If the ladder were slid down to the ground, the marked rung would be where the foot of the ladder now is. If the ladder were pushed up to the wall, the marked rung would be 4 ft. 6 ins. below where the top now is. How far apart are the rungs?