Shrewsbury School.

ARITHMETIC PRIZE, 1916.

A.

To be shewn up in ½ hour. Write the answers on the question paper.

1. Find the balance due to a man's credit from the following banking account.

DEBIT.	£	s.	d.	CREDIT.	£	s.	d.
Carried forward...	73	6	10	*Carried forward...*	209	8	11
Oct. 5—Smith ...	2	8	10	Sept. 11—Cash ...	12	12	0
„ 7—Jones ...	11	4	7	„ 25—Cash ...	83	2	7
„ 7—Robinson ...	1	13	2	„ 25—Cash ...	13	7	6
„ 7—Snelson ...	16	4	7	Nov. 9—Ardent Fire Assurance Co. ...	25	6	8
„ 7—S.P.C.K. ...	0	2	6	Dec. 31—Cash ...	4	4	0
„ 7—Plimmer ...	4	8	7	Dividends of Cinema Ltd.	137	2	5
„ 7—Belgian Refugee Fund	0	1	6				
„ 10—Ford, Ltd....	150	10	0				
„ 27—Boots ...	1	17	11				
„ 30—Selfridge ...	4	2	3				
„ 30—Self ...	5	5	0				
Nov. 3—Brock ...	1	10	10				
„ 10—Matthews ...	2	2	0				
„ 10—Adams ...	0	10	4				
„ 25—Self ...	4	3	6				
Dec. 11—Snelson ...	6	4	8				
„ 11—His Master's Voice, Ltd....	23	18	5				
„ 11—Y.M.C.A. ...	0	2	0				
„ 11—Plimmer ...	3	11	4				
„ 20—Gas Co. ...	23	2	6				
„ 21—War Loan...	131	1	7				
Balance ...							
£				£			

2. Make out the following bill.

	£	s.	d.
3 cwt. 14 lbs. seed potatoes at 14s. 8d. per cwt.			
4½ galls. With's Plant Food at 1s. 3½d. per gall.			
23 bushels beans at 1s. 3½d. per peck ...			
3 shovels at 4s. 11d. each			
4 gross staples at 4½d. per doz. ...			
¾ mile barbed wire at 2¼d. per yard ...			
87 cordon pear trees at 1s. 4½d. each ...			
Total ...			
Less Discount for cash at 2d. in the shilling			
Net ...			

3. In the following marks in an examination reduce the marks obtained by each candidate on each paper to a maximum of 100 (correct to 1 place of decimals) and give the total out of a maximum of 500.

Where a Candidate missed a paper give him the same percentage on the papers missed as he got on all the papers he did.

	I.		II.		III.		IV.		V.		
	Max. 84	%	Max. 200	%	Max. 183	%	Max. 150	%	Max. 80	%	Total.
Brown ..	49		175		96		92		68		
Green ..	61		164		111		102		68		
Black ...	27		83		61		50		4		
White ..	—		113		95		87		57		
Gray ..	56		—		—		78		46		

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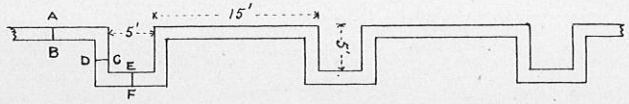
B.

1. The product of three consecutive odd numbers ends in a 3, is divisible by 11, and lies between one mlllion and five million. Find them.

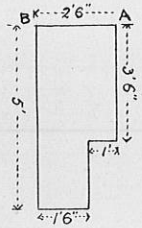
2. Find the number of cubic feet of earth excavated in the following fire trench on a frontage of 40 yards; how long (to the nearest hour) would it take 40 men to dig it if each pair of men dig 40 cubic feet in the first hour, 32 in the second, 20 in the third, 15 in the fourth.

Horizontal Plan



Vertical Section at AB.

(Parapet and Parados not shown).



Section at CD or EF is rectangular 2ft. wide by 5ft. deep.

3. A fraudulent and ignorant grocer on being convicted of using a 14oz. weight to weigh 1lb. of sugar, thought to make an equal profit by adding 2oz. of sand to each lb. of sugar instead. To his chagrin he discovered that his gain per cent. on his outlay was less by 2 than before.

If sugar cost him £1 9s. 2d. per cwt., find the price per lb. at which he claimed to sell it.

4. Work out by logarithms:

$\frac{1970\pi}{(9{\cdot}06)^2}$ If the 1970 and the 9·06 are given correct to three significant figures, give to four significant figures the greatest and least possible values for the answer, allowing for the approximate nature of the tables, and of the numbers given.

5. It has been proposed to make a new war loan attractive by offering "premium bonds." The following plan has been suggested. It is to be issued in £1 exchequer bonds at par. With every 100th bond paid for, one extra one is given away. With every 1000th paid for, an additional nine extra (making ten extra in all) are given away. With every 10,000th an additional 90 extra (making 100 extra in all) are given away, and so on, till with every 100 millionth, 1 million are given away.

On both premium and ordinary bonds $3\frac{1}{2}$ per cent. simple interest is to be paid.

If 100 million is raised in this way, and the whole redeemed in 10 years at par, find the total sum paid by the state in interest and premiums.

To what rate of simple interest on the £100 million would this be equivalent?

6. Explain the advantages of the Arabic over the Roman system of numerals.

If the Roman were the only system invented, how would you express the working of the following sums.

(i.) CXLVII. multiplied by XXXIX.

(ii.) MDCCCXLI divided by CXIV.

X 7. If t stands for ten and e for eleven work out in the scale of 12 (*i.e.* the digits represent descending powers of 12, not of 10).

(i.) 4t09 × 5e7. (ii.) 1 ÷ t correct to 2 "duodecimal" places.

8. A sphere, a cube, and a regular tetrahedron have equal surfaces. Find the ratios of their volumes.

(N.B.—You need not work out the values of square roots or of π.)

9. From the formula

$$\pi = 2{\cdot}4\left\{1+\frac{2}{3}\cdot\frac{1}{10}+\frac{2.4}{3.5}\frac{1}{10^2}+\frac{2.4.6}{3.5.7}\frac{1}{10^3}+\text{etc.}\right\}$$
$$+\ {\cdot}56\left\{1+\frac{2}{3}\cdot\frac{2}{100}+\frac{2.4}{3.5}\left(\frac{2}{100}\right)^2+\frac{2.4.6}{3.5.7}\left(\frac{2}{100}\right)^3+\text{etc.}\right\}$$

Calculate π correct to four decimal places.

(N.B.—the working must be shown up.)