No. 28. By W. VANDUSEN, Wheatland, Man. Since the length of the chord = radius, it is the side of a hexagon (Euc. IV. 15), of which the area $= x^2 \times .433 \times 6$. But of the circle the area $= 8^2 \times 3.1416$. Hence, the six segments, or the difference $= 8^2 (3.1416 - 2.598) = 64 \times .5436$. The area of two of them is, therefore, $64 \times .1812$. But the zone = circle − these two segments $= 64 \times 3\ 1416 - 64 \times .1812 = 64 \times 2.9604 = 189\ 465$.

No. 29. By W.V.

Let s = distance passed over by the hour-hand ; then 12s = " " " " " " minute-hand.

$\therefore$ 12s = 20 min. $+ \frac{1}{12}$s ; s $= \frac{40}{143}$ minute spaces. The minute hand has, therefore, moved over $\frac{40}{143} \times 12 = 20\frac{20}{143}$ minutes past four.

No. 30. By the EDITOR.

$\frac{1}{19} = .05262\frac{3}{19}$, by common division.....(1)

$\therefore \frac{3}{19} = .15789\frac{9}{19}$. Substitute this in (1), and

$\frac{1}{19} = .052631578\frac{9}{19}$.....(2)

$\therefore \frac{9}{19} = .473684210\frac{5}{19}$.....(3)

$\therefore \frac{18}{19} = .947368421\frac{1}{19}$.....(4)

$= .947368421152631578\frac{9}{19}$ from (2) ; and from (4) it is plain that the figures recur after the last 8.

No. 31. By R. S. BREWSTER. Let S be the place of meeting between P and Q.

Then the rates are as PS : QS

$\therefore \frac{8PS}{9QS} : \frac{10QS}{9PS} = 5 : 4$; $\therefore 4PS = 5QS$;

i.e., the rates are as 5 : 4 ; $\frac{5}{9}$ of $39 = \frac{65}{3}$ miles ; $\frac{4}{9}$ of $39 = \frac{52}{3}$ miles

$\therefore$ at $\frac{9}{10}$ former rate A. goes $\frac{52}{3}$ miles in 4 hours ; or former rate $= \frac{10}{9}$ of $\frac{13}{3} = 4\frac{22}{27}$ miles per hour.

And B.'s rate was $\frac{4}{5}$ of this $= \frac{4}{5}$ of $\frac{130}{27} = 3\frac{23}{27}$ miles per hour.

No. 31. By W. M. GOVENLOCK B.A. Let them meet after x hours, A. going y miles, and B. z miles per hour.

Then $xy + xz = 39$; $\therefore x = 39 \div (y + z)$.....(A)

A. is 4 hours longer on the road

$\therefore (39 - xy) \div \frac{9}{10}y = 4$; $\therefore$ from (A), $39z \div (y + z) = \frac{36}{10}y$.....(B)

B is 5 hours longer on the road,

$\therefore (39 - zx) \div \frac{8}{5}z = 5$; $\therefore$ from (A), $39y \div (y + z) = \frac{45}{8}z$.....(C)

B $\div$ C gives $\frac{z}{y} = \frac{16}{25} \cdot \frac{y}{z}$, whence $z = \frac{4}{5}y$.....(D)

From C, $39y \div (y + \frac{4}{5}y) = \frac{45}{8}$ of $\frac{4}{5}y$, whence $y = \frac{130}{27} = 4\frac{22}{27}$, A.'s rate ;

and $\frac{4}{5}$ of $\frac{130}{27} = \frac{104}{27} = 3\frac{23}{27}$ miles per hour, B.'s rate.

No. 31. By W. PRENDERGAST, B.A., Inspector of Separate Schools, Ontario. See EDUCATIONAL JOURNAL, December, 1890.

If A. had maintained his former rate he would have reached his destination $3\frac{3}{5}$ hours after the meeting, and B. would have reached his in $5\frac{5}{8}$ hours. The time required to finish is directly proportional to the distance and inversely to the rate. But the distance itself is inversely proportional to the rate. Hence, by composition we get $3\frac{3}{5} : 5\frac{5}{8}$ inversely proportional to the squares of the rates ; $\therefore$ rates are as 5 : 4.

Thus the *times* required to walk a mile are as $\frac{1}{5} : \frac{1}{4}$.

At their regular rates A. would take $(5\frac{5}{8} - 3\frac{3}{5})$ hours less than B. to walk the whole distance. Therefore B. takes $\frac{27}{520}$ hours longer to walk a mile than A. takes. Hence, $(\frac{1}{4} - \frac{1}{5}) \div \frac{1}{5}$ of A.'s time for a mile $= \frac{27}{520}$ hours.

$\therefore$ A.'s rate $= 4\frac{22}{27}$ miles per hour ; B.'s rate $= 3\frac{23}{27}$ miles per hour.

No. 31. By A. H. P. MATTHEW, Langley, B.C.

Let x = A.'s rate per hour in miles at start.

" y = B.'s " " " " "

$\therefore \frac{5}{8}$y = distance from meeting place to P., and $3\frac{3}{5}$x = " " " " Q.

(1) $\therefore \frac{5}{8}y + 3\frac{3}{5}x$ = total distance = 39 miles

and $\frac{\frac{5}{8}y + 3\frac{3}{5}x}{x}$ = A.'s time at original rate

and $\frac{\frac{5}{8}y + 3\frac{3}{5}x}{y}$ = B.'s " " " "

(2) $\therefore \frac{\frac{5}{8}y + 3\frac{3}{5}x}{y} - \frac{\frac{5}{8}v + 3\frac{3}{5}x}{x} = 2\frac{1}{25}$ hours.

$x = \frac{5}{4}y$.

Substitute No. 1, and $x = 4\frac{22}{27}$, $y = 3\frac{23}{27}$ miles per hour.

N.B.—This fine problem appeared on the Second Class arithmetic paper for Ontario, 1889. We are glad to be able, by the help of our contributors, to place side by side four elegant and totally independent solutions. The comparison of different methods is a valuable window that admits much light.—EDITOR.

No. 32. By W.M.G. Let the *original* cost be \$1 ; *now* it costs $\$\frac{15}{16}$.

Let x = cost of the work ; y = cost of the material

$\therefore x + y = 1$; $\frac{5}{4}x + \frac{5}{8}y = \frac{15}{16}$; $\therefore y = \frac{3}{4}$; $\frac{5}{8}y = \frac{5}{8}$.

Out of a total cost of $\frac{15}{16}$, cost of material is $\frac{5}{8}$

" " " 100 " " " $\$66\frac{2}{3}$. Ans.

No. 32. By A.H.P.M.

Let x = cost of material now, for 1 article

and y = " labor "

then $\frac{6}{5}$x = " material at first

" $\frac{4}{5}$y = " labor at first

$\therefore 15\left(\frac{6x}{5} + \frac{4y}{5}\right) = 16(x + y)$

$\therefore x = 2y$

$\therefore$ the material now costs $\frac{2}{3}$ and labor $\frac{1}{3}$

$\therefore$ on \$100 worth of articles the material is worth $\$66\frac{2}{3}$. Ans.

No. 33. By S.P.G. Let x and y be the numbers, then $x^2 + y^2 = axy$

$x^2 - y^2 = bxy$. Therefore $a = (x^2 + y^2) \div xy$, and $b = (x^2 - y^2) \div xy$; $\therefore a + b = \frac{2x}{y}$, $a - b = \frac{2y}{x}$; *i. e.*, $a^2 - b^2 = 4$.

N.B.—The exponents have evidently been omitted by mistake.

No. 34. By the EDITOR. Every time any number contains 10, it contains 9, with a remainder of 1. Thus, 12345 contains 10, 1234 times and remainder 5. Hence it contains 9 ; 1234 times with remainder (5 + 1234). The operation in full stands thus :

1234,5
123,4
12,3
1,2
1

1371,6

N.B.—A little inspection and a few experiments on other numbers will make the method clear.

No. 35. By A.H.P.M.

$.06 \div .0002 = 3{,}000$ cubic feet per hour.

NOTE.—This equation is copied from the "Manual of Hygiene." It is well explained in section 72, on page 38 of the Manual.

No. 36. By the EDITOR. A cord foot is one-eighth of a cord = 16 cubic feet. If the sides of the curb are perpendicular to the bottom, the width must be 4 feet. But if the sides slant as usual, the data are insufficient. The angle of the slant will be required, and the width at top or at bottom must be defined.

No. 37. By A.H.P.M.

A. gets $\frac{2}{5}$ of all the marks. Let C. get x marks

$\therefore$ B gets $2(\frac{2}{5} - x)$; D. gets $\frac{1}{2}(1320 - x)$; and

E gets $\frac{1}{3}(2640 - 2x)$; $\therefore x = \frac{6}{55}$, and the marks obtained are as 22 : 32 : 6 : 30 : 40. E. is the prizeman.

REVIEW HELPS.

M. A. WATT.

Reviewing is dull work for Junior Classes, and it is hard to keep up interest. I have a plan which I think is original, though that is always questionable in this life of influences. We are "things of shreds and patches." However, it is very interesting. We call it a "Match." The front blackboard is divided into four (or six) sections, half for the boys, half for the girls. Crayons and brushes are placed handy ; "monitors" for cleaning board are chosen from volunteers. Suppose we are reviewing fractions up to addition. A question is announced, first, in changing improper fractions to mixed numbers ; time is given for all to do it rapidly. The names of the boys are given, choosing some good and some poorer workers, and the names of girls of about the same qualifications are also given. Another question is announced to keep the class busy while the others are working on the board. No one is allowed to return to the board after leaving platform, and anyone who declines to work causes a loss to his or her side of the value placed upon the problem. On the other blackboard are two columns headed "Boys," "Girls," in which the mark of each is put. If this style of prob'em prove difficult to the poorer scholars, it is repeated until sufficient practice has been given. If any child in the seat works so rapidly as to get done before the next time, he is allowed to do as many questions of the same style as he can, credit being given in some way for his industry. Any style of question may be reviewed in this way.

It was used one day for music. The staff with an exercise was on the board, the keynote was found, and the whole class directed to get ready for a match on the numbers, letters, and syllables of the notes of the exercise. They all wrote the numbers on their slates, and a part was marked off for a test on the blackboard. The class were eager in their attention to the board, and the dullest were enlightened as their comrades worked out the exercise.

In spelling, the words were given out, and the same went on. It is rather slower in this, though the bad spellers, fearing the publicity, were moved to get ready their much disliked lesson. It was very unpopular to refuse to go to the board, and few tried it after the first time.

It lends itself to geography and grammar, also to history and hygiene, and is a help to almost any lesson. The close attention given to their comrades' work, the critical examination they give to the faults, and to the teacher's marking of these faults, help to clear up points they may have failed to understand in the teaching previously. The danger lies in a spirit of adverse and carping criticism which may be aroused by the emulation, and this should lead the teacher to be very fair and exact in his or her judgments, and judicious in the use of the "Match."

BOOK NOTICES.

BLACKBOARD SKETCHING. By Bertha Hintz, E. L. Kellogg & Co, New York.

Every teacher should be able to illustrate lessons on the blackboard in presence of the class easily and rapidly The elaborate drawing made out of school hours does not repay the teacher for his labor in all cases, and sometimes, when improperly used, spoils what otherwise might have been an excellent lesson. A rapidly executed sketch "made at the moment to exist but a moment" to strengthen or fix the mental picture obtained from the teacher's description or page of the book is all that is required. *All* can learn blackboard sketching, and in a very short time, by following the illustrated directions laid down in this little book. The drawing of objects are taught in proper order, and after the latest and improved methods. We are certain that all who purchase this book and work the first few exercises, and apply them in their teaching, will be delighted and astonished with the result. A.C.C.

NATIONAL DRAWING COURSE. By Anson K. Cross, of Massachusetts State Normal Art School, Ginn & Co., Boston.

This course consists of a set of nine cards for primary grades and five books for grammar grades, a teacher's "Outlines of Lessons" for each grade, a box of tablets from which nearly all the common solids may be constructed, and a glass slate.

In the "Outlines of Lessons" the general plan of the work is outlined, and the hints are such as will be of the greatest material benefit to the teacher who is at a loss to know how to teach drawing. The glass slate is part of the material used, and is of the greatest educational value, because it enables each pupil to correct or confirm his drawing of the appearance of an object by holding the slate between him and the object at right angles to the direction he is looking when observing the object. The "Outlines of Lessons by Weeks," although not intended to be slavishly followed by every teacher, will be found of the greatest benefit to the inexperienced teacher of drawing. We have not space at our disposal to enumerate all the good points of this course. It is destined to be a formidable competitor for public favor with the other two or three excellent courses published in the United States.

We would strongly advise all teachers who have used only the Authorized Public School Course to get a set of this excellent course. It would be a revelation to them, and of everlasting benefit to the pupils.

The teaching of color, which is not taught in schools in Ontario, is fully treated in a masterly way, along with the study of form. A.C.C.