## ARITHMETIC. (Solected.)

1. A grain dealer bought 1300 bushels of wheat and sold } of it at a profit of 5 per cent.  $\frac{1}{3}$  at 8 per cent. profit and the rest at 12 per cent. profit. Had he sold all at a profit of 10 per cent, his gain would have been \$16.68 $\frac{1}{3}$  more. Find the cost price of the wheat.  $\frac{1}{15}$  were sold at 12% profit. The portions are as 3, 5 and 7. And  $(3 \times 1^{-0.5})+(5 \times 1^{-0.5})+(7 \times 1^{-1.2}) (15 \times 1^{-0.5})=11$ , i. e. for every \$15\$ of the cost the grain would have here \$11\$ more.

every \$15 of the cost the grain would have been \$11 more.
∴ original cost =16.681 × 15+11=\$2275.
2. The gress annual receipts of a railroad are divided as follows :

40% for working expenses, 54% to pay a dividend of  $3\frac{1}{2}\%$  to stock-holders, and \$28350 placed in the reserve fund. Find the amt. of the railroad stock.

6%=reserve=\$28350, ... 54% = dividends=\$28350 × 9=31% of stock, : stock=\$7290000.

3. A's present age is " of B's, but 34 years ago it was § of B's. Find their present ages.

The difference of the ages is constant. Now  $9=4\frac{1}{2}$  times (9-7), and  $\bar{o}=1$ <sup>3</sup> times ( $\bar{o}-2$ ).

A's former age  $=1\frac{2}{3} \div 4\frac{1}{2} = \frac{1}{3}$ ? of his present age.  $\therefore \frac{1}{3}\frac{9}{3}$  A's present age =34, A's age =54, B's 42.

4. A boatman rows 5 miles with the tide in the time he would row 3 miles against it. But if the current ran half a mile an hour more, he would row twice as rapidly with the tide as against it. Find this rate in miles per hour in still water.

If 5 and 3 be his rates with and against the current, then  $\frac{1}{5}(5+3)$ =4 will be his rate in still water, and (5-4) or (4-3)=1 will be the rate of the current  $= \frac{1}{2}$  rate in still water.

Similarly if 2 be his rate with and 1 his rate against it then  $\frac{1}{2}(2+$ 1)=11 will be his rate in still water, and  $(2-1\frac{1}{2})$  or  $(1\frac{1}{2}-1)=\frac{1}{2}$ rate of current=1 rate in still water,  $\therefore$   $(\frac{1}{2}-\frac{1}{2})$  rate in still water= $\frac{1}{2}$ mile per hour, i.e. rate in still water = 6 miles.

5 If 12 oxen eat up 33 acres of pasture in 4 weeks and 21 oxen eat L 10 acres of like pasture in 9 weeks; find how many oxen will eat up 24 acres in 18 weeks. Ans. 36. (Proposed by Sir Isaac Newton, 1704.)

NEWTON'S SOLUTION. If 12 oxen in 4 week's eat up 31 acres, then by proportion 36 oxen in 5 weeks, or 16 oxen in 9 weeks, or 8 oxen in 18 weeks, will eat up 10 acres, on supposition that the grass did not grow. But since by reason of the growth of the grass 21 oxen in 9 weeks can eat up only 10 acres, that growth of the grass in 10 acres for the last 5 weeks will be as much as would be sufficient to feed the excess of 21 oxen above 16, that is 5 oxen for 9 weeks, or what is the same thing, tofeed § oxen for 18 weeks. And m 14 weeks, the excess of 18 above the first 4, the mercase of the grass, by analogy, will be such, as to be sufficient to feed 7 oxen for 18 weeks, for it is 5 weeks : 14 weeks : § oxen : 7 oxen. Wherefore add these 7 oxen, which the growth of grass alone would suffice to feed, to the 8, which the grass without growth after 4 weeks would feed, and the sum will be 15 oxen. And, lastly, if 10 acres suffice to feed 5 oxen 18 weeks, then, in proportion, 24 acres would suffice 36 oxen for the same time.

SOLUTION by A. Martin, M.A., editor Mathematical Magazine, Erie, Pa.

In the first case one ox eats  $\frac{1}{2}$  of  $\frac{3\frac{1}{2}}{12}$  or  $\frac{5}{72}$  of an acre and  $\frac{5}{18}$  of the

growth of that acre in one week. In the second case one ox cats h growth of that acre in one week. In the second case one ox cats  $\frac{1}{5}$  of  $\frac{19}{19}$ , or  $\frac{19}{180}$  of an acre, and  $\frac{19}{29}$  of what grows on one acre, in one week. Since one ox cats the same quantity of grass in one week in each case, therefore  $\frac{1}{29} - \frac{1}{54} = \frac{1}{125} = \frac{1}{5}$  of the growth of one acre during one week is  $= \frac{5}{2} - \frac{19}{180} = \frac{1}{125} = \frac{1}{25} = \frac{$ week.  $4 \times 18 = \frac{1}{3} = 100$  and 100 grass, in acres, one ox will eat in 18 weeks.  $24 + (\frac{1}{2} \times 24 \times 18) = 60 = 100$  guantity of grass, in acres, to be raten from 24 acres in 18 weeks; and  $60 \div \frac{3}{2} = 36$ , the number of oxen required to eat it.

# MANITOBA TEACHERS' EXAMINATION, 1882.

### ARITHMETIC.

### Examiner-J. B. SOMERSET, ESQ.

#### TIME-THREE HOURS-1ST & 2ND CLASSES.

The questions marked \* are not to be answered by first class candidates. Second class may work any of the questions, 10 correct answers being considered a full paper for each class.)



2. \*A person has \$15,560.60 invested at 6%; he saves each year of his income and adds it to his capital. What will his income be the fourth year?

3. \*A de ler invests \$2,000 in the purchase of 22 horses, pays \$280 for their carriage here, \$75 for stabling and 11% for insurance. He loses one horse, which the insurance company makes good with \$150. How much per head must he sell the rest for to realize 12 per cent. on his investment?

4. \*At what rate per cent. will \$1,520.00 amount to \$1,733.75 in

21 years? 5. Three contractors agree to build a road for \$10,000. A has build a road for \$10,000. B has 40 men 25 men at work for 16 days and 30 men for 84 days. B has 40 men for 10 days and 45 men for 40 days. C has 48 men for 50 days. C receives \$200 for superintending the work. How much is each contractor entitled to?

6. A note of \$6,000, dated May 16, payable 4 months after date, is discounted on July 21st at 6 per cent. by giving another note at 90 days, the proceeds of which will just meet the amount due. What is the face of the second note, interest being at the same rate?

7. Sterling exchange being at  $9\frac{1}{2}$  per cent. promium, find the cost of a draft on London for £416, 8s 9d, brokerage being  $\frac{1}{2}$  per cent.

8. School debentures are issued maturing in 20 years and bearing 6 per cent. interest. At what rate shall I bid for them so that my investment shall bring me 9 per cent. per annum?

9. If the stock of an insurance company paying yearly dividends of 10 per cent. is purchased at  $137\frac{1}{4}$ , brokerage being  $\frac{1}{4}$  per cent., what per cent of income will it produce on investment !

10. A miner finds a gold nugget weighing 24 lbs. 12 oz. avoirdupois, which when assayed, proves to be 18 carats fine; standard gold being 22 carats fine and worth \$17.621 per oz. Troy. Find the alue of the nugget.

11. A railway train runs over a road 118<sup>1</sup>/<sub>4</sub> miles long in 4<sup>1</sup>/<sub>3</sub> hours ; it stops 10 minutes for refreshments at a certain station and 24 minutes at each of 12 other stations, and runs through a tunnel 24 miles long at 16 miles an hour. What is the average speed per hour exclusive of stoppages, outside of the tunnel ?

12. A room is 25 feet long, 16 ft. 6 in wide, 11 ft. high. There are . so doors 8 ft. high, 3 ft. 4 in. wide; two windows 8 ft. 4 in. high, 4 ft. wide, and a fire place 4 ft. 2 in. square. How many pieces of paper 8 yards long, 1 yard wide would be required to paper its walls?

13. A and B are each possessed of \$4,000. A invests in U.S. 5 per cents at 104 and B in  $3\frac{1}{5}$  per cent. Consols at 91. At the end of a year A sells out at 102 and B at 98. Give the year's income of each and also his capital after selling out.

14. If I buy a horse for \$80 and am allowed 9 mcs. credit, and I sell him forthwith for the same sum, giving 3 months credit, find my gain per cent, money being worth 8 per cent. 15. A property of \$2,000 consisting of three farms of unequal value, is to be divided equally among three sons. They agree each

to take a farm and balance the difference in value by money pay-ments to each other. If the farms be valued as 11, 8 and 6, find the payments that must be made.

#### SOLUTIONS.

- 1. Ans  $-2_1 l_2$ . 2. Income =  $15566.60 \times (588)^3 \times 165 = $968.024956$ . 3.  $P_{-...0} = \{\frac{1}{2} l_0^2 (2000 + 280 + 75 + 30) 150\}_{21} = $120.055$ .

- 3.  $P_{7,...0} = \{\frac{1}{66}(2000 + 280 + 75 + 30) 150\}_{2_1} = \$15$ 4.  $6\frac{1}{2}$ , 5.  $A = \$2311 \cdot 61 : B = \$3581 \cdot 395 ; C = \$4106 \cdot 97$ , 6. Face  $\times \frac{2}{2}0\$ = 5000 \times \frac{1}{6}0?$ ;  $\therefore$  face  $= \$6029 \cdot 71$ . 7. Cost =  $\frac{10}{9} \times \frac{109}{100} \times 416\frac{7}{16} = \$2029 \cdot 195$ . 8. Rate  $\times (1 \cdot 63)^{20} = 100(1 \cdot 06)^{20}$ . Rate  $= 100(\frac{100}{100})^{20}$ . 9.  $137\frac{1}{2}$  yields 10  $\therefore$  yields an income of  $7\frac{2}{57}$ . 10. Value  $= 24\frac{3}{4} \times \frac{17}{4} \times 12 \times \frac{19}{2} \times 17\frac{5}{2} = \$5204 \cdot 88 +$ 11. Distance outside tunnel  $= 115\frac{1}{5}$  mb. Time in tunnel = 10.5 min. Time in tunnel=105min. Actual running time outside tunnel=21612min. .. rate per hour = 1151 + 21611 × 60=313182 miles.
- 12. Distance round 'room = 83ft.; total area of walls=83×11= 913 sq. ft.