noon A was m miles and at 6 p.m. B was n miles from Toronto. Find how many hours from noon A passed B, a being greater than b. Interpret the result when $m=40$, $a=5$, $b=3$, and $n=26$; also when $n=18$.

5. Let x = number of hrs. after noon,
Then distance of A from Toronto $= m - ax$
" " B " $= n + 6b - bx$
$\therefore \quad m - ax = n + 6b - bx.$

$$\text{from which } x = \frac{m-n-6b}{a-b}.$$

Substituting values of letters we get $x = -2$ in the former case, and $x = +2$ in the latter. The meaning being that A passed B at 10 a.m., and 2 p.m., in the two cases respectively.

6. Solve

(1) $xyz = a(yz - zx - xy)$
$= b(zx - xy - yz) = c(xy - yz - zx).$

(2) $$(a+b)^2 y + \frac{x[(c+d)^3 - (a+b)^3]}{(a+b)(c+d)} = \frac{2(a+b)^3}{(c+d)} + (c+d)^3 x.$$
$$(a+b)(c+d)x = (c+d)y - 2(a+b).$$

6. (1) Dividing the first equation by $axyz$

$$\text{we get } \frac{1}{x} - \frac{1}{y} - \frac{1}{z} = \frac{1}{a}.$$

$$\text{Similarly } \frac{1}{y} - \frac{1}{z} - \frac{1}{x} = \frac{1}{b}$$

$$\text{and } \frac{1}{z} - \frac{1}{x} - \frac{1}{y} = \frac{1}{c}.$$

Add the three equations, then

$$-\left(\frac{1}{x} + \frac{1}{y} + \frac{1}{z}\right) = \frac{1}{a} + \frac{1}{b} + \frac{1}{c}.$$

From this subtract the first equation

$$-\frac{2}{x} = \frac{1}{b} + \frac{1}{c}, \quad \text{or } x = \frac{-2bc}{b+c}, \text{ etc.}$$

7. Solve (1) $x^2 - 4x + 3 - 7\sqrt{x^2 - 9x - 6} = 5x - 3.$
(2) $2x^2 - xy = 6$ and $2y^2 - 3xy = 8.$

7. (1) $x^2 - 4x + 3 - 7\sqrt{x^2 - 9x - 6} = 5x - 3,$
$\therefore (x^2 - 9x + 6) - 7\sqrt{x^2 - 9x - 6} = 0,$
or $\sqrt{x^2 - 9x + 6}\,(\sqrt{x^2 - 9x + 6} - 7) = 0,$
$\therefore \sqrt{x^2 - 9x + 6} = 0$, or
$\sqrt{x^2 - 9x + 6} - 7 = 0$

from which $x^2 - 9x + 6 = 0.$
or $x^2 - 9x + 6 = 49,$

$$\therefore x = \frac{9 \pm \sqrt{81 - 24}}{2} \text{ or } x = \frac{9 \pm \sqrt{81 + 172}}{2}$$
$$= \tfrac{1}{2}(9 \pm \sqrt{57}). \quad = \tfrac{1}{2}(9 \pm \sqrt{253}).$$

(2) $2x^2 - xy = 6$
$2y^2 - 3xy = 8.$

Add the equations, divide by 2 and take the square root; then $x - y = \sqrt{7}$.

Second equation may be written: $x(x + x - y) = 6$ from which, by substitution, $x^2 + x\sqrt{7} - 6 = 0,$

$$\therefore x = \frac{-\sqrt{7} \pm \sqrt{31}}{2},\ y = \frac{-3\sqrt{7} \pm \sqrt{31}}{2},$$

8. Investigate the relations of the roots of $ax^2 + bx + c = 0$ to the coefficients.

Find what values of m will give equal roots to $x^2 - 3(2+m)x + 9(5+m) = 0$, and solve the equation in each case.

8. First part of question is "Book-work." Conditions that equation $ax^2 + bx + c = 0$ may have equal roots is $b^2 = 4ac$. Applying this principle to given example, then

$$9(2+m)^2 - 36(5+m) = 0.$$

Simplifying and solving, $m = \pm 4$.

9. Using the relations referred to in the first part of question 8, determine what values of the fraction $\frac{x^2 + 4x - 16}{4}$ will make x imaginary.

9. Put $\frac{x^2 + 4x - 16}{x - 4} = k$; clear of fractions and arrange in quadratic form

$$x^2 - (k-4)x + 4(k-4) = 0.$$

Now the conditions that x may be imaginary is $b^2 - 4ac$ must be negative; or

$(k-4)^2 - 16(k-4)$ is negative,
$\therefore k - 4 - 16$ is negative, or $k < 20$.

CLASSICS.

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NOTES ON CICERO, IN CAT., III.

§ 11. *Toto indicio*, etc.—When all the information had now been produced and laid before the Senate.

Domum suam. Bradl., 316, iii.