Question set 3 continued... [CoreCode Programming Academy]

3. Newton's law of gravitation:

Let 'm1' be the mass of object 1.

Let 'm2' be the mass of object 2.

And let 'r' be the distance between them.

The gravitational force of attraction is given by

$$F = G.m_1.m_2 / r^2$$

where G is a universal constant of gravitation.

$G = 6.67 \times 10^{-11}$

Write a program which will accept m1, m2 and r from user and print the gravitational force.

Do the validity check for m1, m2 and r.

[Hint: m1, m2 and r should be positive]

4. Colocumb's Law: A particle can be positively charged, negatively charged or neutral. Colocumb's law governs the force between the charged particles. Like charges (+,+ or −,−) repel each other and opposite charges (−,+ or +,−) attract each other. The magnitude of force of attraction or repulsion is governed by the following equation.

$F = k.q_1.q_2 / r^2$. where

k = Colocumb's constant $= 8.988 \times 10^9$

q_1, q_2 = Changes on particles with sign. [Positively charged particle will have positive sign & the negatively

Charged particle will have negative sign]

r = distance between the charges.

Write a program which will –

(a) accept q1, q2 (with sign) & r from user

(b) Print the magnitude of the force

(c) State whether the force is that of attraction or repulsion.

[Do validity checks whenever necessary].

5. Quadratic Equation Solver :

Quadratic eqn of a single variable is stated as follows

$ax^2 + bx + c = 0$ where a, b, c are real numbers and $a \neq 0$.

The roots of the equation are governed by the following formula.

$$r1 = \frac{-b + \sqrt{b^2 - 4ac}}{2a}, \quad r2 = \frac{-b - \sqrt{b^2 - 4ac}}{2a}.$$

Write a program which will

(a) accept a, b, c from user.

(b) print the roots of the eqn.

(c) do the validity checks.

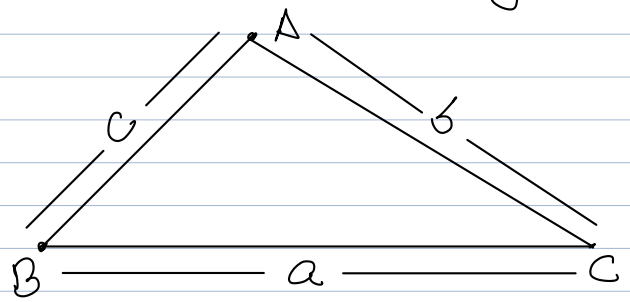
C1: $a \neq 0$

C2: $b^2 - 4ac \geq 0$ [If this condition is not met then print the message as follows –

"the eqn $ax^2 + bx + c = 0$ does not have roots in real" and exit from the code].

[Additional Hint: Use Sqrt() function to compute the Squave root]

6. Let ΔABC be any triangle. By convention the length of the side oppo. to angle A is denoted by a, that of angle B is by b and that of angle C is by c.



- The perimeter of a triangle is governed by formula -

Perimeter(ΔABC) = $a+b+c$.

- The area of the triangle is governed by formula -

$$\text{Area}(\Delta ABC) = \sqrt{S\cdot(S-a)\cdot(S-b)\cdot(S-c)}$$

where S = Semi-perimeter of a triangle.

$$S = (a+b+c)/2.$$

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$$m\angle A \text{ (in radians)} = \cos^{-1}\left(\frac{b^2+c^2-a^2}{2bc}\right).$$

$$m\angle B \text{ (in radians)} = \cos^{-1}\left(\frac{c^2+a^2-b^2}{2\cdot c\cdot a}\right).$$

$$m\angle C \text{ (in radians)} = \cos^{-1}\left(\frac{a^2+b^2-c^2}{2ab}\right).$$

Write a program which will

[a] Sides of a triangle a, b, c from user.

[b] Compute and print the perimeter of a triangle.

[c] Compute and print the area of a triangle.

[d] Compute and print the measures of all angles of a triangle in radians, in degrees.

[e] Validity checks:

$a > 0$, $b > 0$, $C > 0$

Sides of any two sides of a triangle is greater than the third.

If any of the above condition is violated then print the appropriate error message and exit.

[Hint: Use pow() function to compute power

Use acos() function to compute $\cos^{-1}$.

Use sqrt() function to compute the square roots.

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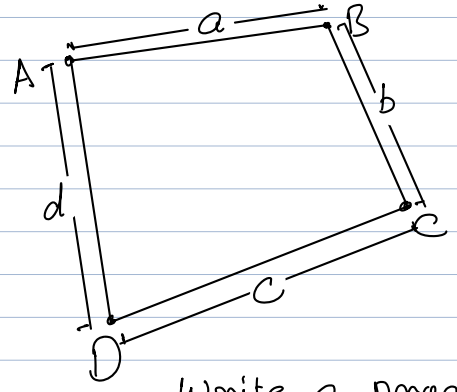
P-7: Let □ABCD be any quadrilateral.



Let $l(AB) = a$, $l(BC) = b$, $l(CD) = c$, $l(DA) = d$

Perimeter (□ABCD) = $a + b + c + d$

Area (□ABCD) = $\sqrt{(S-a).(S-b)(S-d).(S-d)}$

Write a program which will

(a) Accept lengths of sides of quadrilateral from user.

(b) Print the perimeter of the quadrilateral.

(c) Print the area of the quadrilateral.

(d) Do the validity checks:

C1: $a > 0$, $b > 0$, $c > 0$, $d > 0$

C2: Sum of any three sides of a triangle is greater than the fourth side.

P-8: Consider a circle with radius r.

Its circumference is given by formula = $2.\pi.r$.

Its area is given by formula $= \pi r^2$.

Write a program which will

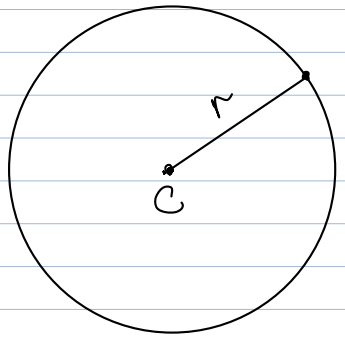
(a) Accept r from user.

(b) Print the circumeference.

(c) Print the area.

(d) Do the validity checks.

c1: $r > 0$.



[3C - will contain more complex problems
But will be given after 3A and 3B are complete].