QUESTION DEPARTMENT.

QUESTIONS SOLVED.

[For a Newfoundland subscriber.]

1. Prove clearly that $x^0 = 1$.

$$\frac{x^2}{x^2} = x^2 \div x^2 = x^{2-2} = x^0.$$

$$\frac{x^2}{x^2} = 1, \therefore x^0 = 1.$$

2. Prove the rule for finding the area of a triangle from its sides.

Let BC be the base of the triangle ABC, and AD the perpendicular on BC.

Let $AB = c$, $AC = b$, $BC = a$, $AD = d$, $DC = e$, and half the sum of the sides of the triangle be

$$\frac{AB+BC+CA}{2} = \frac{a+b+c}{2} = s.$$

Then $\frac{a+b-c}{2} = \frac{a+b+c-2c}{2} = \frac{a+b+c}{2} - c = s-c.$

Similarly $\frac{c+a-b}{2} = s-b$ and $\frac{b+c-a}{2} = s-a.$

Proof. $c^2 = a^2 + b - 2ac.$ (Euc. II. 13).

$$\therefore e = \frac{a^2+b^2+c^2}{2a}.$$

$$\therefore d = \sqrt{b^2 - \frac{(a^2+b^2-c^2)^2}{4a^2}} \quad \text{(Euc. I. 47).}$$

$$\therefore \text{Area ABC} = \frac{a}{2}d = \frac{a}{2}\sqrt{\frac{4a^2b^2-(a^2+b^2-c^2)^2}{4a^2}}.$$

$$\text{Area} = \sqrt{\frac{a^2}{4} \times \frac{4a^2b^2-(a^2+b^2-c^2)^2}{4a^2}}$$

$$= \sqrt{\frac{4a^2b^2-(a^2+b^2-c^2)^2}{16}}$$

$$= \sqrt{\frac{(2ab)^2-(a^2+b^2-c^2)^2}{16}}$$

Here the numerator being the difference of the squares of two quantities, it is equal to the product of their sum and difference.

$$\therefore \text{Area} = \sqrt{\frac{(2ab+a^2+b^2-c^2)(2ab-a^2-b^2+c^2)}{16}}$$

$$= \sqrt{\frac{(a^2+2ab+b^2-c^2)(c^2-a^2+2ab-b^2)}{16}}$$

$$= \sqrt{\frac{\{(a+b)^2-c^2\}\{c^2-(a-b)^2\}}{16}}$$

$$= \sqrt{\frac{(a+b+c)}{2} \times \frac{(a+b-c)}{2} \times \frac{(c+a-b)}{2} \times \frac{c-a+b)}{2}}$$

$$= \sqrt{s(s-c)(s-b)(s-a)}$$

That is, the area = the square root of the continued product of half the sum of the sides, and the differences between half the sum of the sides and each side separately.

3. Prove the rule for finding the area of a circle.

$$d^2 \times \cdot 7854 = \text{area}.$$

Let the circle be considered to be made up of an infinite number of triangles, with their bases in the circumference and their apexes at the centre, then the sum of their areas would be equal to the sum of their bases, that is, the circumference multiplied by the radius and divided by two.

That is, the area of the circle $= \frac{\text{circum.} \times \text{rad.}}{2}$

But the circum. $= 3 \cdot 1416 \times$ diam.

$$\therefore \text{area} = \frac{3 \cdot 1416 \times d \times r}{2}$$

$$= \frac{3 \cdot 1416 \times d \times d}{4}$$

$$= \cdot 7854 \times d^2$$

4. Divide a^x by b^y.

$$a^x \div b^y = \frac{a^x}{b^y}$$

5. Reduce to its lowest terms $\frac{x^{m-1}\, y^{2n}}{x^{2m}\, y^{n+1}}$

Precisely similar to this $\frac{x^2\, y^6}{x^5\, y^2} = \frac{y^3}{x^3}$

As the quantities are monomials, it can be seen at once that they can be divided by subtracting their powers.

6. From what source is "Useful Knowledge" papers compiled?

From all or any books, papers, or magazines containing useful information—particularly from the book of "Nature,"—which every one should study directly as well as from other books. Paul Bert's "First Year of Scientific Knowledge" is one of the most popular compendiums.

7. Solve Exercises I and II, Question Department EDUCATIONAL REVIEW for October, 1891.

The solution given of the "James Harper" exercises is correct as far as the last paragraph on page 108. Here a slight error has crept in. Instead of as in the text, read thus: The jeweller loses property worth $\frac{300 \times 2925}{4 \cdot 905}$ and the premiums he paid on two-thirds of that amount at $3\frac{1}{4}$ per cent for three years, together with annual interest on the premiums at 6 per cent, that is he loses

$$\frac{300 \times 2925}{4 \cdot 905} + \frac{21 \cdot 255 \times 300 \times 2925}{300 \times 4 \cdot 905}$$

less the insurance paid to him.

The second exercise is an inane puzzle which we have failed to solve, and over which we would not advise our readers to waste any time.

8. Explain which is correct: "Six and two are eight," or "Six and two is eight."

All good usage requires the verb to be plural.

9. Being on the bank of a river, I wish to know how I would measure its width, having only a book with me.

Assuming that the corners of the leaves of your book are right angles, fold a leaf so that the upper edge will coincide with the other edge forming the right angle. This gives you an angle of 45°. Sight an object across the river and another along your bank of the river, such that the lines from these objects to the place where you are standing will form