# 03 - Formulae and Functions

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# Outline

1 Formulae

2 Functions

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## Formulae

| Area of a Circle | Circumference of a Circle | Area of a Rectangle | Perimeter of a Rectangle |
|---|---|---|---|
| $\pi r^2$ | $2\pi r$ | $l \times w$ | $2 \times l + 2 \times w$ |
| Area of a Triangle | Surface Area of a Sphere | Volume of a Sphere | Quadratic Formula |
| $\frac{1}{2}bh$ | $4\pi r^2$ | $\frac{4}{3}\pi r^3$ | $x = \dfrac{-b \pm \sqrt{b^2 - 4ac}}{2a}$ |

$\pi = 3.14159265358979323846264338327 9 \ldots$

- A formula is a way of writing down a generic computation so it can be repeated as many times as needed.
- Letters serve as placeholders for numbers. (We refer to these as variables.)
- To apply a formula, we just fill in the numbers.

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## Examples

What is the area of a circle which has a radius of 4cm? What is its circumference?

1. $A = \pi r^2$
2. $A = 3.14 \times (4\text{cm})^2$
3. $A = 3.14 \times 16\text{cm}^2$
4. $A = 50.24\text{cm}^2$
5. $C = 2\pi r$
6. $C = 2 \times 3.14 \times 4\text{cm}$
7. $C = 6.28 \times 4\text{cm}$
8. $C = 25.12\text{cm}$

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## Examples

What is the perimeter of an American football field? (A standard football field $53\frac{1}{3}$yd wide and 120yd long). What is its area?

1. $P = 2 \times l + 2 \times w$
2. $P = 2 \times 120\text{yd} + 2 \times 53\frac{1}{3}\text{yd}$
3. $P = 240\text{yd} + 2 \times 53\frac{1}{3}\text{yd}$
4. $P = 240\text{yd} + 106\frac{2}{3}\text{yd}$
5. $P = 346\frac{2}{3}\text{yd}$
6. $A = l \times w$
7. $A = 120\text{yd} \times 53\frac{1}{3}\text{yd}$
8. $A = 6,400\text{yd}^2$

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What is the surface area of a basketball? (The diameter of a basketball is 10in) What is its volume?

1. $S = 4\pi r^2$
2. $S = 4 \times 3.14 \times (5\text{in})^2$
3. $S = 4 \times 3.14 \times 25\text{in}^2$
4. $S = 12.56 \times 25\text{in}^2$
5. $S = 314\text{in}^2$
6. $A = \frac{4}{3}\pi r^3$
7. $A = \frac{4}{3} \times 3.14 \times (5\text{in})^3$
8. $A = \frac{4}{3} \times 3.14 \times 125\text{in}^3$
9. $A \approx 1.33 \times 3.14 \times 125\text{in}^3$
10. $A \approx 4.18 \times 125\text{in}^3$
11. $A \approx 522.5\text{in}^3$

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## Functions

- A function is a rule which shows how one set maps onto another. (Usually we mean one set of numbers onto another set of values.)
- Algebraic functions are written like a formula

$$f(x) = x + 2$$

- $f$ applies $x + 2$ to the given value. For example:

$$f(2) = 2 + 2$$
$$f(2) = 4$$

- Note that $f(x)$ is the notation that means "Function of $x$" and not $f \cdot x$.

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## Examples

Write each of the geometric formulae from the previous section as a function.

Area of a Circle

1. $\pi r^2$
2. $A(r) = \pi r^2$

Circumference of a Circle

1. $2\pi r$
2. $c(r) = 2\pi r$

Area of a Rectangle

1. $l \times w$
2. $A(l, w) = l \times w$

Perimeter of a Rectangle

1. $P(l, w) = 2 \times l + 2 \times w$

Area of a Triangle

1. $\frac{1}{2}bh$
2. $A(b, h) = \frac{1}{2}bh$

Surface Area of A Sphere

1. $4\pi r^2$
2. $S(r) = 4\pi r^2$

Volume of a Sphere

1. $\frac{4}{3}\pi r^3$
2. $V(r) = \frac{4}{3}\pi r^3$

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## Examples

In the first half of a basketball game, team A scored 60 points and team B scored 70 points. In the second half, team A scores 7 points per minute and team B scores 8 points per minute.

Write two functions, one for team A and one for team B, representing each team's respective score in the second half. If the second half of the game comprises 24 minutes of play, which team wins the game?

1. $s_a(x) = 60 + 7x$
2. $s_a(24) = 60 + 7 \cdot 24$
3. $s_a(24) = 60 + 168$
4. $s_a(24) = 228$

1. $s_b(x) = 70 + 8x$
2. $s_b(24) = 70 + 8 \cdot 24$
3. $s_b(24) = 70 + 192$
4. $s_b(24) = 262$
5. Team B wins!

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