

TIME: 3 HOURS  
MARKS: 150

MATHEMATICS  
(PAPER 1)  
SEPTEMBER 2008



education

Western Cape Education Department

NATIONAL STRATEGY FOR LEARNER ATTAINMENT

NATIONAL SENIOR CERTIFICATE

**SEPTEMBER EXAMINATION – 2008**

This question paper consists of 9 pages and  
1 diagram sheet and  
1 formula sheet.

*National Strategy for Learner Attainment*

**INSTRUCTIONS AND INFORMATION**

Read the following instructions carefully before answering the questions.

1. This question paper consists of 12 questions. Answer ALL the questions.
2. Clearly show ALL calculations, diagrams, graphs, et cetera, which you have used in determining the answers.
3. An approved scientific calculator (non-programmable and non-graphical) may be used, unless stated otherwise.
4. If necessary, answers should be rounded off to TWO decimal places, unless stated otherwise.
5. Number the answers correctly according to the numbering system used in this question paper.
6. Diagrams are NOT necessarily drawn to scale.
7. It is in your own interest to write legibly and to present the work neatly.
8. A diagram sheet for QUESTION 8.1.5 and QUESTION 10.3 is included at the end of this question paper. Write your name in the spaces provided and hand them in together with your ANSWER SHEET.
9. A formula sheet is attached.
10. Good Luck.

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**QUESTION 1**

1.1 Solve for  $x$ :

1.1.1  $x^2 + 6 = 5x$  (3)

1.1.2  $3x(x - 2) = 4$  (5)

1.1.3  $(2x + 3)(3 - x) > 4$  (4)

1.2 Solve for  $x$  and  $y$  simultaneously:

$x - 2y = 3$  and  $4x^2 - 5xy + y^2 = 0$  (7)

**[19]**

**QUESTION 2**

2.1 Sipho invests R5 000 at an interest rate of 8,4% per annum, compounded annually. After how many years will he be able to withdraw R8 793? (nearest year) (4)

2.2 Mr Samuels bought a new car for R119 000. He wants to repay the car over a period of 5 years. He would then, after 5 years, again like to buy a new car. The inflation rate is 6,2% per annum. In 5 years' time, the trade-in value for the car will be R57 627,20.

2.2.1 What is the annual depreciation rate on a reducing balance, which was used to calculate the trade-in value? (4)

2.2.2 Mr Samuels decides that, in 5 years' time, he will give his car to his son and then buy a new car of R189 000. He sets up a sinking fund to make provision for the purchase price of this car. The account used offers 8,7% interest per annum, compounded monthly.

(a) Calculate the effective yearly interest rate as a percentage, correct to one decimal digit. (3)

(b) Calculate the monthly payment into the sinking fund. Payments are made at the end of each month. (5)

**[16]**

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**QUESTION 3**

3.1 Consider the sequence: 9; 4; -1; -6; ...

3.1.1 Write down the next two terms of the sequence if the pattern continues. (2)

3.1.2 Calculate the sum of the first 20 terms of this sequence. (3)

3.2 A Boeing747 has been flying at a constant speed, but needs to decelerate before landing. In the last few minutes before landing, the distance it flies is 20km in the first minute, 16km in the second minute, 12,8km in the third minute, and so on, the numbers forming a geometric sequence.

3.2.1 Determine the common ratio. (1)

3.2.2 What will the  $n^{\text{th}}$  term be? (1)

3.2.3 Determine how far it will be travelling in the fourth minute. (2)

3.2.4 Write down in sigma notation, the total distance before landing. (2)

3.2.5 Determine the total distance it flies before landing. (2)

3.3 Consider the sequence:

-2; 1; 10; 25; ...

3.3.1 Is the general term for the sequence linear, quadratic or neither? Justify your answer. (3)

3.3.2 Determine a formula for  $T_n$ , the general term of the given sequence. (6)

3.2.3 Which term of the sequence is 1081? (4)

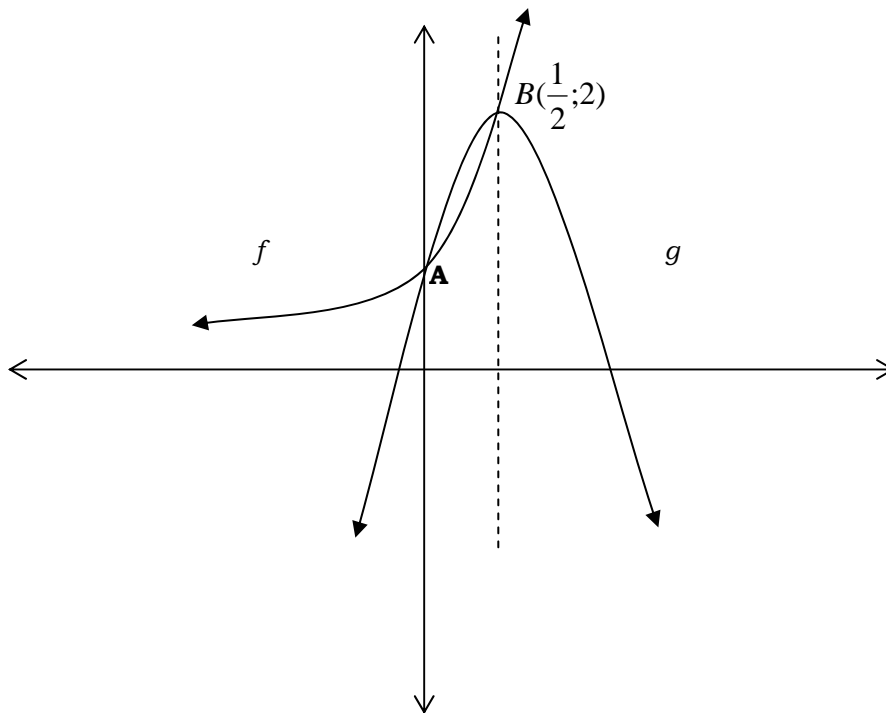
**[26]**

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**QUESTION 4**

The sketch, not drawn to scale, represents the graphs of  $f(x) = k^x$  and  $g(x) = ax^2 + bx + c$ .

The two graphs intersect at the points A and B  $\left(\frac{1}{2}; 2\right)$ , the turning point of  $g$ .

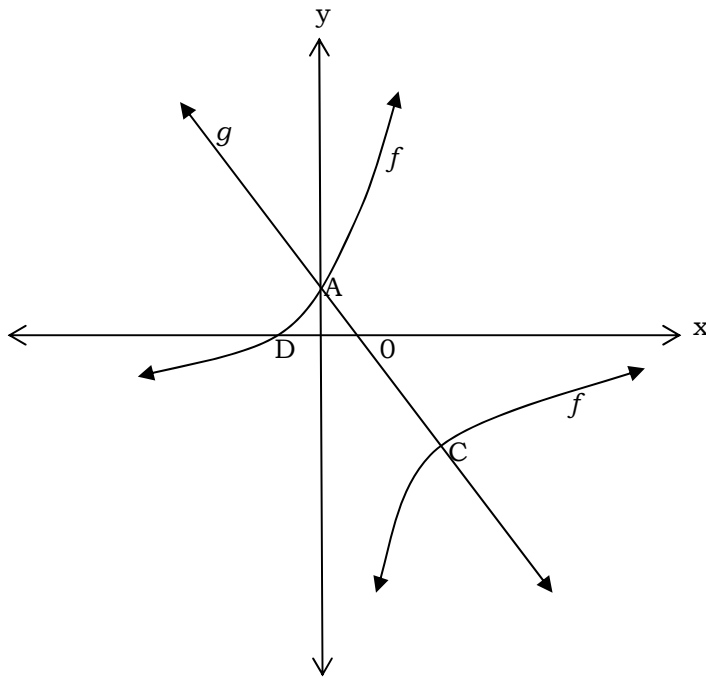


- 4.1 Write down the value of  $k$ . (2)
- 4.2 Determine the co-ordinates of A (3)
- 4.3 Show that the numerical values of  $a$  and  $b$  are  $-4$  and  $4$  respectively. (5)
- 4.4 Write down the range of  $g$ . (2)
- 4.5 Write down the equation of  $f^{-1}$ , the inverse of  $f$  in the form  $y = \dots$  (2)
- 4.6 Determine the value(s) of for which  $f(x) - g(x) = 0$  (2)

**[16]**

**QUESTION 5**

Sketched are  $f(x) = \frac{-3}{x-1} - 2$  and  $g(x) = -2x + 1$ .



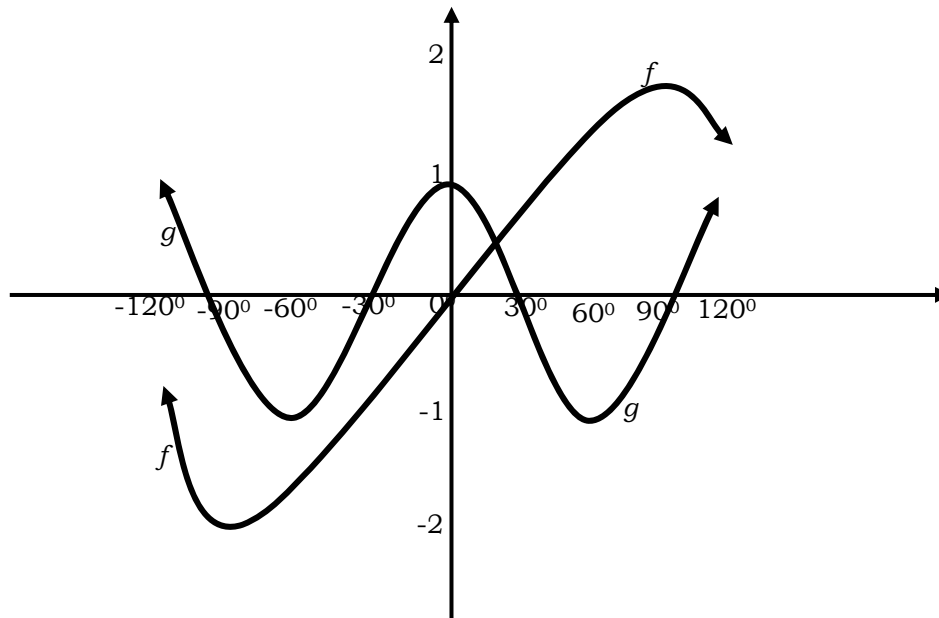
Determine:

- 5.1 the asymptotes of  $f$  (2)
- 5.2 the co-ordinates of A (3)
- 5.3 the co-ordinates of C (5)
- 5.4 the co-ordinates of D (2)
- 5.5 the values of  $x$  for which  $f(x) > 0$  (2)

**[14]**

**QUESTION 6**

Sketch graphs of  $f: f(x) = a \sin x$  and  $g: g(x) = \cos nx$  are given below.



6.1 Determine:

- 6.1.1 the domain of  $f$ . (2)
- 6.1.2 the range of  $f$  and  $g$  (4)
- 6.1.3 the values of  $a$  and  $n$  (2)
- 6.1.4 the period of  $g$  (1)

**[9]**

**QUESTION 7**

7.1 If  $f(x) = x^2$ , find  $f'(x)$  by first principles. (5)

7.2 Determine the derivatives of:

7.2.1  $x^3 + 2x^2 - x + 4$  (3)

7.2.2  $\frac{1}{\sqrt{x}} + (3x)^2$  (3)

**[11]**

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**QUESTION 8**

8.1 Given:  $f(x) = x^3 - 9x^2 + 24x$

8.1.1 Show by calculation that the graph of  $f$  has only **ONE** real  $x$ - intercept (5)

8.1.2 Write down the  $y$ -intercept of the graph of  $f$ . (1)

8.1.3 Determine the co-ordinates of the turning points of  $f$ . (5)

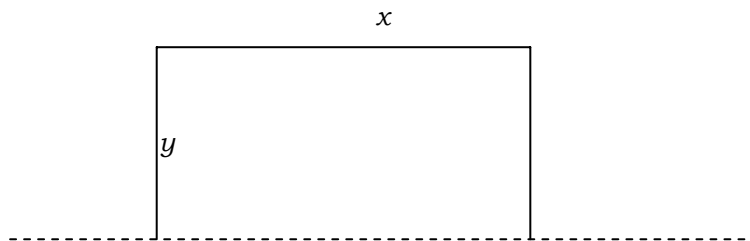
8.1.4 Use the DIAGRAM SHEET to make a neat sketch of  $f$ . Clearly indicate the co-ordinates of all the intercepts with the axes and of the turning points and points of inflection. (4)

8.1.5 For what value(s) of  $k$  will the function  $f(x) = x^3 - 9x^2 + 24x = k$  have **TWO** equal root? (2)

**(17)**

**QUESTION 9**

The municipality has decided to build a play park in one of the suburbs. It is to be rectangular with an area of  $1800\text{m}^2$ . Palisade fencing needs to be erected on three sides, since the fourth side already has a brick wall. Let the length and breadth of the play park be  $x$  and  $y$  respectively.



9.1 Determine an expression for the total length of fencing ( $L$ ) required in terms of  $x$  and  $y$ . (1)

9.2 Show that the total length of fencing required can also be written as  $L = x + \frac{3600}{x}$ . (4)

9.3 Determine the least amount of fencing that will be needed to complete the job. (5)

**[10]**



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**QUESTION 10**

A factory produces tables and chairs. It requires 8 hours to produce one table and 4 hours for one chair.

The factory has a maximum working week of 72 hours. To cover costs at least 10 items of furniture in total has to be produced weekly. Not more than 8 chairs may be produced per week. The profit on the table is R60 and on one chair is R100.

Let  $x$  be the number of tables and  $y$  be the number of chairs being produced per week.

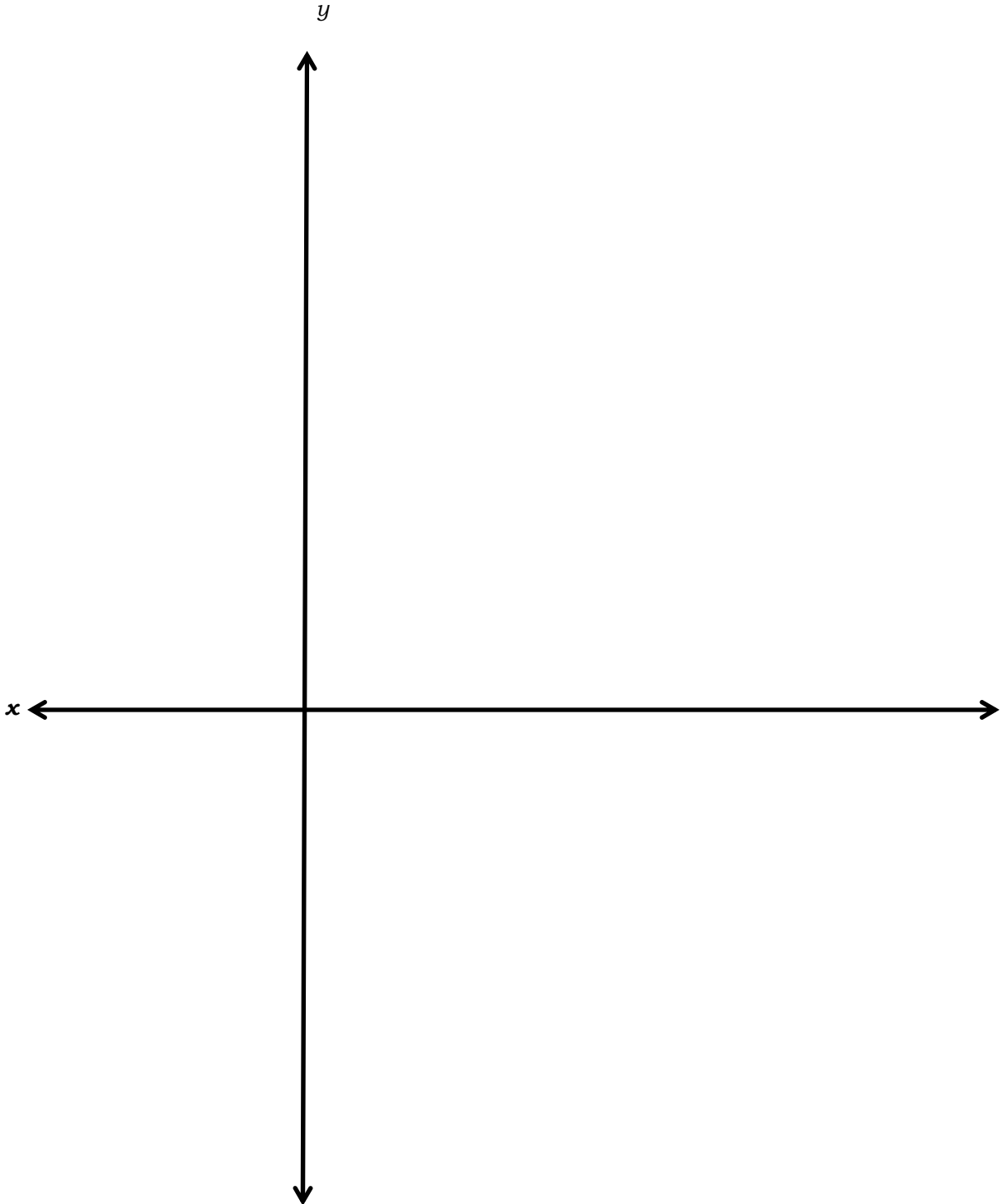
- 10.1 Write down the constraints in terms of  $x$  and  $y$  to represent the above-mentioned information. (3)
- 10.2 Write down the objective function which is used to determine the profit per week. (1)
- 10.3 Use the attached graph paper (DIAGRAM SHEET) to represent the constraints graphically. Clearly indicate the feasible region. (4)
- 10.4 Determine the number of tables and chairs respectively that have to be produced weekly to ensure maximum profit. (2)
- 10.5 Use a search line to determine the maximum weekly profit. (2)
- [12]**

**TOTAL: 150**

**NAME :**

**DIAGRAM SHEET**

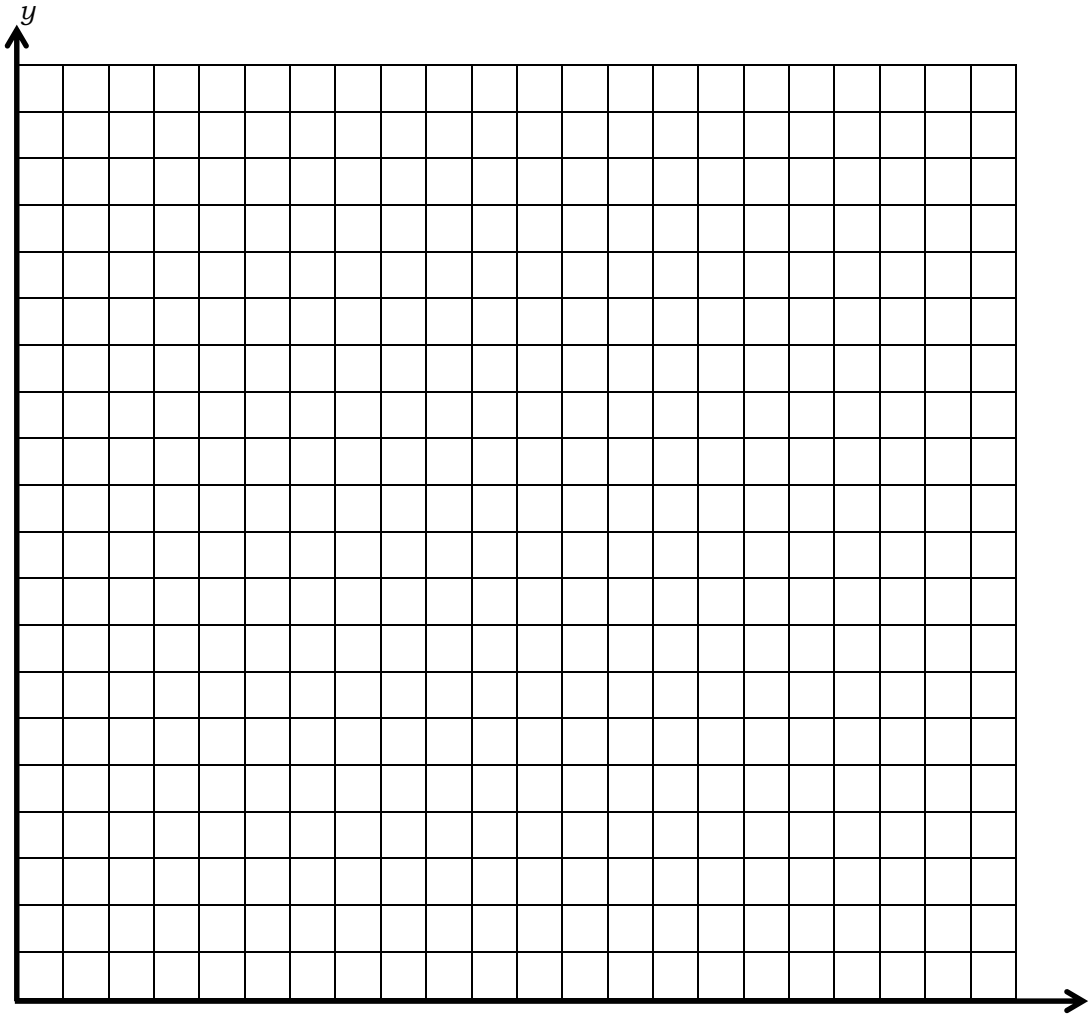
**QUESTION 8.1.4**



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NAME :

QUESTION 10.3



**INLIGTINGSBLAD: WISKUNDE**  
**INFORMATION SHEET: MATHEMATICS**

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$A = P(1 + ni)$$

$$A = P(1 - ni)$$

$$A = P(1 - i)^n$$

$$A = P(1 + i)^n$$

$$\sum_{i=1}^n 1 = n$$

$$\sum_{i=1}^n i = \frac{n(n+1)}{2}$$

$$\sum_{i=1}^n (a + (i-1)d) = \frac{n}{2}(2a + (n-1)d)$$

$$\sum_{i=1}^n ar^{i-1} = \frac{a(r^n - 1)}{r - 1} ; r \neq 1$$

$$\sum_{i=1}^{\infty} ar^{i-1} = \frac{a}{1-r} ; -1 < r < 1$$

$$F = \frac{x[(1+i)^n - 1]}{i}$$

$$P = \frac{x[1 - (1+i)^{-n}]}{i}$$

$$f'(x) = \lim_{h \rightarrow 0} \frac{f(x+h) - f(x)}{h}$$

$$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$

$$M\left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2}\right)$$

$$y = mx + c$$

$$y - y_1 = m(x - x_1)$$

$$m = \frac{y_2 - y_1}{x_2 - x_1}$$

$$m = \tan \theta$$

$$(x - a)^2 + (y - b)^2 = r^2$$

In  $\triangle ABC$ :

$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

$$a^2 = b^2 + c^2 - 2bc \cdot \cos A$$

$$\text{area } \triangle ABC = \frac{1}{2} ab \cdot \sin C$$

$$\sin(\alpha + \beta) = \sin \alpha \cdot \cos \beta + \cos \alpha \cdot \sin \beta$$

$$\sin(\alpha - \beta) = \sin \alpha \cdot \cos \beta - \cos \alpha \cdot \sin \beta$$

$$\cos(\alpha + \beta) = \cos \alpha \cdot \cos \beta - \sin \alpha \cdot \sin \beta$$

$$\cos(\alpha - \beta) = \cos \alpha \cdot \cos \beta + \sin \alpha \cdot \sin \beta$$

$$\cos 2\alpha = \begin{cases} \cos^2 \alpha - \sin^2 \alpha \\ 1 - 2\sin^2 \alpha \\ 2\cos^2 \alpha - 1 \end{cases}$$

$$\sin 2\alpha = 2 \sin \alpha \cdot \cos \alpha$$

$$\bar{x} = \frac{\sum fx}{n}$$

$$\sigma^2 = \frac{\sum_{i=1}^n (x_i - \bar{x})^2}{n}$$

$$P(A) = \frac{n(A)}{n(S)}$$

$$P(A \text{ of } B) = P(A) + P(B) - P(A \text{ en } B)$$

$$\hat{y} = a + bx$$

$$b = \frac{\sum (x - \bar{x})(y - \bar{y})}{\sum (x - \bar{x})^2}$$

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