



UNIVERSITI MALAYSIA TERENGGANU

**FINAL EXAMINATION
PEPERIKSAAN AKHIR**

**SEMESTER II SESSION 2025/2026 (STEM FOUNDATION)
SEMESTER II SESI 2025/2026 (ASASI STEM)**

COURSE <i>KURSUS</i>	:	MATHEMATICS II <i>MATEMATIK II</i>
COURSE CODE <i>KOD KURSUS</i>	:	AMM1124
DURATION <i>TEMPOH</i>	:	3 HOURS <i>3 JAM</i>

MATRIC NO. <i>NO. MATRIK</i>	:	_____
PROGRAMME <i>NAMA PROGRAM</i>	:	_____
SEAT NO. <i>NO. MEJA</i>	:	_____

INSTRUCTIONS TO CANDIDATES
ARAHAN KEPADA CALON

- Answer all questions.
Sila jawab semua soalan.
- All answers must be written in answer booklet provided.
Semua jawapan hendaklah ditulis dalam buku jawapan yang disediakan.

DO NOT OPEN THE QUESTION PAPER UNTIL INSTRUCTED
JANGAN BUKA KERTAS SOALAN INI SEHINGGA DIBERITAHU

THIS QUESTION PAPER CONSISTS OF EIGHTEEN (18) PRINTED PAGES
KERTAS SOALAN INI MENGANDUNGI LAPAN BELAS (18) MUKA SURAT BERCETAK

PART A / BAHAGIAN A (40 Marks/ 40 Markah)

Please choose the most appropriate answer for each question in this part.
Sila pilih jawapan yang paling tepat bagi setiap soalan dalam bahagian ini.

1. Identify which of the following is **not** a polynomial. (1 Mark)
*Kenal pasti antara berikut yang manakah **bukan** suatu polinomial. (1 Markah)*
 - A. $\frac{2}{x} + x^2$
 - B. $\sqrt{5}p^3$
 - C. -3
 - D. $17q^2 + 5q - rs$

2. Find the degree of the polynomial $25x^4y^2 + x^5$. (1 Mark)
Cari darjah polinomial $25x^4y^2 + x^5$. (1 Markah)
 - A. 2
 - B. 8
 - C. 6
 - D. 5

3. Given that $(3x + 1)$ is a factor of $f(x)$. Find a **true** statement. (1 Mark)
*Diberi bahawa $(3x + 1)$ merupakan faktor bagi $f(x)$. Cari pernyataan yang **benar**. (1 Markah)*
 - A. $f(-1) = 3$
 - B. $f\left(\frac{-1}{3}\right) = 0$
 - C. $f\left(\frac{1}{3}\right) = 0$
 - D. $f(3) = 0$

4. Find the third order and first degree of the following differential equation. (1 Mark)
Cari tertib ketiga dan darjah pertama bagi persamaan pembezaan berikut. (1 Markah)
 - A. $\frac{dy}{dx} = 3x$
 - B. $\left(\frac{dy}{dx}\right)^3 + y^2 = 5x$
 - C. $\frac{d^3y}{dx^3} + 6\frac{d^2y}{dx^2} + 4\frac{dy}{dx} = \sin x$
 - D. $3y\left(\frac{d^3y}{dx^3}\right)^4 = \left(\frac{d^2y}{dx^2}\right)^3 + 7\frac{dy}{dx}$

5. State the linear differential equation $x^{-3} \frac{dy}{dx} - x^{-4}y = \cos 2x$ in the standard form of $\frac{dy}{dx} + P(x)y = Q(x)$. (1 Mark)

Nyatakan persamaan pembezaan linear $x^{-3} \frac{dy}{dx} - x^{-4}y = \cos 2x$ dalam bentuk am $\frac{dy}{dx} + P(x)y = Q(x)$. (1 Markah)

- A. $\frac{dy}{dx} + \frac{3}{x} = x^3 \cos 2x$.
- B. $\frac{dy}{dx} - \frac{3y}{x} = \frac{\cos 2x}{x^{-3}}$
- C. $\frac{dy}{dx} - 3x^3y = x^3 \cos 2x$
- D. $\frac{dy}{dx} + 3x^{-3}y = \cos 2x$

6. Find the correct formula of Newton-Raphson for the equation $f(x) = 4x^3 - 2x^2 + 7$. (1 Mark)

Cari formula Newton-Raphson yang betul bagi persamaan $f(x) = 4x^3 - 2x^2 + 7$. (1 Markah)

- A. $x_{n+1} = x_n - \frac{4x_n^3 - 2x_n^2 + 7}{12x_n^2 - 4x_n}$
- B. $x_{n+1} = x_n - \frac{4x_n - 2x_nx + 7}{4x_n^3 - 2x_n^2}$
- C. $x_{n+1} = x_n - \frac{12x_n^2 - 4x_nx + 7}{4x_n^3 - 2x_n^2 + 7}$
- D. $x_{n+1} = x_n - \frac{4x_n^3 - 2x_n^2}{4x_n^2 - 2x_n}$

7. Find the **correct** statement about the trapezoidal rule. (1 Mark)
*Cari pernyataan yang **betul** tentang peraturan trapezoid. (1 Markah)*
- A. The trapezoidal rule gives an exact value for all polynomials functions.
Peraturan trapezoid memberikan nilai yang tepat untuk semua fungsi polynomial.
- B. The trapezoidal rule can only be used when the function is symmetric.
Peraturan trapezoid hanya boleh digunakan apabila fungsi adalah simetri.
- C. When the number of strips increases, the accuracy of the approximation decreases.
Apabila bilangan jalur bertambah, maka ketepatan anggaran adalah berkurang.
- D. The trapezoidal rule approximates the area under a curve by replacing it with straight- line segments.
Peraturan trapezoid menganggarkan luas di bawah sebuah lengkung dengan menggantikannya dengan segmen garis lurus.

8. Table 1 shows the amount of money bringing by students Year 1 to school.
Jadual 1 menunjukkan jumlah duit yang dibawa oleh pelajar Tahun 1 ke sekolah.

Table 1
Jadual 1

Amount of money (RM) <i>Jumlah duit (RM)</i>	1	2	3	4	5	6
Number of students <i>Bilangan pelajar</i>	2	7	5	k	10	8

Find the maximum value of k if the mode is 5. (1 Mark)
Cari nilai maksimum bagi k jika mod adalah 5. (1 Markah)

- A. 7
- B. 8
- C. 9
- D. 10
9. Identify the number of arrangements of the letters for the word FRIDGE. (1 Mark)
Kenal pasti bilangan susunan huruf bagi perkataan FRIDGE. (1 Markah)
- A. 24
- B. 120
- C. 720
- D. 5040

10. Find the number of different ways to select 5 out of 18 dishes in a menu book. (1 Mark)
Cari bilangan cara untuk memilih 5 daripada 18 hidangan yang ada di dalam buku menu. (1 Markah)
- A. $\frac{5}{18}$
B. 120
C. 1028160
D. 8568
11. Find the **correct** statement about the probability. (1 Mark)
*Cari pernyataan yang **betul** tentang kebarangkalian. (1 Markah)*
- A. Probability can be negative.
Kebarangkalian boleh bernilai negatif.
B. Probability is always greater than 1.
Kebarangkalian sentiasa lebih besar daripada 1.
C. Probability lies between 0 and 1.
Kebarangkalian berada antara 0 dan 1.
D. Probability must be a whole number.
Kebarangkalian mesti merupakan nombor bulat.
12. Select the **correct** statement about mutually exclusive events. (1 Mark)
*Pilih pernyataan yang **betul** tentang peristiwa saling eksklusif. (1 Markah)*
- A. It occurs at the same time.
Ia berlaku pada masa yang sama.
B. It has common outcomes.
Ia mempunyai hasil yang sama.
C. It cannot occur together.
Ia tidak boleh berlaku serentak.
D. It is independent.
Ia bersifat bebas.
13. Select an example of a discrete random variable. (1 Mark)
Pilih satu contoh pembolehubah rawak diskret. (1 Markah)
- A. Height of students in a class.
Tinggi pelajar di dalam kelas.
B. Time taken to complete a test.
Masa yang diambil untuk menjawab satu ujian.
C. Number of heads obtained when tossing a coin three times.
Bilangan kepala yang diperoleh apabila satu syiling dilambung sebanyak tiga kali.
D. Temperature measured during the day.
Suhu yang diukur pada waktu siang.

14. Table 2 shows a sample space showing all the possible values of a random variable X .
Jadual 2 menunjukkan satu ruang sampel yang menunjukkan semua nilai yang mungkin bagi pembolehubah rawak X .

Table 2
Jadual 2

		Red Merah			
		1	2	3	4
Blue Biru	1	1	2	3	4
	2	2	4	6	8
	3	3	6	9	12
	4	4	8	12	16

Find the probability that $X = 3$. (1 Mark)
Cari kebarangkalian $X = 3$. (1 Markah)

- A. $\frac{7}{16}$
- B. $\frac{1}{8}$
- C. $\frac{1}{6}$
- D. 2
15. Select which of the following is **not** a property of a probability distribution of a discrete random variable. (1 Mark)
*Pilih antara berikut yang manakah **bukan** merupakan ciri-ciri suatu taburan kebarangkalian pembolehubah rawak diskret. (1 Markah)*
- A. $0 \leq P(X = x) \leq 1$.
- B. $\sum P(X = x) = 1$.
- C. $P(X = x)$ cannot be zero.
 $P(X = x)$ tidak boleh menjadi kosong.
- D. X takes countable values.
 X boleh mengambil nilai yang boleh dibilang.
16. Select the **correct** statement about the normal distribution. (1 Mark)
*Pilih pernyataan yang **betul** tentang taburan normal. (1 Markah)*
- A. The normal distribution is skewed to the right for most real-life data.
Taburan normal pencong ke kanan bagi kebanyakan data kehidupan sebenar.
- B. In a normal distribution, the mean, median and mode are all equal.
Dalam taburan normal, min, median dan mod adalah sama.
- C. The normal distribution can only be used for discrete random variables.
Taburan normal hanya boleh digunakan untuk pembolehubah rawak diskret.
- D. The total area under the normal distribution curve is greater than 1.
Jumlah luas di bawah lengkung taburan normal adalah lebih besar daripada 1.

17. Find the integrating factor $V(x) = e^{\int P(x)dx}$ if $P(x) = \frac{3}{x+1}$. (2 Marks)
Cari faktor pengamir $V(x) = e^{\int P(x)dx}$ jika $P(x) = \frac{3}{x+1}$. (2 Markah)

- A. $e^{\ln(x+1)}$
- B. $(x+1)^3$
- C. $\ln(x+1)$
- D. $3(x+1)$

18.

Table 3
Jadual 3

x	-1.0	0	1.0	2.0	3.0
$f(x)$	3.26	4.98	12.45	15.09	10.48

Based on Table 3, find $\int_{-1}^3 f(x)dx$ by using trapezoidal rule. (2 Marks)
Berdasarkan Jadual 3, cari $\int_{-1}^3 f(x)dx$ dengan menggunakan peraturan trapezoid. (2 Markah)

- A. 46.26
- B. 39.39
- C. 70.78
- D. 65.04

19. A dice is rolled twenty times with the results as in Table 4.
Sebiji dadu dilambungkan dua puluh kali dengan keputusan seperti Jadual 4.

Table 4
Jadual 4

Outcome <i>Hasil</i>	1	2	3	4	5	6
Frequency <i>Kekerapan</i>	3	x	3	5	3	2

Given that the mean is 3.35. Find the value of x . (2 Marks)
Diberikan bahawa min adalah 3.35. Cari nilai bagi x . (2 Markah)

- A. 3
- B. 2
- C. 4
- D. 1

20. The back-to-back stem and leaf diagram represents the heights (in centimetre) of students in Group A and Group B.
Gambarajah batang dan daun belakang-ke-belakang mewakili tinggi pelajar (dalam sentimeter) bagi Kumpulan A dan Kumpulan B.

Group A <i>Kumpulan A</i>	Stem <i>Batang</i>	Group B <i>Kumpulan B</i>
7 3 2 0	16	0 4
3 3 0	17	1 4 5 7
8 5 4	18	1 1 2 6

Key: 0 | 17 | 4 means 170 cm for Group A and 174 cm for Group B
Kunci: 0 | 17 | 4 bermaksud 170 cm untuk Kumpulan A dan 174 cm untuk Kumpulan B

Find the median height for Group B. (2 Marks)
Cari median bagi tinggi untuk Kumpulan B. (2 Markah)

- A. 177 cm
 B. 176 cm
 C. 173 cm
 D. 174 cm
21. A committee of five people is to be selected at random from a group consisting of 9 men and 5 women. Find the number of ways to select the committees which contain exactly 2 women. (2 Marks)
Satu jawatankuasa yang terdiri daripada lima orang akan dipilih secara rawak daripada satu kumpulan yang terdiri daripada 9 lelaki dan 5 wanita. Cari bilangan cara untuk memilih ahli jawatankuasa yang mesti terdiri daripada 2 orang wanita. (2 Markah)
- A. 94
 B. 46
 C. 360
 D. 840
22. A student must answer 5 out of 7 exam questions. Identify the number of choices he has if it is compulsory for him to answer the first two questions. (2 Marks)
Seorang pelajar perlu menjawab 5 daripada 7 soalan peperiksaan. Kenal pasti bilangan cara yang ada jika dia wajib menjawab dua soalan yang pertama. (2 Markah)
- A. 7C_5
 B. 5C_3
 C. 7C_3
 D. 7C_2

23. A coin is tossed 5 times. Find the probability of getting at least one tail. (2 Marks)
Sekeping syiling dilambung sebanyak 5 kali. Cari kebarangkalian mendapat sekurang-kurangnya satu ekor. (2 Markah)
- A. $\frac{1}{32}$
B. $\frac{5}{32}$
C. $\frac{31}{32}$
D. 1
24. A bag contains 4 red marbles, 7 white marbles, 5 black marbles, and 2 blue marbles. Find the probability that a marble picked from the bag randomly is either a red or a white marble. (2 Marks)
Sebuah beg mengandungi 4 guli merah, 7 guli putih, 5 guli hitam dan 2 guli biru. Cari kebarangkalian bahawa sebiji guli yang dipilih secara rawak daripada beg tersebut ialah guli merah atau guli putih. (2 Markah)
- A. $\frac{3}{18}$
B. $\frac{4}{18}$
C. $\frac{7}{18}$
D. $\frac{11}{18}$
25. A drawer contains 6 black towels and 4 white towels. Camy takes 2 towels at random from the drawer, one after the other. Find the probability that Camy takes 1 black towel and 1 white towel. (2 Marks)
Satu laci mengandungi 6 helai tuala hitam dan 4 helai tuala putih. Camy mengambil dua helai tuala daripada laci tersebut sehelai demi sehelai. Cari kebarangkalian Camy mengambil 1 helai tuala hitam dan 1 helai tuala putih. (2 Markah)
- A. $\frac{2}{5}$
B. $\frac{2}{9}$
C. $\frac{8}{15}$
D. $\frac{1}{9}$

26. A random variable X has the following probability distribution as in Table 5.
Satu pembolehubah rawak X mempunyai taburan kebarangkalian seperti Jadual 5.

Table 5
Jadual 5

$X = x$	1	2	3	4	5
$P(X = x)$	0.05	0.25	0.2	0.4	0.1

Given that $E(X) = 3.25$. Find the standard deviation. (2 Marks)
Diberi bahawa $E(X) = 3.25$. Cari sisihan piawai. (2 Markah)

- A. 1.0897
B. 1.1875
C. 2.225
D. 3.25
27. The probability that a student passess an exam is 0.6. Find the probability that exactly 2 students pass out of 3 students. (2 Marks)
Kebarangkalian seorang pelajar lulus dalam peperiksaan ialah 0.6. Cari kebarangkalian tepat 2 daripada 3 orang pelajar lulus. (2 Markah)
- A. 0.288
B. 0.800
C. 0.864
D. 0.432
28. If $Z \sim N(0,1)$, find $P(1.20 < Z < 2.40)$. (2 Marks)
Jika $Z \sim N(0,1)$, cari $P(1.20 < Z < 2.40)$. (2 Markah)
- A. 0.8931
B. 0.1151
C. 0.1069
D. 0.0082

PART B/ BAHAGIAN B (60 Marks/ 60 Markah)

Please answer all questions.

Sila jawab semua soalan.

1. Consider a polynomial $p(x) = ax^3 + bx^2 + 2$, where a and b are constant. When $p(x)$ is divided by the $x - 4$, remainder is 162 and when $p(x)$ is divided by $x + 2$ the remainder is -30 . Compute the values of a and b . (5 Marks)

Pertimbangkan satu polinomial $p(x) = ax^3 + bx^2 + 2$ yang mana a dan b adalah pemalar. Apabila $p(x)$ dibahagikan dengan $x - 4$, baki adalah 162 dan apabila $p(x)$ dibahagikan dengan $x + 2$ baki adalah -30 . Kira nilai a dan b . (5 Markah)

2. Given a differential equation
Diberi satu persamaan pembezaan

$$\frac{dy}{dx} = \frac{x^2y - 4y}{x + 2}.$$

- a. Show that the differential equation can be written as $\frac{1}{y} dy = (x - 2)dx$.

(3 Marks)

Tunjukkan bahawa persamaan pembezaan tersebut boleh ditulis sebagai

$$\frac{1}{y} dy = (x - 2)dx. \quad (3 \text{ Markah})$$

- b. By using answer in a., compute the particular solution of the differential equation by using separable variable technique, given that $y = 3$ when $x = 0$. (5 Marks)

Dengan menggunakan jawapan pada a., kira penyelesaian khusus bagi persamaan pembezaan tersebut dengan menggunakan teknik pemboleh ubah terpisahkan, diberi $y = 3$ apabila $x = 0$. (5 Markah)

3. Given
Diberi

$$f(x) = x^3 + 4x - 13.$$

- a. Show that the root of the equation lies in the interval $(1, 2)$. (3 Marks)

Tunjukkan bahawa punca bagi persamaan tersebut terletak pada selang $(1, 2)$. (3 Markah)

- b. By taking $x_1 = 1.3$ as an initial approximation, compute the root of the equation by using Newton- Raphson method. Give your answer correct to four significant figures. (4 Marks)

Dengan mengambil $x_1 = 1.3$ sebagai anggaran awal, kira punca bagi persamaan tersebut dengan menggunakan kaedah Newton-Raphson. Berikan jawapan anda betul kepada empat angka bererti. (4 Markah)

4. The length (in centimeter) of 200 fish caught in a fishing trap by a group of men are summarised in the Table 6.

Panjang bagi 200 ekor (dalam sentimeter) ikan yang ditangkap dalam perangkap ikan oleh sekumpulan lelaki diringkaskan dalam Jadual 6.

Table 6
Jadual 6

Fish length (cm) <i>Panjang ikan (cm)</i>	Number of fish <i>Bilangan ikan</i>
$29 < x < 34$	8
$34 \leq x < 39$	19
$39 \leq x < 44$	42
$44 \leq x < 49$	69
$49 \leq x < 54$	34
$54 \leq x < 59$	23
$59 \leq x < 64$	5

- a. Find the mean value. (2 marks)
Cari nilai min. (2 markah)
- b. Find the value of median. (3 Marks)
Cari nilai median. (3 Markah)
- c. Find the value of standard deviation. (4 Marks)
Cari nilai sisihan piawai. (4 Markah)
5. Patrick would like to create a code by using all seven digits 4,4,5,7,7,7, and 8.
Patrick ingin membuat satu kod menggunakan kesemua tujuh digit 4,4,5,7,7,7, dan 8.
- a. Find the number of arrangements that can be formed if the odd digits are together and the even digits are together. (3 Marks)
Cari bilangan susunan yang boleh dibentuk jika digit ganjil mesti bersama-sama dan angka genap mesti bersama-sama. (3 Markah)
- b. Compute the number of arrangements that can be formed if the 4s are not together. (4 Marks)
Kira bilangan susunan yang boleh dibentuk jika kedua-dua digit 4 tidak boleh bersama-sama. (4 Markah)

6. It was found that 68% of passengers on a train used a phone during their journey. For those using a phone, 70% were under 30 years old, 25% were between 30 and 65 years old and the rest were over 65 years old. For those not using a phone, 26% were under 30 years old and 64% were over 65 years old.
Didapati bahawa 68% penumpang kereta api menggunakan telefon semasa perjalanan mereka. Bagi mereka yang menggunakan telefon, 70% berumur di bawah 30 tahun, 25% berumur antara 30 hingga 65 tahun dan selebihnya berumur lebih 65 tahun. Bagi mereka yang tidak menggunakan telefon, 26% berumur di bawah 30 tahun dan 64% berumur lebih 65 tahun.
- a. Construct a tree diagram to represent this information. (4 Marks)
Bina gambar rajah pokok untuk mewakili maklumat ini. (4 Markah)
- b. Find the probability that a passenger uses a mobile phone or a passenger is under 30 years old. (3 Marks)
Cari kebarangkalian bahawa seorang penumpang menggunakan telefon atau penumpang berumur di bawah 30 tahun. (3 Markah)
7. Three biased coins A, B , and C are tossed once. The probability of obtaining a head for coin A and B is $\frac{2}{3}$. The probability of obtaining a head for coin C is $\frac{4}{5}$.
Tiga syiling A, B , dan C yang pincang dilambung sebanyak satu kali. Kebarangkalian mendapat kepala bagi syiling A dan B adalah $\frac{2}{3}$. Kebarangkalian mendapat kepala bagi syiling C adalah $\frac{4}{5}$
- a. Find the probability of obtaining exactly two heads and one tail. (3 Marks)
Cari kebarangkalian mendapat dua kepala dan satu ekor. (3 Markah)
- b. The random variable X is the number of heads obtained when the three coins are tossed. Build a probability distribution table for X . (5 Marks)
Pembolehubah rawak X merupakan bilangan kepala yang diperoleh apabila tiga syiling dilambung. Bina satu jadual taburan kebarangkalian bagi X . (5 Markah)

8. On any occasions, the probability that a gymnast doing correctly any movement is 0.65.
Dalam sebarang keadaan, kebarangkalian seorang gimnas melakukan mana-mana pergerakan dengan betul adalah 0.65 .
- a. Find the probability that she will do the routine correctly on exactly 5 out of 7 occasions. (2 Marks)
Cari kebarangkalian dia akan melakukan rutin dengan betul dalam 5 daripada 7 kejadian. (2 Markah)
- b. On one day, she does the routine 50 times. By using a suitable approximation, compute the probability that she will doing the routine correctly on fewer than 29 occasions. (7 Marks)
Pada suatu hari, dia melakukan rutinnnya 50 kali. Dengan menggunakan penganggaran yang sesuai, kira kebarangkalian dia akan melakukan rutin dengan betul, kurang daripada 29 kejadian. (7 Markah)

End of Question Paper
Kertas Soalan Tamat

LIST OF FORMULAE

Integrating Factor

$$\frac{dy}{dx} + P(x)y = Q(x)$$

Differentiation

$y = f(x)$	$\frac{dy}{dx}$
x^n	nx^{n-1}
$\ln x$	$\frac{1}{x}$
e^x	e^x
$\sin x$	$\cos x$
$\cos x$	$-\sin x$
$\tan x$	$\sec^2 x$

$y = f(x)$	$\frac{dy}{dx}$
$\sec x$	$\sec x \tan x$
$\operatorname{cosec} x$	$-\operatorname{cosec} x \cot x$
$\cot x$	$-\operatorname{cosec}^2 x$
$\tan^{-1} x$	$\frac{1}{1+x^2}$

Integration

Integration by parts: $uv - \int v du$

(Arbitrary constants are omitted; a denotes a positive constant.)

$y = f(x)$	$\int f(x)dx$
x^n	$\frac{x^{n+1}}{n+1}, (n \neq -1)$
$\frac{1}{x}$	$\ln x $
e^x	e^x
e^{ax+b}	$\frac{1}{a}e^{ax+b}$

$y = f(x)$	$\int f(x)dx$
$\sin(ax+b)$	$-\frac{1}{a}\cos(ax+b)$
$\cos(ax+b)$	$\frac{1}{a}\sin(ax+b)$
$\sec^2(ax+b)$	$\frac{1}{a}\tan(ax+b)$

Numerical Methods

1) Newton- Raphson, $x_{n+1} = x_n - \frac{f(x_n)}{f'(x_n)}$

2) Trapezoidal Rule, $\int_a^b f(x)dx \approx \frac{h}{2}[(y_0 + y_n) + 2(y_1 + y_2 + \dots + y_{n-1})]$

Ungrouped Data

1) Mean, $\bar{x} = \frac{\sum x}{n}$

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

3) Standard Deviation, $s = \sqrt{\frac{\sum_{i=1}^n (x_i - \bar{x})^2}{n-1}}$

Grouped Data

1) Mean, $\bar{x} = \frac{\sum fx}{\sum f}$

2) Mode = $L + \left(\frac{d_1}{d_1 + d_2} \right) c$ where

L : lower boundary of the modal class

d_1 : the difference between the frequency of the modal class and the frequency of the class before it.

d_2 : the difference between the frequency of the modal class and the frequency of the class after it.

c : the size of the modal class

3) Median = $L + \left(\frac{\frac{N}{2} - F}{f_m} \right) c$ where

L : lower boundary of the median class

N : the total number of observations

F : the cumulative frequency of the median class before

f_m : the frequency of median class

c : the class width of median class

4) Variance, $s^2 = \frac{\sum fx^2 - \frac{(\sum fx)^2}{\sum f}}{\sum f - 1}$

5) Standard Deviation, $s = \sqrt{\frac{\sum fx^2 - \frac{(\sum fx)^2}{\sum f}}{\sum f - 1}}$

Permutation and Combinations

- 1) Permutation, ${}^nP_r = \frac{n!}{(n-r)!}$
- 2) Combination, ${}^nC_r = \frac{n!}{r!(n-r)!}$

Probability

- 1) Mutually exclusive, $P(A \cup B) = P(A) + P(B)$
- 2) Not Mutually exclusive, $P(A \cup B) = P(A) + P(B) - P(A \cap B)$
- 3) Conditional probability, $P(A|B) = \frac{P(A \cap B)}{P(B)}$
- 4) Independent Events, $P(A \cap B) = P(A) \times P(B)$

Discrete Random Variable

- 1) $E(X) = \sum xp(x)$, $E(aX + b) = aE(X) + b$
- 2) $Var(X) = E(X^2) - E(X)^2$, $Var(aX + b) = a^2 Var(X)$

Binomial Distribution

- 1) General form: $X \sim B(n, p)$
- 2) Binomial random variable, ${}^nC_k p^k q^{n-k}$
- 3) $E(X) = np$
 $Var(X) = npq$

Normal Distribution

- 1) General form, $X \sim N(\mu, \sigma^2)$
- 2) Standardise normal distribution, $Z = \frac{X - \mu}{\sigma}$

THE NORMAL DISTRIBUTION FUNCTION

If Z has a normal distribution with mean 0 and variance 1, then, for each value of z , the table gives the value of $\Phi(z)$, where

$$\Phi(z) = P(Z \leq z).$$

For negative values of z , use $\Phi(-z) = 1 - \Phi(z)$.



z	0	1	2	3	4	5	6	7	8	9	1	2	3	4	5	6	7	8	9
											ADD								
0.0	0.5000	0.5040	0.5080	0.5120	0.5160	0.5199	0.5239	0.5279	0.5319	0.5359	4	8	12	16	20	24	28	32	36
0.1	0.5398	0.5438	0.5478	0.5517	0.5557	0.5596	0.5636	0.5675	0.5714	0.5753	4	8	12	16	20	24	28	32	36
0.2	0.5793	0.5832	0.5871	0.5910	0.5948	0.5987	0.6026	0.6064	0.6103	0.6141	4	8	12	15	19	23	27	31	35
0.3	0.6179	0.6217	0.6255	0.6293	0.6331	0.6368	0.6406	0.6443	0.6480	0.6517	4	7	11	15	19	22	26	30	34
0.4	0.6554	0.6591	0.6628	0.6664	0.6700	0.6736	0.6772	0.6808	0.6844	0.6879	4	7	11	14	18	22	25	29	32
0.5	0.6915	0.6950	0.6985	0.7019	0.7054	0.7088	0.7123	0.7157	0.7190	0.7224	3	7	10	14	17	20	24	27	31
0.6	0.7257	0.7291	0.7324	0.7357	0.7389	0.7422	0.7454	0.7486	0.7517	0.7549	3	7	10	13	16	19	23	26	29
0.7	0.7580	0.7611	0.7642	0.7673	0.7704	0.7734	0.7764	0.7794	0.7823	0.7852	3	6	9	12	15	18	21	24	27
0.8	0.7881	0.7910	0.7939	0.7967	0.7995	0.8023	0.8051	0.8078	0.8106	0.8133	3	5	8	11	14	16	19	22	25
0.9	0.8159	0.8186	0.8212	0.8238	0.8264	0.8289	0.8315	0.8340	0.8365	0.8389	3	5	8	10	13	15	18	20	23
1.0	0.8413	0.8438	0.8461	0.8485	0.8508	0.8531	0.8554	0.8577	0.8599	0.8621	2	5	7	9	12	14	16	19	21
1.1	0.8643	0.8665	0.8686	0.8708	0.8729	0.8749	0.8770	0.8790	0.8810	0.8830	2	4	6	8	10	12	14	16	18
1.2	0.8849	0.8869	0.8888	0.8907	0.8925	0.8944	0.8962	0.8980	0.8997	0.9015	2	4	6	7	9	11	13	15	17
1.3	0.9032	0.9049	0.9066	0.9082	0.9099	0.9115	0.9131	0.9147	0.9162	0.9177	2	3	5	6	8	10	11	13	14
1.4	0.9192	0.9207	0.9222	0.9236	0.9251	0.9265	0.9279	0.9292	0.9306	0.9319	1	3	4	6	7	8	10	11	13
1.5	0.9332	0.9345	0.9357	0.9370	0.9382	0.9394	0.9406	0.9418	0.9429	0.9441	1	2	4	5	6	7	8	10	11
1.6	0.9452	0.9463	0.9474	0.9484	0.9495	0.9505	0.9515	0.9525	0.9535	0.9545	1	2	3	4	5	6	7	8	9
1.7	0.9554	0.9564	0.9573	0.9582	0.9591	0.9599	0.9608	0.9616	0.9625	0.9633	1	2	3	4	4	5	6	7	8
1.8	0.9641	0.9649	0.9656	0.9664	0.9671	0.9678	0.9686	0.9693	0.9699	0.9706	1	1	2	3	4	4	5	6	6
1.9	0.9713	0.9719	0.9726	0.9732	0.9738	0.9744	0.9750	0.9756	0.9761	0.9767	1	1	2	2	3	4	4	5	5
2.0	0.9772	0.9778	0.9783	0.9788	0.9793	0.9798	0.9803	0.9808	0.9812	0.9817	0	1	1	2	2	3	3	4	4
2.1	0.9821	0.9826	0.9830	0.9834	0.9838	0.9842	0.9846	0.9850	0.9854	0.9857	0	1	1	2	2	2	3	3	4
2.2	0.9861	0.9864	0.9868	0.9871	0.9875	0.9878	0.9881	0.9884	0.9887	0.9890	0	1	1	1	2	2	2	3	3
2.3	0.9893	0.9896	0.9898	0.9901	0.9904	0.9906	0.9909	0.9911	0.9913	0.9916	0	1	1	1	1	2	2	2	2
2.4	0.9918	0.9920	0.9922	0.9925	0.9927	0.9929	0.9931	0.9932	0.9934	0.9936	0	0	1	1	1	1	1	2	2
2.5	0.9938	0.9940	0.9941	0.9943	0.9945	0.9946	0.9948	0.9949	0.9951	0.9952	0	0	0	1	1	1	1	1	1
2.6	0.9953	0.9955	0.9956	0.9957	0.9959	0.9960	0.9961	0.9962	0.9963	0.9964	0	0	0	0	1	1	1	1	1
2.7	0.9965	0.9966	0.9967	0.9968	0.9969	0.9970	0.9971	0.9972	0.9973	0.9974	0	0	0	0	0	1	1	1	1
2.8	0.9974	0.9975	0.9976	0.9977	0.9977	0.9978	0.9979	0.9979	0.9980	0.9981	0	0	0	0	0	0	0	1	1
2.9	0.9981	0.9982	0.9982	0.9983	0.9984	0.9984	0.9985	0.9985	0.9986	0.9986	0	0	0	0	0	0	0	0	0

Critical values for the normal distribution

If Z has a normal distribution with mean 0 and variance 1, then, for each value of p , the table gives the value of z such that

$$P(Z \leq z) = p$$

p	0.75	0.90	0.95	0.975	0.99	0.995	0.9975	0.999	0.9995
z	0.674	1.282	1.645	1.960	2.326	2.576	2.807	3.090	3.291