

SULIT



Second Semester Examination
2017/2018 Academic Session

May/June 2018

**EEM421 – Quality Techniques
(Kaedah Kualiti)**

Duration : 3 hours
(Masa : 3 jam)

Please ensure that this examination paper consists of **FIFTEEN (15)** pages and **TWO (2)** page of printed appendix material before you begin the examination.

*[Sila pastikan bahawa kertas peperiksaan ini mengandungi **LIMA BELAS (15)** muka surat dan **DUA (2)** muka surat lampiran yang bercetak sebelum anda memulakan peperiksaan ini.]*

Instructions: This question paper consists of **FIVE (5)** questions. Answer **ALL** questions. All questions carry the same marks.

[Arahan: Kertas soalan ini mengandungi **LIMA (5)** soalan. Jawab **SEMUA** soalan. Semua soalan membawa jumlah markah yang sama.]

In the event of any discrepancies, the English version shall be used.

[Sekiranya terdapat sebarang percanggahan pada soalan peperiksaan, versi Bahasa Inggeris hendaklah digunapakai.]

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1. (a) Histogram is one of basic quality tools which is used to graph a large number of qualitative data. List down three advantages of employing a histogram for quality improvement.

Histogram adalah salah satu teknik kualiti asas yang digunakan untuk merekod sejumlah data kualitatif di dalam bentuk graf. Senaraikan tiga kelebihan menggunakan histogram untuk penambahbaikan kualiti.

(15 marks/markah)

- (b) The raw data in Table 1.1 represents the delay measured in signal strength transmission from a computer to a mobile device. Create a histogram with a reasonable number of classes from this data.

Data mentah berikut Jadual 1.1 mewakili kelewatan yang diukur dari kekuatan isyarat penghantaran dari komputer ke alat mudah alih. Buatlah sebuah histogram dengan bilangan kelas yang munasabah daripada data tersebut.

Table 1.1
Jadual 1.1

Experiment	Delay (s)
1	1.35
2	0.75
3	0.35
4	1.1
5	2.3
6	3.05
7	2.2
8	4
9	3.3
10	0.2
11	0.8
12	1.9
13	2.5
14	2.3
15	2.2
16	1.2
17	0.9
18	0.7
19	2.3
20	2.2
21	1.05
22	1.24
23	2.15
24	1.45
25	0.98
26	2.57
27	2.32

(25 marks/markah)

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- (c) Discuss the principle used in creating a Pareto chart and why it is important for quality improvement.

Bincangkan prinsip yang digunakan untuk membina carta Pareto dan mengapa ia penting untuk peningkatan kualiti.

(15 marks/markah)

- (d) Online buyers are highly appreciative when they receive not only a confirmation message of their purchase, but also tracking details, followed by prompt delivery. If the recipient is absent and the shipment cannot be delivered, any company that offers rescheduling will certainly earn extra brownie points. Table 1.2 shows the findings of a recent survey done by the quality team of an online shop where roughly 1000 buyers were polled on their views about their past shopping experience with the company. With reference to the table, create a Pareto chart for the buyers' complaints on the shipping and handling aspects of the company, and identify the main problems that need to be focused on for continuous quality improvement.

Pembeli-pembeli dalam talian sangat menghargai apabila mereka menerima bukan sahaja mesej pengesahan berkenaan pembelian mereka, tetapi juga maklumat-maklumat penjejakan, diikuti penghantaran segera. Jika penerima tidak hadir dan penghantaran tidak boleh dilakukan, syarikat-syarikat yang menawarkan penjadualan semula akan memperolehi kelebihan. Jadual 1.2 menunjukkan penemuan dari kajian terkini oleh pasukan kualiti sebuah syarikat dalam talian di mana lebih kurang pendapat 1000 pembeli direkodkan berkenaan pengalaman pembelian mereka yang terdahulu dengan syarikat tersebut. Dengan merujuk jadual tersebut, buatlah sebuah carta Pareto untuk aduan-pembeli-pembeli berkenaan aspek-aspek penghantaran dan pengendalian syarikat tersebut, dan tentukan masalah-masalah utama yang perlu diberi fokus untuk peningkatan kualiti berterusan.

No.	Shipping and Handling Aspects	Very satisfied	Satisfied	Neutral	Dissatisfied	Very dissatisfied
1	Informative confirmation e-mail message (e.g. with order number, delivery date, contact info)	80%	20%	0%	0%	0%
2	On-time delivery	0%	50%	50%	0%	0%
3	Choice of shipping options (delivery date, shipping insurance)	80%	20%	0%	0%	0%
4	Rescheduling, if not deliverable	90%	10%	0%	0%	0%
5	Shipment tracking	50%	50%	0%	0%	0%
6	Shipment insurance	5%	30%	65%	0%	0%
7	Quality and care in packaging	0%	0%	5%	25%	70%
8	Indication of the exact time of delivery	0%	0%	30%	60%	10%
9	Choice of freight forwarder (Hermes, DHL, ...)	0%	50%	50%	0%	0%
10	Alternate shipping address (package shop, package station, ...)	80%	20%	0%	0%	0%
11	Overnight delivery	55%	45%	0%	0%	0%

Table 1.2

Jadual 1.2

(45 marks/markah)

2. (a) Explain what it means by process capability.

Terangkan apa yang dimaksudkan dengan kebolehan proses.

(5 marks/markah)

- (b) What is the capability index for Six-Sigma process? Support your answer by drawing appropriate figure and explain why it is useful.

Apakah indeks kebolehan untuk proses "Six-Sigma?" Sokong jawapan anda dengan melukis rajah yang bersesuaian dan terangkan kenapa ia berguna.

(15 marks/markah)

- (c) Tolerances for a capacitor are 70 pF +/- .01 pF. The current process produces capacitors with a mean of 70.001 pF with a population standard deviation of 0.004 pF. The process population is normally distributed.

Toleransi sebuah kapasitor adalah 70 pF +/- .01 pF. Proses semasa menghasilkan kapasitor dengan purata 70.001 pF dengan sisihan piawai 0.004 pF. Proses tersebut mempunyai taburan normal.

- (i) Is the process capable?

Adakah proses tersebut berkebolehan?

(10 marks/markah)

- (ii) What proportion will meet specifications? Sketch the distribution to visualize your answer.

Berapakan bahagian yang memenuhi spesifikasi? Lakarkan taburan tersebut untuk menggambarkan jawapan anda.

(25 marks/markah)

- (d) In order to produce resistors with almost identical properties, samples of a recent production have been taken and the measurement data is displayed as in Table 2.1.

Untuk menghasilkan perintang-perintang yang mempunyai ciri-ciri yang hampir sama, sampel-sampel dari produksi terkini telah diambil dan maklumat ukuran adalah seperti di Jadual 3.1.

Group	Sample 1 (k Ω)	Sample 2 (k Ω)	Sample 3 (k Ω)	Sample 4 (k Ω)	Sample 5 (k Ω)
1	1.02	1.03	1.01	1.02	0.91
2	1.00	1.02	1.03	1.00	1.00
3	1.02	1.02	1.03	1.02	1.00
4	1.01	1.03	1.01	1.02	1.00
5	1.00	1.02	1.02	0.91	1.01

Table 2.1
Jadual 2.1

- (i) What type of chart would best describe if the resistors production is in or out of control?
Apakah jenis carta yang paling sesuai untuk menggambarkan produksi perintang tersebut jika ia di dalam atau di luar kawalan?

(5 marks/markah)

- (ii) If the company wish to produce resistors with tolerances of $1.00 \pm 0.008 \text{ k}\Omega$ with a standard deviation of $0.0005 \text{ k}\Omega$, determine whether they are capable to do that based on the process capability index.

Jika syarikat tersebut ingin menghasilkan perintang dengan toleransi $1.00 \pm 0.008 \text{ k}\Omega$ dengan sisihan piawai $0.0005 \text{ k}\Omega$, tentukan sama ada mereka berkebolehan berbuat demikian berdasarkan indeks kebolehan proses.

(40 marks/markah)

3. (a) With the importance of quality in international competition, and the demonstrated success of those companies that have been able to produce products of high quality, one must conclude that '**design for life cycle**' is very important. Briefly describe the term "**Design for Life Cycle**" and give **an example of a product** with "Design for Life Cycle" approach.

*Dengan kepentingan kualiti dalam persaingan antarabangsa, dan kejayaan yang ditunjukkan oleh syarikat-syarikat yang telah dapat menghasilkan produk yang berkualiti tinggi, secara kesimpulannya '**reka bentuk untuk kitaran hidup**' adalah sangat penting. Terangkan secara ringkas '**Rekabentuk untuk Kitaran hidup**' dan nyatakan satu **contoh** produk yang menggunakan cara '**Rekabentuk untuk Kitaran Jangka Hayat**'*

(20 marks/markah)

- (b) Product development is an interdisciplinary activity requiring contribution from the three functions in design and development aspects. Identify the **three functions** in product design and development. Then, **draw** the model of the Production System.

*Pembangunan produk adalah aktiviti antara disiplin yang memerlukan sumbangan daripada tiga fungsi dalam aspek rekabentuk dan pembangunan. Kenal pasti **tiga fungsi** dalam rekabentuk dan pembangunan produk. Kemudian, **lukiskan** model Sistem Pengeluaran.*

(30 marks/markah)

- (c) Design for manufacturing and assembly is an approach to product design that systematically includes considerations of manufacturability and assemblability in the design. Design for Manufacturing (DFM) and Design for Assembly (DFA), DFM/A also includes principles and guidelines that indicate how to design a given product for maximum manufacturability. Identify **SIX** general **principles and guidelines** in design for manufacturability.

Rekabentuk dalam pembuatan dan pemasangan adalah satu pendekatan untuk merekabentuk produk yang sistematik termasuk pertimbangan keupayaan pembuatan dan kebolehan pengabungan dalam reka bentuk. Design untuk Pembuatan (DFM) dan reka bentuk untuk pemasangan (DFA), DFM / A juga merangkumi prinsip dan garis panduan yang menunjukkan bagaimana untuk merekabentuk produk yang diberikan untuk keupayaan pembuatan yang maksimum. Kenal pasti **ENAM prinsip-prinsip** umum dan **garis panduan** reka bentuk untuk pembuatan.

(30 marks/markah)



Figure 3.1: The evolution of Apples' product
Rajah 3.1: Evolusi produk Apple.

- (d) Figure 3.1 shows the evolution and development of Apples' products. Describe and explain **FIVE** characteristics of **successful product development**.

Rajah 3.1 menunjukkan evolusi dan pembangunan produk Apple. Jelaskan LIMA ciri-ciri ke arah kejayaan dalam pembangunan sesuatu produk.

(20 marks/markah)

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4. An Electrical Engineer would like to compare die performance from different wafer manufacturers, Avago Technologies (A) and Win Semiconductors (W) on Printed Circuit Board. The engineer had sample of 30 pieces of Dies each and ran experiment with both suppliers' wafers on the PCB, ran through COQ (Customer oriented Qualification), COOQ (Combo Customer Oriented Qualification) and BO Test (Break-Out).

Seorang Jurutera Elektrik ingin membandingkan prestasi 'die' dari pengeluar wafer yang berbeza, Avago Technologies (A) dan Win Semikonduktor (W) bagi Papan Litar Bercetak. Jurutera mempunyai sampel sebanyak 30 keping 'Dies' masing-masing dan menjalankan uji kaji dengan wafer pembekal di PCB, dijalankan melalui COQ (Kelayakan berorientasikan pelanggan), COOQ (Kelayakan Berorientasi Pelanggan Kombo) dan Ujian BO (Keluar).

Results from the experiment using Minitab Software and fill in the blanks

Hasil daripada eksperimen menggunakan perisian Minitab dan isikan tempat kosong.

(100 marks/markah)

Tests for Normality for Avago Technologies (A)

Computed Chi-Square goodness-of-fit statistic = 14.0
 P-Value = 0.300708
 Shapiro-Wilks W statistic = 0.969682
 P-Value = 0.575956
 Z score for skewness = 0.207516
 P-Value = 0.835603
 Z score for kurtosis = 0.967661
 P-Value = 0.333212

Tests for Normality for Win Semiconductors (W)

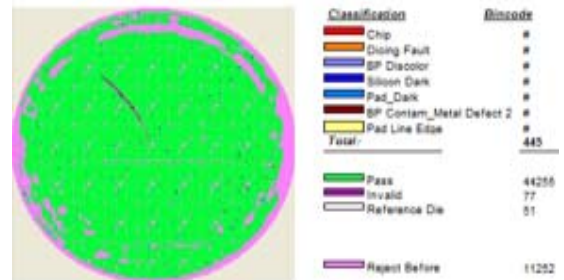
Computed Chi-Square goodness-of-fit statistic = 14.0
 P-Value = 0.300708
 Shapiro-Wilks W statistic = 0.970065
 P-Value = 0.586068
 Z score for skewness = 0.884435
 P-Value = 0.37646
 Z score for kurtosis = 0.611344
 P-Value = 0.540969

Variance Check

Cochran's C test: 0.690481 P-Value = 0.0344795
 Bartlett's test: 1.08156 P-Value = 0.034484
 Hartley's test: 2.23082
 Levene's test: 1.81821 P-Value = 0.182769

Comparison of Medians

Median of sample 1: 7.01
 Median of sample 2: 6.59
 Mann-Whitney (Wilcoxon) W test to compare medians
 Null hypothesis: median1 = median2
 Alt. hypothesis: median1 NE median2
 Average rank of sample 1: 34.75
 Average rank of sample 2: 26.25
 W = 322.5 P-value = 0.0600863



Comparison of Means (assuming equal variances)

95.0% confidence interval for mean of Avago Technologies (A):
 6.92833 +/- 0.331474 [6.59686,7.25981]
 95.0% confidence interval for mean of Win Semiconductors (W):
 6.60567 +/- 0.22193 [6.38374,6.8276]
 95.0% confidence interval for the difference between the means

assuming equal variances: 0.322667 +/- 0.390422 [-0.0677552,0.713088]

t test to compare means

Null hypothesis: mean1 = mean2

Alt. hypothesis: mean1 NE mean2

assuming equal variances: t = 1.65434 P-value = 0.103462

Comparison of Means (not assuming equal variances)

95.0% confidence interval for mean of Avago Technologies (A):
 6.92833 +/- 0.331474 [6.59686,7.25981]
 95.0% confidence interval for mean of Win Semiconductors (W):

6.60567 +/- 0.22193 [6.38374,6.8276]

95.0% confidence interval for the difference

Hypothesis Statement:

Ho : Avago Technologies (A) and Win Semiconductors (W) wafers are similar.

H_A :

_____ (5 marks)

Normality Test:

- Avago Technologies (A) _____ (p = _____), (10 marks)

- Win Semiconductors (W) _____ (p = _____) (10 marks)

Since data _____, (5 marks)

Variance Check

Data Not Normal Or Normal; -Ho : $\sigma_A = \sigma_W$; H_A: $\sigma_A \neq \sigma_W$

_____ (5 marks) Test, p = _____ (5 marks), therefore σ between Avago Technologies (A) and Win Semiconductors (W) wafers is _____.(5 marks)

Test for _____ ; _____.(5 marks)

-Ho : _____ A= _____ W; (5 marks) H_A : _____ A \neq _____ W (5 marks)

-P = _____ (5 marks), therefore _____ (5 marks) is _____ (5 marks) significantly different for wafer value.

Results:

Since _____ (5 marks) Test and _____ (5 marks) shows _____ (5 marks) difference; thus Accept _____ (5 marks).

Conclusions:

_____ (5 marks) .

5. President Donald Trump issued an executive order recently blocking Broadcom Ltd. from acquiring Qualcomm Inc. on Security Risks. Both companies are major players on Industry 4.0 and Cloud Technology. Major companies are ISO certified manufacturers and with Lean Six Sigma adoption. Several method have successfully leveraged these proven process improvement methodologies to raise productivity, increase the bottom line and improve quality and the customer experience. Unfortunately, many manufacturers and businesses in general have still not discovered the value of Lean Six Sigma. There are many reasons organizations do not use Lean Six Sigma. In which some are valid, many are misconceptions and still others are pure fiction.

Presiden Donald Trump mengeluarkan arahan eksekutif baru-baru ini bagi menghalang Broadcom Ltd. daripada memperoleh Qualcomm Inc. bagi Risiko Keselamatan. Kedua-dua syarikat itu adalah peneraju utama Industri 4.0 dan Teknologi Awan. Syarikat-syarikat utama adalah pengilang ISO yang disahkan dan menggunakan Lean Six Sigma. Beberapa langkah telah berjaya memanfaatkan metodologi penambahbaikan proses terbukti untuk meningkatkan produktiviti, meningkatkan garis bawah dan meningkatkan kualiti dan pengalaman pelanggan. Malangnya, banyak pengeluar dan perniagaan secara umum masih belum dapat menemui nilai Lean Six Sigma. Terdapat banyak sebab organisasi tidak menggunakan Lean Six Sigma. Di mana ada yang sah, banyak salahfahaman dan masih ada lagi fiksyen semata.

- (a) Why do engineers and statisticians perform statistical analysis?
Mengapa para jurutera dan ahli statistik melaksanakan analisis statistik?

(10 marks/markah)

- (b) List 4 Characteristics of Normal Distribution.
Senaraikan 4 ciri-ciri Taburan Normal.

(10 marks/markah)

- (c) When a person informs you that he is taking 30 data sample, which theorem is he referring to?

Apabila seseorang memberitahu anda bahawa dia mengambil 30 sampel data, teori yang manakah yang dia maksudkan?

(5 marks/markah)

- (d) Explain the importance of the theorem that you had mentioned for Question(c)?

Terangkan kepentingan teori yang anda telah sebutkan pada soalan (c)?

(15 marks/markah)

- (e) How Lean Six Sigma seeks to improve the quality of manufacturing and business process?

Bagaimana Lean Six Sigma bertujuan untuk meningkatkan kualiti pembuatan dan proses perniagaan?

(10 marks/markah)

- (f) What does ISO mean?
Apakah maksud ISO?

(10 marks/markah)

- (g) What does ISO do?
Apakah fungsi ISO?

(10 marks/markah)

- (h) What does an audit do?
Apakah fungsi Audit?

(10 marks/markah)

- (i) Why is an audit beneficial?
Mengapakah audit penting?

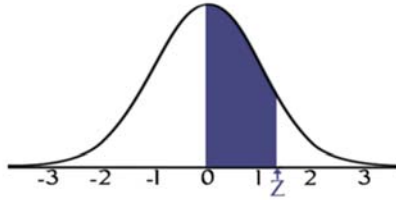
(10 marks/markah)

- (j) What must be considered when determining the scope of the management system, according to ISO 9001:2015?

Apakah yang perlu dipertimbangkan untuk menentukan skop system pengurusan berlandaskan ISO 9001:2015?

(10 marks/markah)

APPENDIX



STANDARD NORMAL TABLE (Z)

Entries in the table give the area under the curve between the mean and z standard deviations above the mean. For example, for z = 1.25 the area under the curve between the mean (0) and z is 0.3944.

z	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
0.0	0.0000	0.0040	0.0080	0.0120	0.0160	0.0190	0.0239	0.0279	0.0319	0.0359
0.1	0.0398	0.0438	0.0478	0.0517	0.0557	0.0596	0.0636	0.0675	0.0714	0.0753
0.2	0.0793	0.0832	0.0871	0.0910	0.0948	0.0987	0.1026	0.1064	0.1103	0.1141
0.3	0.1179	0.1217	0.1255	0.1293	0.1331	0.1368	0.1406	0.1443	0.1480	0.1517
0.4	0.1554	0.1591	0.1628	0.1664	0.1700	0.1736	0.1772	0.1808	0.1844	0.1879
0.5	0.1915	0.1950	0.1985	0.2019	0.2054	0.2088	0.2123	0.2157	0.2190	0.2224
0.6	0.2257	0.2291	0.2324	0.2357	0.2389	0.2422	0.2454	0.2486	0.2517	0.2549
0.7	0.2580	0.2611	0.2642	0.2673	0.2704	0.2734	0.2764	0.2794	0.2823	0.2852
0.8	0.2881	0.2910	0.2939	0.2969	0.2995	0.3023	0.3051	0.3078	0.3106	0.3133
0.9	0.3159	0.3186	0.3212	0.3238	0.3264	0.3289	0.3315	0.3340	0.3365	0.3389
1.0	0.3413	0.3438	0.3461	0.3485	0.3508	0.3531	0.3554	0.3577	0.3599	0.3621
1.1	0.3643	0.3665	0.3686	0.3708	0.3729	0.3749	0.3770	0.3790	0.3810	0.3830
1.2	0.3849	0.3869	0.3888	0.3907	0.3925	0.3944	0.3962	0.3980	0.3997	0.4015
1.3	0.4032	0.4049	0.4066	0.4082	0.4099	0.4115	0.4131	0.4147	0.4162	0.4177
1.4	0.4192	0.4207	0.4222	0.4236	0.4251	0.4265	0.4279	0.4292	0.4306	0.4319
1.5	0.4332	0.4345	0.4357	0.4370	0.4382	0.4394	0.4406	0.4418	0.4429	0.4441
1.6	0.4452	0.4463	0.4474	0.4484	0.4495	0.4505	0.4515	0.4525	0.4535	0.4545
1.7	0.4554	0.4564	0.4573	0.4582	0.4591	0.4599	0.4608	0.4616	0.4625	0.4633
1.8	0.4641	0.4649	0.4656	0.4664	0.4671	0.4678	0.4686	0.4693	0.4699	0.4706
1.9	0.4713	0.4719	0.4726	0.4732	0.4738	0.4744	0.4750	0.4756	0.4761	0.4767
2.0	0.4772	0.4778	0.4783	0.4788	0.4793	0.4798	0.4803	0.4808	0.4812	0.4817
2.1	0.4821	0.4826	0.4830	0.4834	0.4838	0.4842	0.4846	0.4850	0.4854	0.4857
2.2	0.4861	0.4864	0.4868	0.4871	0.4875	0.4878	0.4881	0.4884	0.4887	0.4890
2.3	0.4893	0.4896	0.4898	0.4901	0.4904	0.4906	0.4909	0.4911	0.4913	0.4916
2.4	0.4918	0.4920	0.4922	0.4925	0.4927	0.4929	0.4931	0.4932	0.4934	0.4936
2.5	0.4938	0.4940	0.4941	0.4943	0.4945	0.4946	0.4948	0.4949	0.4951	0.4952
2.6	0.4953	0.4955	0.4956	0.4957	0.4959	0.4960	0.4961	0.4962	0.4963	0.4964
2.7	0.4965	0.4966	0.4967	0.4968	0.4969	0.4970	0.4971	0.4972	0.4973	0.4974
2.8	0.4974	0.4975	0.4976	0.4977	0.4977	0.4978	0.4979	0.4979	0.4980	0.4981
2.9	0.4981	0.4982	0.4982	0.4983	0.4984	0.4984	0.4985	0.4985	0.4986	0.4986
3.0	0.4987	0.4987	0.4987	0.4988	0.4988	0.4989	0.4989	0.4989	0.4990	0.4990
3.1	0.4990	0.4991	0.4991	0.4991	0.4992	0.4992	0.4992	0.4992	0.4993	0.4993
3.2	0.4993	0.4993	0.4994	0.4994	0.4994	0.4994	0.4994	0.4995	0.4995	0.4995
3.3	0.4995	0.4995	0.4995	0.4996	0.4996	0.4996	0.4996	0.4996	0.4996	0.4997
3.4	0.4997	0.4997	0.4997	0.4997	0.4997	0.4997	0.4997	0.4997	0.4997	0.4998

APPENDIX

Hypothesis Statement:

Ho : Avago Technologies (A) and Win Semiconductors (W) wafers are similar.

H_A : _____ (5 marks)

Normality Test:

- Avago Technologies (A) _____ (p = _____), (10 marks)

- Win Semiconductors (W) _____ (p = _____) (10 marks)

Since data _____, (5 marks)

Variance Check

Data Not Normal Or Normal; -Ho : $\sigma_A = \sigma_W$; H_A: $\sigma_A \neq \sigma_W$

_____ (5 marks) Test, p = _____ (5 marks), therefore σ between Avago Technologies (A) and Win Semiconductors (W) wafers is _____ (5 marks)

Test for _____ ; _____ (5 marks)

-Ho : _____ A = _____ W; (5 marks) H_A : _____ A \neq _____ W (5 marks)

-P = _____ (5 marks), therefore _____ (5 marks) is _____ (5 marks) significantly different for wafer value.

Results:

Since _____ (5 marks) Test and _____ (5 marks) shows _____ (5 marks) difference; thus Accept _____ (5 marks).

Conclusions:

_____ (5 marks) .