Penyelesaian Lengkap

SET 1

KERTAS 1

1 C

2 B

3 C
Untuk graf *v*-*t*, kecerunan graf sama dengan pecutan. Pada titik C, kecerunan terbesar. Maka pada titik C pecutan terbesar.
For v-t graph, the slope of the graph gives the acceleration. At point C*, the gradient is greatest. So at point* C*, the acceleration is greatest.*

4 C
Semasa bongkah menggelongsor di atas lantai, geseran antara bongkah dengan lantai menghasilkan haba yang meleburkan ais. Jisim ais berkurang, pecutan bongkah turut bertambah. Pecutan terus bertambah selagi ais menggelongsor di atas lantai.
As the block slides on the floor, the friction between the block and the floor produces heat that melts the ice. The mass of the ice decreases and the acceleration of the block increases. Acceleration continues to increase as long as the ice slides over the floor.

5 B
$a = 3\ \text{m s}^{-2}$, $u = 0$, $s = 54\ \text{m}$

$$s = ut + \frac{1}{2}at^2$$

$$54 = 0 + \frac{1}{2}(3)t^2$$

$$t = 6\ \text{s}$$

6 D
$u = 30\ \text{m s}^{-1}$, $g = -10\ \text{m s}^{-2}$, $t = 5\ \text{s}$

$$v = u + gt$$
$$= 30 + (-10)^5$$
$$= -20\ \text{m s}^{-1}$$

Laju/*Speed* = 20 m s^{-1} ke arah bawah/*downwards*

7 C

8 D

9 B

$$mg = \frac{GMm}{r^2}$$

Di permukaan planet/*On the surface of the planet*

$$g = \frac{GM}{R^2}$$

$$g' = \frac{GM}{r^2}$$

Bahagi/*dividing* $\frac{g}{g'} = \frac{r^2}{R^2}$ $\qquad \frac{g}{\frac{1}{9}g} = \frac{r^2}{R^2}$

$$r = 3R$$

Ketinggian/*Height* $= 3R - R = 2R$

10 B

11 C

12 A

$$V = \frac{4}{3}\pi r^3$$

Isi padu dan jisim berkadar terus dengan kuasa tiga jejari. Maka jisim *X* ialah lapan kali jisim *Y*.
Volume and mass are directly proportional to the radius cubed. So the mass of X is eight times the mass of Y.

$$Q_X = Q_Y$$
$$m_X c\Delta\theta_X = m_Y c\Delta\theta_Y$$
$$8m_Y(2) = m_Y\Delta\theta_Y$$
$$\Delta\theta_Y = 16\ ^\circ\text{C}$$

13 C

Tekanan disebabkan berat/*Pressure due to the weight* $= \frac{W}{A}$

$$P_{\text{air}} = P_a + \frac{W}{A}$$

14 A

15 C
$a = 6$ cm, $D = 12$ cm, $\lambda = 2$ cm

$$PQ = 2x = 2\frac{\lambda D}{a} = 2\left(\frac{2 \times 12}{6}\right) = 8\ \text{cm}$$

16 A
t_1 dan t_2 ialah masa untuk mendengar gema 1 dan gema 2.
t_1 *and* t_2 *time to hear echo one and echo two.*

$$t_1 = \frac{2 \times 140}{340} = 0.706\ \text{s}$$

$$t_2 = \frac{2 \times 160}{340} = 0.941\ \text{s}$$

$$\Delta t = 0.941 - 0.706 = 0.24\ \text{s}$$

17 B
Nisbah halaju cahaya dalam udara kepada halaju cahaya di medium sama dengan indek biasan medium, *n*.
The ratio of the speed of light in air to the speed of light in the medium is equal to the index of the medium, n.

$$n = \frac{\sin i}{\sin r} = \frac{\sin 30^\circ}{\sin 20^\circ} = 1.46$$

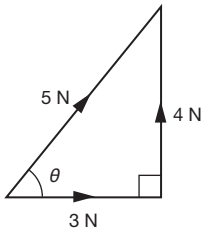
18 D

19 D

Imej adalah songsang dalam dua hala. Kiri menjadi kanan, atas menjadi bawah.
The image is inverted in both directions. Left becomes right, top becomes bottom.

20 D
$W = 20$ N $mg = 20$
$m = 2$ kg
Komponen berat ke bawah landasan = $mg \sin \theta = 20 \sin 30°$ = 10 N
Component weight down the plane = $mg \sin \theta = 20 \sin 30°$ = 10 N
$\sum F = ma$
$F - 10 = 2(1)$
$F = 12$ N

21 D



$\tan \theta = \frac{4}{3} = 1.333$
$\theta = 53.1°$

22 C
3 spring
$3T = W$ (T = ketegananan setiap spring)
Untuk setiap spring
$T = \frac{W}{3}$
$\frac{W}{3}$ memanjang $(12 - 9) = 3$ cm, W memanjang 9 cm
sistem 2 spring, Ketegangan setiap spring = $\frac{W}{2}$
Pemanjang setiap spring = 4.5 cm
Panjang sistem = 6 + 4.5 = 10.5 cm
For 3 *springs*
$3T = W$
$T = \frac{W}{3}$
For each spring
$\frac{W}{3}$ *extends* $(9 - 6) = 3$ cm, W *extends* 9 cm
Tension in each spring = $\frac{W}{2}$
Extension of each spring = 4.5 cm
Length of system = 9 + 4.5 = 13.5 cm

23 C
$P = h\rho g = 0.15 \times 1\,000 \times 9.81$
$= 1\,500$ N

24 A

25 A

26 B

$P = VI$
$I = \frac{140}{120} = 1.2$ A

27 A
$V = \frac{1}{1+2}(6) = 2$ V

28 C
R = rintangan mentol
R = *resistance of bulb*
$I_1 = \frac{E}{R + r}$
$I_2 = \frac{E}{R + \frac{1}{2}r}$

29 C

30 A

31 C

32 A

33 B
$eV = \frac{1}{2}mv^2$
$1.6 \times 10^{-19}\ V = \frac{1}{2} \times 9.1 \times 10^{-31}\ (3.6 \times 10^7)^2$
$V = 3.7$ kV

34 C
$I_E = I_{B+} + I_C = 18.7 + 0.15 = 18.85$ mA

35 C
Numbor proton / *Proton number* = 82 + 2 = 84
Nomber neutron / *Neutron number* = 210 − 84 = 126

36 C

37 B

38 B

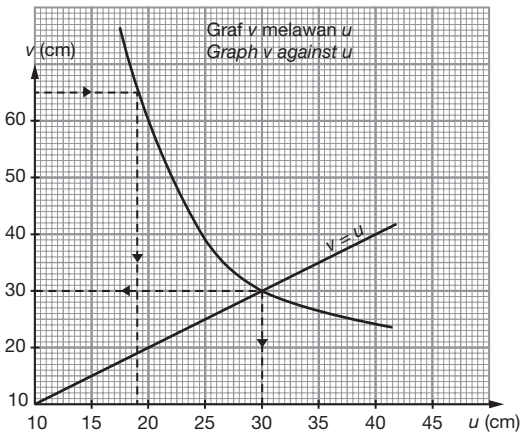
39 B
$E = \frac{hc}{\lambda}$
$= \frac{6.63 \times 10^{-34} \times 3 \times 10^8}{6 \times 10^{-7}}$
$= 3.3 \times 10^{-19}$ J

40 B

KERTAS 2

Bahagian A

1



(a) Dari graf
From the graph
$v = 65.0$ cm, $u = 19.0$ cm.

$$\frac{1}{u} + \frac{1}{v} = \frac{1}{f}$$

$$\frac{1}{f} = \frac{1}{65.0} + \frac{1}{19.0}$$

$$f = 14.7 \text{ cm}$$

(b) Untuk kanta cembung, apabila $u = 2f$, v juga sama dengan $2f$, iaitu $v = u = 2f$.
Titik silang pada graf = (30.0, 30.0).
Maka, $2f = 30.0$ cm, $f = 15.0$ cm.
For a convex lens, when $u = 2f$, v is also equal to $2f$, that is $v = u = 2f$.
Intersecting point on the graph = (30.0, 30.0).
So, $2f = 30.0$ cm, $f = 15.0$ cm

2 (a) V_p turut bertambah
V_p *increases accordingly*

(b) Arus tapak bertambah apabila V_p bertambah dalam keadaan gelap menyebabkan arus pemungut turut bertambah. Suis geganti dihidupkan.
The base current increases when V_p increases in dark conditions causing the collector current increases. The relay switch is turned on.

(c) $$V_P = \frac{10}{10 + 20}(6) = 2.0 \text{ V}$$

(d) Lampu tidak menyala kerana voltan pada litar suis automatik terlalu rendah.
The lamp does not light up because the voltage on the automatic switch circuit is too low.

3 (a)

Kuantiti skalar *Scalar quantity*	**Kuantiti vektor** *Vector quantity*
Jisim, tenaga keupayaan *Mass, potential energy*	Daya, berat, sesaran *Force, weight, friction*

(b) $$s = ut + \frac{1}{2}at^2$$

$$= 0 + \frac{1}{2}g \sin \theta t^2$$

$$\frac{2s}{t^2} = g \sin \theta$$

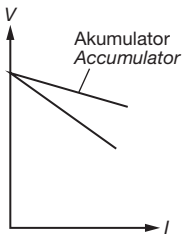
Plotkan graf $\left(\frac{2s}{t^2}\right)$ melawan sin θ. Pecutan graviti, g sama dengan kecerunan graf.
Plot graph $\left(\frac{2s}{t^2}\right)$ against sin θ. *The gradient of graph gives the gravitational acceleration, g.*

4 (a) $$R = \frac{V}{I} = \frac{6}{1} = 6\ \Omega$$

(b) Jumlah rintangan dalam
Total internal resistance

(c) $$4r = -\frac{6 - 3}{0 - 2} = 1.5\ \Omega$$
$$r = 0.375\ \Omega$$

(d)



Kecerahan bertambah. Arus mengalir bertambah kerana rintangan dalam sudah berkurang.
Brightness increases. The current flowing increases because the internal resistance has decreased

5 (a) $$\frac{2}{5} \times 10 = 4 \text{ N}$$

(b)

(c) Tidak sama
Not equal.

(d) $$\sum F = m_{system}a$$
$$15 - 10 = (2 + 3)a$$
$$a = 1 \text{ m s}^{-1}$$

(e) $$\sum F = ma$$
$$T = 9 \text{ N}$$

6 (a) Mentol akan menggunakan 3 J tenaga elektrik dalam masa satu saat apabila dibekalkan voltan sebanyak 6 V.
The bulb will use 3 J *of electrical energy in one second when a voltage of* 6 V *is supplied.*

(b) (i) Bilangan lilitan pada gegelung sekunder dalam Rajah 6.2 adalah lebih daripada bilangan lilitan pada gegelung sekunder dalam Rajah 6.1.
The number of turns on the secondary coil in Diagram 6.2 *is more than the number of turns on the secondary coil in Diagram* 6.1.

(ii) Lampu *Q* lebih cerah.
Lamp Q is brighter.

(iii) Voltan output dalam Rajah 6.2 lebih tinggi.
The output voltage in Diagram 6.2 *is greater.*

(iv) Voltan output bertambah apabila bilangan lilitan pada gegelung sekunder bertambah.
The output voltage increases as the number of turns on the secondary coil increases.

(c) 9 V

(d) $\eta = \frac{P_O}{P_{in}} \times 100\%$

$90 = \frac{3}{V_O I_P} \times 100 = \frac{3}{240 I_P} \times 100$

$I_P = 0.014\text{A}$

7 (a) (i) Isi padu air disesarkan = isi padu bahagian tiub kaca di bawah permukaan air

Isi padu = luas keratan rentas × panjang

$= 2.5 \times 8 = 20\ \text{cm}^3$

Volume of water displaced = volume of the part of the glass tube below the surface of the water

Volume = cross-sectional area × length

$= 2.5 \times 8 = 20\ \text{cm}^3$

(ii) $m = \rho V = 1 \times 20 = 20\ \text{g} = 0.020\ \text{kg}$

Berat air disesarkan/*Weight of water displaced*

$= mg = 0.020 \times 9.81 = 0.196\ \text{N}$

(b) (i) Daya apungan = Berat tiub kaca + berat butir-butir plumbum

Buoyant force = Weight of glass tube + weight of lead shots

(ii) Apabila satu jasad terapung, berat jasad = berat cecair disesarkan iaitu, jisim jasad terapung = jisim cecair disesarkan

Jisim tiub kaca + Jisim butir-butir plumbum = 20 g

Jisim butir-butir plumbum = 20 – 12 = 8 g

When a body floats, the weight of the body = the weight of the liquid displaced ie, mass of floating body = mass of liquid displaced

Mass of glass tube + Mass of lead shots = 20 g

Mass of lead shots = 20 – 12 = 8 g

(c) Tiub kaca akan terapung dengan panjang terendam bertambah .

The glass tube will float with increased submerged length .

(d) (i) Diameter tiub kaca seharusnya sempit. Untuk meningkatkan kepekaan hidrometer.

The diameter of the glass tube should be narrow. To increase the sensitivity of the hydrometer.

(ii) Tiub seharusnya panjang. Untuk meningkatkan julat ketumpatan cecair yang diukur.

The tube should be long. To increase the density range of the liquid being measured.

8 (a) Haba yang diperlukan untuk menaikkan suhu 1 kg bahan sebanyak 1 °C.

The amount of heat required to increase the temperature of 1 kg *of the material by* 1 °C.

(b) (i) Lebih kuasa

Higher power

Untuk memanaskan air dengan lebih cepat/Untuk membekalkan lebih haba sesaat.

To heat the water faster/To supply more heat per second.

(ii) *Muatan haba tentu yang rendah*

Lower specific heat capacity

Cerek tidak menyerap banyak haba(dan justru itu menambahkan kecekapan cerek).

The kettle does not absorb too much heat(and thereby increases the efficiency of the kettle).

(c) Cerek Q

Kettle Q

(d) (i) $E = Pt = 2\,000 \times 6.5 \times 60 = 960\,000\ \text{J}$

(ii) $Q(\text{water/}air) = mc\theta = 2.3 \times 4\,200 \times (100 - 25)$

$= 780\,000\ \text{J}$

$\text{Kecekapan} = \frac{\text{Haba diserap oleh air}}{\text{Jumlah tenaga dibekalkan}} \times 100\ \%$

$= \frac{780\,000}{960\,000} \times 100\%$

$= 81.2\ \%$

$\textit{Efficiency} = \frac{\textit{Heat absorbed by water}}{\textit{Total energy supplied}} \times 100\ \%$

$= \frac{780\,000}{960\,000} \times 100\%$

$= 81.2\ \%$

(i) Haba diserap oleh cerek

= (960 000 – 780 000 – 120 000) = 60 000J

Heat absorbed by kettle

= (960 000 – 780 000 – 200 000) = 60 000 J

$m \times 500 \times (100 - 25) = 60\,000$

$m = 1.6\ \text{kg}$

Bahagian B

9 (a) Ketumpatan kayu hendaklah kecil untuk mengurangkan berat supaya lebih mudah dikendalikan.

The density of the wood should be small so that it reduces its weight and therefore easier to handle.

Kekuatan bahan harus tinggi untuk mengelakkan pecah semasa terkena sasaran atau jatuh semasa digunakan.

The material strength should be high to avoid breakage while hitting the target or fall while in use.

Keratan rentas sayap hendaklah berbentuk aerofoil untuk menjadikannya kekal di udara untuk masa lebih lama dan mencapai jarak yang lebih jauh.

The cross-sectional of the wings should be aerofoil to make it aloft for longer time and reach a farther distance.

Badan bumerang harus licin untuk mengurangkan geseran udara.

The boomerang's body should be smooth to reduce air friction.

Bumerang yang paling sesuai ialah bumerang *K* kerana mempunyai permukaan licin, ketumpatan rendah, kekuatan bahan yang baik dan mempunyai sayap berbentuk aerofoil.

The most suitable boomerang is boomerang K as it has smooth surface, low density, good material strength and has cross-sectional aerofoil shaped wings.

(b) Semasa menghentikan pergerakan besbol, berlaku perubahan momentum, dan dengan itu daya impuls akan bertindak ke atas tangannya. Daya impuls berkadar songsang dengan masa impak. Jika bola ditangkap dengan menghentikan ia di laluannya, masa impak adalah pendek dan daya impuls besar akan bertindak ke atas tangannya. Dengan menggerakkan tangannya ke belakang apabila menangkap bola akan memanjangkan masa untuk perubahan momentum dan akan mengurangkan daya impuls ke atas tangannya.

While stopping the baseball, there is a change in momentum and hence an impulsive force will act on his hand. Impulsive force in inversely proportional to time of impact. If the ball is caught by stopping it in its path, the time is short and a considerable impulsive force will act on his hand. By moving his hand backwards when catching the ball will prolong the time for the change in momentum and will reduce the impulsive force on his hand.

(c) Apabila dua daya pada arah yang sama
When the two forces are in the sane direction

$$\sum F = ma$$
$$8 + 6 - 1 = 2a_{max}$$
$$a_{max} = 6.5 \text{ m s}^{-1}$$

Apabila dua daya pada arah berlawanan
Whe the two forces are in opposite direction

$$\sum F = ma_{min}$$
$$8 - 6 - 1 = 2 \times a_{min}$$
$$a_{min} = 0.5 \text{ m s}^{-2}$$

10 (a) (i) Tungsten/*Tungsten*
Rintangan yang tinggi untuk menghasilkan haba yang cukup untuk filamen menghasilkan cahaya.
High resistance to produce enough heat for filament to glow and produce light.

(ii) Nipis/*Thin*
Untuk meningkatkan rintangan filamen.
To increase the resistance of the filament.

(iii) Bergelung/*Coiled*
Wayar bergelung menjadikan filamen lebih panjang seterusnya meningkatkan rintangan.
Coiled wire makes the filament longer hence, the resistance will increase.

(iv) Gas nitrogen pada tekanan rendah/*Nitrogen gas at low pressure*.
Untuk mengelakkan pemejalwapan filamen dan pengoksidaan logam.
To prevent sublimation of the filament and metal oxidation.

Mentol *P* dipilih kerana filamen adalah dawai tungsten yang nipis dan bergelung, dan mentol mengandungi gas lengai nitrogen pada tekanan rendah.
Bulb P is chosen as the filament is tungsten wire which is thin and coiled, and the bulb contains inert gas of nitrogen at low pressure.

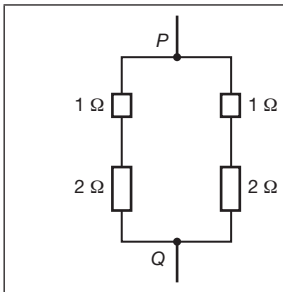
(b) Mentol / *bulb P*, $P = \frac{V^2}{R}$ $R = \frac{12^2}{48} = 3\ \Omega$

Mentol / *bulb Q*, $Q = \frac{12^2}{24} = 6\ \Omega$

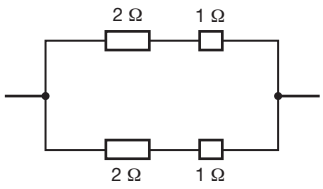
(i) Apabila *P* dan *Q* selari, voltan merentasi kedua-dua sama dengan 12 V. Maka *P* membebaskan 48 J sesaat manakala *Q* membebaskan 24 J sesaat. Maka *P* lebih cerah.
When P and Q are in parallel, the voltage across them is equal to 12 V. *So P releases* 48 J *per second while Q releases* 24 J *per second. So P is brighter.*

(ii) Apabila *P* dan *Q* sesiri, mereka membahagikan voltan 12 V. *P* ambil 4 V manakala *Q* ambil 8 V. Kuasa sama dengan *VI*, dimana *I* adalah sama untuk *P* dan *Q*. Jadi, *Q* membebaskan lebih kuasa dan lebih cerah (kurang cerah daripada cerah normal).
When P and Q are in series, they share the voltage 12 *V. P takes* 4 *V while Q takes* 8 *V. Power is equal to VI, where I is the same for P and Q. So, Q releases more power and is brighter (less bright than normal use).*

(c) (i)



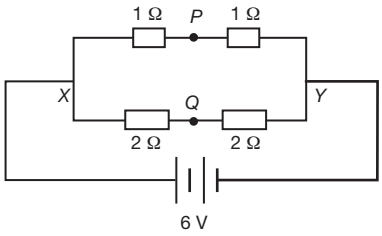
$$\frac{1}{R_1} = \frac{1}{3} + \frac{1}{3}$$
$$R_1 = \frac{3}{2}\ \Omega$$



$$\frac{1}{R_2} = \frac{1}{2} + \frac{1}{4}$$
$$R_2 = \frac{4}{3}\ \Omega$$

XY | $R_1 : R_2 = 9 : 8$

(ii)



$V_{XQ} = 3$ V

$P = \frac{V^2}{R} = \frac{3^2}{2} = 4.5$ W

Bahagian C

11 (a) (i) Lintasan Bumi adalah lebih panjang dan jarak Bumi dari Matahari lebih dekat pada bulan Mac.
The path moved is longer and the distance of Earth from the Sun is nearer in March.

(ii) Semakin panjang lintasan dilalui, semakin tinggi laju purata Bumi.
Deduksi: Semakin dekat Bumi dari Matahari semakin tinggi halajunya.
The longer the path moved, the higher its average speed.
Deduction: The nearer the Earth from the Sun, the higher its velocity.

(iii) Hukum Kepler kedua.
Kepler's second law.

(b) Pecutan ditakrifkan sebagai kadar perubahan halaju, iaitu $a = \frac{v_f - v_i}{t}$. Halaju adalah kuantiti vektor yang mempunyai kedua-dua magnitud dan arah. Apabila halaju malar, tiada perubahan dari segi magnitud dan arah. Oleh kerana $v_f = v_i$ dan $v_f - v_i = 0$, maka pecutan $a = 0$, tiada pecutan. Apabila kelajuan adalah malar (contohnya objek bergerak dengan kelajuan malar dalam bulatan) *n* dari satu kedudukan ke kedudukan lain, terdapat perubahan arah (walaupun tiada perubahan magnitud) dan dengan demikian berlakulah perubahan halaju. Oleh keran $v_f \neq v_i$ dan $v_f - v_i \neq 0$, maka objek itu memecut.

Acceleration is defined as rate of change in velocity, that is $a = \frac{v_f - v_i}{t}$. *Velocity is a vector quantity which means it has both magnitude and direction. When the velocity is constant, there is no change in magnitude and direction. Since* $v_f = v_i$ *and* $v_f - v_i = 0$, *therefore acceleration* $a = 0$. *When the speed is constant (for example an object moving with constant speed in a circle), when it moves from one position to another, there is a change in direction and thus a change in velocity. Since* $v_f \neq v_i$ *and* $v_f - v_i \neq 0$, *the object accelerates.*

(c) Bahan-bahan untuk satelit mesti mempunyai takat lebur yang tinggi untuk mengelakkan satelit daripada melebur. Bahan untuk badan satelit harus mempunyai kekonduksian haba yang rendah untuk mengelakkan haba memasuki satelit dan memusnahkan instrumen di dalam satelit. Bahan-bahan untuk satelit harus mempunyai ketumpatan rendah (untuk mengurangkan jisim satelit) untuk mengurangkan momentum atau daya impuls semasa pendaratan. Sistem payung terjun harus disediakan supaya ia dapat dibuka semasa mendarat untuk mengurangkan kelajuan mendarat. Satelit itu harus mendarat di laut untuk memanjangkan masa impak demi mengurangkan daya impuls.

The materials for the satellite must have high melting point to prevent the satellite from melting. The material for the body of the satellite should have low conductivity of heat to prevent heat transferred into the interior and destroy the instruments in the satellite. The materials for the satellite should be of low density (to reduce the mass of satellite) to reduce the momentum or impulsive for while landing. A parachute system should be available so that it will open while landing to reduce the landing speed. The satellite should land on sea to prolong the time interval of impact to reduce the impulsive force.

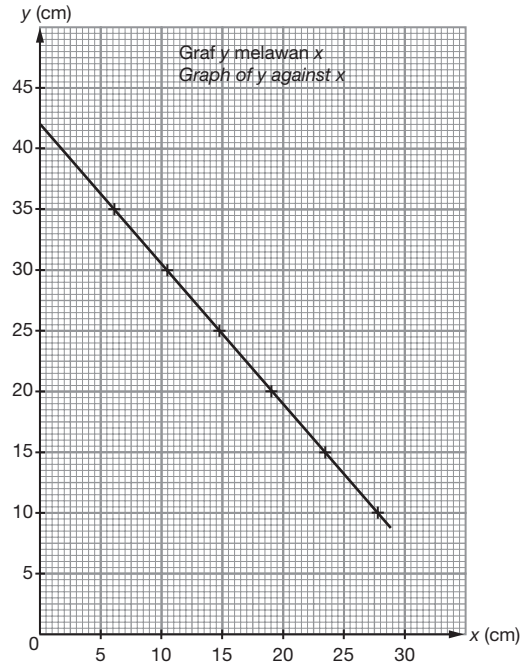
KERTAS 3

(a) (i) y
(ii) x

(b)

x (cm)	y (cm)
10.0	27.7
15.0	23.3
20.0	19.0
25.0	14.9
30.0	10.6
35.0	6.4

(c)



(d) $y_o = 42.2$ cm

(e) Kecerunan/*gradient* = –1.17

(f) $M = \frac{50.0(58.5 - y_o)}{y_o - 30.0}$

$= \frac{50.0(58.5 - 42.2)}{42.2 - 30.0}$

$= 66.8$ g