KEMENTERIAN PENDIDIKAN MALAYSIA
Jabatan Pendidikan Negeri Pulau Pinang

PULAU PINANG PENERAJU TRANSFORMASI PENDIDIKAN NEGARA

MODUL GMAT + PENANG

FORMAT BAHARU KSSM
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Tingkatan 5

Jawapan & Langkah Kerja

EDISI GURU

DIGUBAL OLEH GURU-GURU MATEMATIK TAMBAHAN NEGERI PULAU PINANG

BAB 1

SUKATAN MEMBULAT
CIRCULAR MEASURE

1. Tukar sudut dalam darjah

   2 rad. $\times \frac{180}{3.142}$

   = 114.58^o

   Luas sektor POQ

   $= \frac{1}{2}(10)(10)(2).$

   atau

   Luas segi tiga ROS

   $= \frac{1}{2}(5)(5)sin114.58^o$

   Luas kawasan berlorek PRSQ

   = Luas sektor POQ - Luas segi tiga ROS

   $= \frac{1}{2}(10)(10)(2) - \frac{1}{2}(5)(5)sin114.58^o$

   $=88.63cm^2$

2. $\frac{r\theta}{r\left(\frac{\pi}{2}-\theta\right)} = \frac{2}{3}$

   $\theta = \frac{\pi}{5}$ rad.// 0.6284rad.

   Luas sektor BOC

   $=\frac{1}{2}(8)(8)(0.6284)$

   Atau

   Luas segi tiga AOB

   $=\frac{1}{2}(8)(8)(\sin 54^o)$

   Luas kawasan berlorek

   = Luas sektor BOC + Luas segi tiga AOB

   $= 46cm^2$

3. $\theta = 60^o$

Luas semibulatan

$= \frac{1}{2}r^2(\pi)$

Luas sektor AOB = Luas sektor BOC

$= 2x\frac{1}{3}x\frac{1}{2}\pi r^2$

Luas tembereng perentas AB= Luas tembereng BC

$= 2x\frac{1}{2}r^2(\theta - \sin 60^o)$

Luas kawasan berlorek

$= 2 \times \frac{1}{3}x\frac{1}{2}\pi r^2 - 2x\frac{1}{2}r^2(\frac{\pi}{3} - \sin 60^o) - \frac{1}{2}r^2 (\sin 120^o)$

$= 0.4330\ r^2$

4. (a) $0.1312 \times \dfrac{180}{3.142} = 7^o\ 31'$

$XY = \dfrac{1}{4}h$

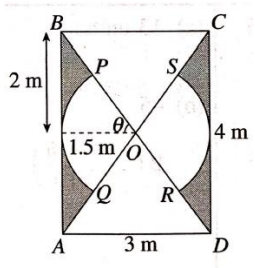
(b) $\dfrac{1}{4}h = j\alpha$

$j = \dfrac{h}{4\alpha}$

PQ $= h - \dfrac{h}{4\alpha}$

$= \dfrac{4\alpha h - h}{4\alpha}$

5.



$$\tan\theta = \frac{2}{1.5}$$

$$\theta = 0.9273\ rad$$

$$\angle AOB = \angle COD$$

$$= 2 \times 0.9273$$

$$= 1.8546\ rad$$

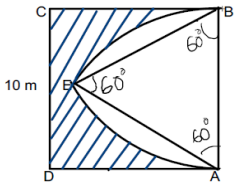
Area of shaded region

$$= 2 \times (\text{ Area of triangle } - \text{ Area of sector })$$

$$= 2\left[\frac{1}{2} \times 4 \times 1.5 - \frac{1}{2}(1.5)^2(1.8546)\right]$$

$$= 1.827\ m^2$$

6.



$60^\circ = \frac{60^\circ \times \pi}{180^\circ} = 1.0473\ rad$

Luas segiempat sama $= 10 \times 10 = 100\ m^2$

Luas sector $AEB = \frac{1}{2}(10)^2 \times 1.0473$

$= 52.365\text{m}^2$

Luas tembereng $EB = 52.365 - \frac{1}{2} \times 10 \times 10 \times sin60^\circ$

$= 9.0637m^2$

Luas Kawasan berlorek $= 100 - 52.365 - 9.0637$

$= 38.5713\text{m}^2$

7. (a) $r\theta = 110$
$r(180° \times \frac{\pi}{180°}) = 110$
$r = 35.00$ cm

(b) i) Luas sector $POQ = \frac{1}{2}35^2(118^\circ \times \frac{\pi}{180^\circ})$
$= 1261.60$ cm^2

ii) $\frac{1}{2}(35)^2 \sin 118^\circ$

Luas tembereng $= \frac{1}{2}(35)^2(2.0598) - \frac{1}{2}(35)^2 \sin 118^\circ$
$= 720.79$ cm^2

iii) Isipadu $= 720.79 \times 200$
$= 144\ 158.9199$ cm^3
$= 144.159\ l$

8. Anggap $UO = x$ dan $UQ = y$
$\frac{1}{2}(3y)(3x) - \frac{1}{2}(y)(x) = 35$ or $x^2 + y^2 = 7^2$
$1225 + 16y^4 = 784y^2$
$y = 6.884$ dan $x = 1.271$

tan $\angle QOU = \frac{6.884}{1.271}$
$\theta = 2.967 - 1.388 = 1.579$ rad

Panjang lengkok *PQ/Arc length PQ* $= 7 \times 1.579 = 11.053$ cm
or panjang *OR / length OR* $= \sqrt{(3.813)^2 + (20.652)^2} = 21$ cm

Perimeter seluruh rajah / *Perimeter of the whole diagram*
$= 3.813 + 20.652 + (21 - 7) + 11.053 + 7 = 56.518$ cm

9. (a) $\frac{1}{2} \times j \times 3j = \frac{1}{2} \times j^2 \times \theta$

$\theta = 3$ rad

(b) $OR = \sqrt{j^2 + 9j^2} = \sqrt{10\,j^2} = \sqrt{10}\,j$ cm
Panjang lengkok *PQ / Length of arc PQ* $= j\theta = 3j$ cm
Perimeter seluruh rajah/ *Perimeter of the whole diagram*
$= OS + SR + RQ + QP + PO$
$= 3j + j + \sqrt{10}\,j - j + 3j + j$
$= 7j + \sqrt{10}\,j$ cm $= \left(7 + \sqrt{10}\right)j$ cm

10. (a) $\sin\alpha = \frac{2.4}{4}$

$\alpha = 36.87^{\circ} = 0.6436\, rad$
$\theta = 3.142 - 0.6436 = 2.4984\, rad$

$(b)\ S_{ST} = 2.4 \times (90^{\circ} \times \frac{\pi}{180^{\circ}}) = 3.7704$
$S_{QT} = 4 \times 2.498 = 9.992$
$OR = \sqrt{4^2 - 2.4^2}$ = 3.2
Perimeter = 3.7704 + 9.992 + 2.4 + 3.2 + 4
= 23.3624 cm

(c) Luas *TRS* = $\frac{1}{2}(2.4)^2 \times \frac{\pi}{2} = 4.5245\text{cm}^2$
Luas TOP = 1/2×4^2× 0.6436 = 5.1488 cm^2

Luas ΔTOR = 1/2×3.2×2.4 =3.84 cm^2

Luas Kawasan berlorek = 4.5245 – (5.148-3.84)

=3.2157 cm^2

11. (a) 12 = r (α)

28 = (9 + r) (α)
$\frac{12}{r} = \frac{28}{9+r}$
r = 6.75
$\alpha = \frac{12}{r}$
$\alpha = \frac{16}{9}\, rad$

(b) Luas segitiga $QOR = \frac{1}{2} \times (9 + 6.75) \times (9 + 6.75) \sin\left(\frac{16}{9} rad\right)$

Luas sektor *POS* = $\frac{1}{2} \times \left(\frac{27}{4}\right)^2 \times \left(\frac{16}{9}\right)$

Luas kawasan berlorek = Luas segitiga *QOR* – luas sektor *POS*

$= \left[\frac{1}{2} \times (9 + 6.75) \times (9 + 6.75) \sin\left(\frac{16}{9} rad\right)\right]$
$-[\frac{1}{2} \times \left(\frac{27}{4}\right)^2 \times \left(\frac{16}{9}\right)]$
= 121.384 – 80.5
= 80.884

12. (a) $(i)\ 60° = 60 \times \frac{3.142}{180} = 1.04733\ rad$

Perimeter kawasan berlorek

$= 3 \times 6(1.04733)$

$= 18.852$ cm

(*ii*) Luas kawasan berlorek / *Area of the shaded region*

$= \left[\frac{1}{2}(12)^2 \sin 60°\right] - 3\left[\frac{1}{2}(6)^2 \times 1.04733\right]$

$= 5.798\ \text{cm}^2$

$(b)\ \angle AON = \cos^{-1}\frac{2}{3} = 0.8411\ rad$

$\angle AOB = 2 \times 0.8411 = 1.6822\ rad$

Luas sektor major berlorek/ *Area of the shaded major sector*

$= \frac{1}{2}(30^2)(2\pi - 1.6822) + \frac{1}{2}(30^2)\sin 1.6822$

$= 2518.02\ cm^2$

Peratusan bekas yang berisi air/ *percentage of container filled with water*

$= \frac{2518.02}{\pi(30^2)} \times 100\%$

$= 89.05\%$

BAB 2

PEMBEZAAN
DIFFERENTIATION

1. a) $\underset{x\to 4}{had}\left(\dfrac{x^2-16}{x+4}\right) = \underset{x\to 4}{had}\left[\dfrac{(x+4)(x-4)}{x+4}\right]$

$= \underset{x\to 4}{had}(x-4)$

$= 0$

b) $\underset{x\to 0}{had}\dfrac{3}{x-1} = \dfrac{3}{0-1}$

$= -3$

2. (a) $y = x^{\frac{1}{2}}(x+7)$

$y = x^{\frac{3}{2}} + 7x^{\frac{1}{2}}$

$\dfrac{dy}{dx} = \dfrac{3}{2}x^{\frac{1}{2}} + \dfrac{7}{2}x^{-\frac{1}{2}}$

$\dfrac{dy}{dx} = \dfrac{3\sqrt{x}}{2} + \dfrac{7}{2\sqrt{x}}$

$\dfrac{dy}{dx} = \dfrac{3x+7}{2\sqrt{x}}$

(b) $u = 2x^2 + x$ $\qquad$ $v = 2x - 5$

$u' = 4x + 1$ $\qquad$ $v' = 2$

$\dfrac{dy}{dx} = \dfrac{(2x-5).(4x+1) - (2x^2+x).2}{(2x-5)^2}$

$\dfrac{dy}{dx} = \dfrac{8x^2 - 18x - 5 - 4x^2 - 2x}{(2x-5)^2}$

$\dfrac{dy}{dx} = \dfrac{4x^2 - 20x - 5}{(2x-5)^2}$

(c) $\frac{dy}{dx} = 3 \times -3(9-2x)^2 \times -2$

$\frac{dy}{dx} = 18(9-2x)^2$

3. $u = 2x + 1$ $v = (1-x)^2$

$\frac{du}{dx} = 2x$ $\frac{dy}{dx} = 2x - 2$

$$\frac{dy}{dx} = \frac{v\frac{du}{dx} - u\frac{dv}{dx}}{v^2}$$

$$\frac{dy}{dx} = \frac{(1-x)^2(2) - (2x+1)(-2(1-x)}{[(1-x)^2]^2}$$

$$\frac{dy}{dx} = \frac{(1-2x+x^2) - (4x^2-4x+2x-2)}{[1-x]^4}$$

$$\frac{dy}{dx} = \frac{-2x-2x+4}{(1-x)^4}$$

4. Katakan $u = x^3$ dan $v = (2-3x)^4$

$$\frac{d}{dx}\left[x^3(2-3x)^4\right]$$

$$= u\frac{dv}{dx} + v\frac{du}{dx}$$
$$= x^3\frac{d}{dx}(2-3x)^4 + (2-3x)^4\frac{d}{dx}(x^3)$$
$$= x\left[4(2-3x)^3(-3)\right] + (2-3x)^4(3x^2)$$
$$= 3x^2(2-3x)^3\left[-4x + (2-3x)\right]$$
$$= 3x(2-3x)^3(2-7x)$$

5. $f(x) = \left(\frac{x^2+5}{x}\right)^3$

$$= (x + 5x^{-1})^3$$

$$f'(x) = 3(x+5x^{-1})^2\left[1 + (-1)(5)x^{-2}\right]$$

$$= 3\left(x+\frac{4}{x}\right)^2\left(1-\frac{5}{x^2}\right)$$

$$f'(1) = 3\left(1+\frac{5}{1}\right)^2\left(1-\frac{5}{1^2}\right)$$

$$= 3(6^2)(-4)$$

$$= -432$$

6. (a) (i) $f(0) = 4$

(ii) Apabila *x* menghampiri sifar dari arah kiri, $\underset{x\to 0}{\text{had}}\, f(x) = 1$
dan apabila *x* menghampiri sifar dari arah kanan, $\underset{x\to 0}{\text{had}}\, f(x) = 4$
Oleh sebab had kiri tidak sama dengan had kanan, maka
$\underset{x\to 0}{\text{had}}\, f(x)$ tidak wujud

(b) (i) $\underset{x\to -1}{\text{had}}\, f(x) = 2$

(ii) $\underset{x\to 5}{\text{had}}\, f(x) = 3$

(c) $\underset{x\to 5}{\text{had}}\, \frac{-x^2+4}{x-2}$

$= \underset{x\to 5}{\text{had}}\, \frac{-[x^2-4]}{x-2}$

$= \underset{x\to 5}{\text{had}}\, -\frac{(x+2)(x-2)}{x-2}$

$= \underset{x\to 5}{\text{had}}\, -(x+2)$

$= -(5+2)$

$= -7$

7. $y = \dfrac{ax+b}{x^2} = (ax+b)x^{-2}$

$\dfrac{dy}{dx} = (ax+b)(-2x^{-3}) + x^{-2}(a)$

$= -x^{-2}a - 2x^{-3}b$

Diberi $\dfrac{dy}{dx} = 0$ dan $x = 2$

$0 = -\dfrac{a}{4} - \dfrac{2b}{8}$

$a = -b$ ----------(1)

$\dfrac{d^2y}{dx^2} = 2x^{-3}a + 6x^{-4}b$

Diberi $\dfrac{d^2y}{dx^2} = 0$ dan $x = 2$

$\dfrac{1}{2} = \dfrac{2a}{8} + \dfrac{6b}{16}$

$4 = 2a + 3b$ --------(2)

Gantikan (1) dalam (2)

$4 = -2b + 3b$

$b = 4$

$a = -4$

8. $A = (2x + 6)(3x - 2)$
$A = 6x^2 + 14x - 12$
$\frac{dA}{dx} = 12x + 14$

$When\ x = 4,\ \ A = 6(4^2) + 14(4) - 12 = 140\ and\ \frac{dA}{dx} = 12(4) + 14 = 62$
$\delta x = \frac{m}{100} \times 4 = 0.04m$

$\frac{\delta A}{\delta x} = \frac{dA}{dx}$

$\delta A = 62 \times 0.04m = 2.48m$

Hence, the corresponding percentage change in area is $\frac{2.48m}{140} \times 100 = 1.7714m\%$

9. $10 = 5 - m(5) + n(5^2)$
$5 = -5m + 25n$
$1 = -m + 5n - - - - - - - - eq.1$

$\frac{dy}{dx} = -m + 2nx$
$6 = -m + 2n(5)$
$6 = -m + 10n - - - - - eq.2$

$Eq.2 - Eq.1:\ \ 5 = 5n$
$n = 1$

$1 = -m + 5(1)$
$m = 4$

10. (a) $y = -10x + 25$
$y + \delta y = 10(x + \delta x) + 25$
$y + \delta y = -10x - 10\delta x + 25$
$\delta y = -10x - 10\delta x + 25 - (-10x + 25)$
$\delta y = -10\delta x$
$\frac{\delta y}{\delta x} = -10$

$\frac{dy}{dx} = \lim_{\delta x \to 0} -10 = -10$

(b) $\frac{dy}{dx} = 3x^2 + 2$

$3x^2 + 2 = -4$

$3x^2 + 6 = 0$

$3(x^2 + 2) = 0$

$x^2 + 2 = 0$ cannot be solved as $x = \sqrt{-2}$ is undefined.

(c) $\frac{dy}{dx} = 3x^2 - 6x - 9$

$y = -\frac{1}{15}x + 2$, then $m_{normal} = -\frac{1}{15}$ while $m_{tangent} = 15$

$3x^2 - 6x - 9 = 15$

$3x^2 - 6x - 24 = 0$

$x^2 - 2x - 8 = 0$

$(x - 4)(x + 2) = 0$

$x = 4$ or $x = -2$

When $x = 4$, $y = 4^3 - 3(4^2) - 9(4) + 10 = -10$ hence the coordinates is $(4, -10)$

$-10 = -\frac{1}{15}(4) + c$

$c = -\frac{146}{15}$

Equation of normal is $y = -\frac{1}{15}x - \frac{146}{15}$

11. (a) $PQ + QRS + ST + TUP = 50$

$PQ + \frac{1}{2}(2\pi j) + ST + \frac{1}{2}(2\pi j) = 50$

$2PQ + 2\pi x = 50$

$PQ = 25 - \pi x$

$L = \frac{1}{2}\pi x^2 + (25 - \pi x)(2x) + \frac{1}{2}\pi x^2$

$L = \pi(x)^2 + 50x - 2\pi x^2$

$L = 50x - \pi x^2$

(b) $\frac{dL}{dx} = 50 - 2\pi x$

$\frac{dL}{dx} = 0$, $50 - 2\pi x = 0$, $x = \frac{25}{\pi}$

$\frac{d^2L}{dx} = -2\pi\ (> 0)$, L is maximum while $x = \frac{25}{\pi}$

$L = 50\left(\frac{25}{\pi}\right) - \pi\left(\frac{25}{\pi}\right)^2$

$L = \frac{625}{\pi} = 198.94\ \text{cm}^2$

12. (a) $L = 2\pi r$

$\frac{dL}{dr} = 2\pi$

$\frac{dL}{dt} = \frac{dL}{dr} \times \frac{dr}{dt}$

$0.2 = 2\pi \times \frac{dr}{dt}$

$\frac{dr}{dt} = \frac{1}{10\pi} = 0.03183\ \text{cms}^{-1}$

(b) $L = 2\pi r = 80$

$r = \frac{40}{\pi}$

$\frac{\delta r}{\delta t} = \frac{dr}{dt}$

$\frac{\delta r}{4} = \frac{1}{10\pi}$

$\delta r = \frac{2}{5\pi}$

$r + \delta r = \frac{40}{\pi} + \frac{2}{5\pi}$

$= 12.86\ \text{cm}$

13. (a) $\frac{dy}{dx} = 2 - \frac{2b}{x^3}$

$-\frac{2b}{x^3} = \frac{16}{x^3}$

$b = -8$

(b) $2 + \frac{16}{x^3} = 0$

$x^3 = -8$

$x = -2$

$y = 2(-2) - \frac{8}{(-2)^2} = -6$

Titik pusingan $= (-2, -6)$

$\frac{d^2y}{dx^2} = -\frac{48}{(-2)^4} = -3\ (< 0)$ Titik maksimum

14. Katakan AF = CD = x
Perimeter = $2\pi j + 2x = 120$
$x = 60 - \pi j$

Luas = $2j$ x x
= $2j$ x $(60 - \pi j)$
= $120j - 2\pi j^2$ cm^2

$\frac{dL}{dj} = 120 - 4\pi j = 0$

$j = \frac{30}{\pi}$

$\frac{d^2L}{dj^2} = -4\pi$ (nilai < 0)

Luas adalah maksimum, apabila : $\frac{d^2L}{dj^2} < 0$ dan $j = \frac{30}{\pi}$

Oleh itu :

L = $120(\frac{30}{\pi}) - 2\pi (\frac{30}{\pi})^2$
= $\boldsymbol{\frac{1800}{\pi}}$

15. $\frac{dy}{dx} = \frac{-9}{x^4}$

Apabila $x = 3$, $\frac{dy}{dx} = -\mathbf{\frac{1}{9}}$

$$\delta y = \frac{dy}{dx} \times \delta x$$

$$= -\frac{1}{9}(-0.02)$$

$$= \frac{1}{450}$$

$$\therefore y + \delta y = \frac{3}{27} + \frac{1}{450}$$

$$= 0.113$$

16. (a) Apabila $x = k$, $y = 36 - \frac{4}{3}k^2$

Maka koordinat P ialah $(k, 36 - \frac{4}{3}k^2)$

Luas PQRS, $A = 2k\left[36 - \frac{4}{3}k^2\right]$

$= \frac{216k - 8k^3}{3}$ (Terbukti)

(b) $\frac{dA}{dk} = \frac{1}{3}[216 - 24k^2] = 0$

$$k = 3$$

$\frac{d^2A}{dk^2} = \frac{1}{3}(-48k)$

Apabila $k = 3$, $\frac{d^2A}{dk^2} = \frac{1}{3}(-48(3))$

$= -48 < 0$ (maksimum)

Oleh itu, maksimum $A = \frac{216(3) - 8(3)^3}{3}$

$= 144$ unit^2

17. (a) $u = 2x^2$ $\Rightarrow \frac{du}{dx} = 4x$

$v = (2x-2)^2$ $\Rightarrow \frac{dv}{dx} = 2(2x-2)(2)$

$= 4(2x-2)$

$= 8x - 8$

$\frac{d}{dx}[2x^2(2x-2)^2] = (2x^2)(8x-8) + (2x-2)^2(4x)$

$= 4x(2x-2)(4x-2)$

(b) (i) $36x^2h = 5832$

$h = \frac{162}{x^2}$

$A = 4(6xh) + (6x)^2 + 4 \times \frac{1}{2} \times 6x \times 5x$

$A = 96x^2 + \frac{3888}{x^2}$.

(ii) $\frac{dA}{dx} = 192x - \frac{3888}{x^2}$

$\frac{dx}{dt} = 0.06$

$\frac{dA}{dx} = 192(3) - \frac{3888}{9}$

$\frac{dA}{dt} = \frac{dA}{dx} \times \frac{dx}{dt}$

$= 144 \times 0.06$

$= 8.64\ \text{cm}^2\text{s}^{-1}$

18. (a) $\frac{dV}{dt} = -3.5\pi$

$V = \frac{4}{3}\pi r^3$, $\frac{dV}{dr} = 4\pi r^2$

Apabila r = 5, $\frac{dV}{dr} = 4\pi(5)^2$

$= 100\pi$

$\frac{dV}{dt} = \frac{dV}{dr} \times \frac{dr}{dt}$

$\frac{dr}{dt} = \frac{dV}{dt} \times \frac{1}{\frac{dV}{dr}}$

$= -3.5\pi \times \frac{1}{100\pi}$

$= -0.035\ \text{cms}^{-1}$

(b) $\frac{dy}{dx} = 8x^{-2}$

$= \frac{8}{x^2}$

Apabila $y = 3$, ganti dalam persamaan, $3 = 5 - \frac{8}{x}$

$x = 4$

Oleh itu, $\frac{dy}{dx} = \frac{8}{(4)^2}$

$= 0.5$

Apabila y berubah dari 3 kepada $3 + q$,

$\delta y = (3 + q) - 3$

$= q$

$\delta x = \frac{dx}{dy} \times \delta y$

$= \frac{1}{0.5} \times q$

$= \frac{q}{0.5}$

19. (a) *Let O = centre of the circle, r = radius of the circle*
Then, OA = OB = OC = OD = r

$$r = \sqrt{\left(\frac{x}{2}\right)^2 + 4^2}$$

$$r = \sqrt{\frac{x^2}{4} + 16}$$

The area of shaded region, $L = \pi r^2 - 8x$

$$L = \pi\left(\sqrt{\frac{x^2}{4} + 16}\right)^2 - 8x$$

$$L = \frac{\pi x^2}{4} - 8x + 16\pi \text{ (Proved)}$$

(b) $\frac{dL}{dx} = \frac{2\pi x}{4} - 8 = \frac{\pi x}{2} - 8$

When L is minimum, $\frac{dL}{dx} = 0$, *then* $\frac{\pi x}{2} - 8 = 0$

$$x = \frac{16}{\pi} cm$$

$$\frac{d^2L}{dx^2} = \frac{\pi}{2} \geq 0$$

The area of the shaded region is minimum when $x = \frac{16}{\pi} cm$

20. *When* $x = 2,\ dx = 0.03(2) = 0.06$ *and* $y = 15$

$\frac{dy}{dx} = 10x - 4$

$\frac{dy}{dx} = 10x - 4 = \frac{dy}{0.06},\ dy = 0.96$

$\frac{0.96}{15} \times 100 = 6.4$

21. (a) Radius of the surface of the water, *r*

$r = \sqrt{8^2 - (8-h)^2}$

$r = \sqrt{16h - h^2}$

Area of surface of the water = $\pi r^2 = \pi(16h - h^2)$

(b) $\frac{dA}{dh} = 16\pi - 2\pi h$ and given $\frac{dh}{dt} = 0.2$

$\frac{dA}{dt} = \frac{dA}{dh} \times \frac{dh}{dt}$

$\frac{dA}{dt} = (16\pi - 2\pi h) \times 0.2$ and substitute *h = 6.*

$\frac{dA}{dt} = 0.8\pi$

(c) $dh = 2.01 - 2 = 0.01$

$16\pi - 2\pi h = \frac{dA}{0.01}$ and substitute *h = 2,*

$dA = 0.12\pi$

22. (a) $\delta s = (t + \delta t)^2 - 3(t + \delta t) - (t^2 - 3t)$

$= t^2 + 2t\delta t + (\delta t)^2 - 3t - 3\delta dt - t^2 + 3t$

$= 2t\delta t + (\delta t)^2 - 3\delta dt$

$\frac{\delta s}{\delta t} = 2t + \delta t - 3$

$\frac{ds}{dt} = \lim_{\delta t \to 0} \frac{\delta s}{\delta t}$

$$\frac{ds}{dt} = \underset{\delta t \to 0}{\text{had}}\ 2t + \delta t - 3$$
$$= 2t - 3$$

Apabila $t = 5$, $\frac{ds}{dt} = 2(5) - 3 = 7ms^{-1}$

(b) $\frac{\delta s}{\delta t} = 2t - 3$

$$\frac{\delta^2 s}{\delta t} = 2(t + \delta t) - 3$$
$$\frac{\delta^2 s}{\delta t} = 2t + 2\delta t - 3$$
$$\frac{\delta^2 s}{\delta t} = 2\delta t$$
$$\frac{\delta^2 s}{\delta t^2} = 2$$
$$\frac{d^2 s}{dt^2} = \underset{\delta t \to 0}{\text{had}}\ 2$$
$$s''(t) = 2$$

23. Katakan
X = bilangan pokok tomato yang ditanam
Y = bilangan tomato dihasilkan

Maka
Y = Bilangan pokok x Bilangan buah setiap pokok
$= (80 + x)(40 - 2x)$
$= 320 - 120x - 2x^2$

$$\frac{dy}{dx} = -120 - 4x$$

Apabila $\frac{dy}{dx} = 0,$
$-120 - 4x = 0$

$4x = -120$

$x = -30$ dan $\frac{d^2 y}{dx^2} = -4 < 0$

Maka y adalah maksimum apabila $x = -30$
Maka bilangan pokok tomato yang harus ditanam

$= 80 + x$

$= 80 + (-30)$

$= 50$

24. (a) $y = ax^4 + bx^3 + 5$

Diberi $(-1,4)$ adalah titik minimum dan $(2,85)$ adalah titik di atas lengkung.

Bila x = -1 dan y = 4, $4 = a - b + 5$

$a = b - 1$ ---------(1)

Bila x = 2 dan y = 85, $85 = 16a - 8b + 5$

$10 = 2a + b$ -------(2)

Gantikan (1) dalam (2), $10 = 2(b - 1) + b$

$b = 4$

$a = 4 - 1 = 3$

(b) $y = 3x^4 + 4x^3 + 5$

$\frac{dy}{dx} = 12x^3 + 12x^2$

Untuk titik pegun $\frac{dy}{dx} = 0$

$12x^3 + 12x^2 = 0$

$12x^2(x+1) = 0$

$x = 0$ atau -1

Bila $x = 0$, $y = 3(0)^4 + 4(0)^3 + 5 = 5$

Maka koordinat titik pegun lain di atas lengkung ialah (0,5)

x	-0.5	0	0.5
$\frac{dy}{dx}$	$12(-0.5)^3 + 12(-0.5)^2 = 1.5(positif)$	0	$12(0.5)^3 + 12(0.5)^2 = 4.5(positif)$
Lakaran tangen			

Maka titik (0,5) ialah titik lengkok balas.

25. (a) $y = x^2(3-x) + \frac{1}{2}$

$y = 3x^2 - x^3 + \frac{1}{2}$

$\frac{dy}{dx} = 6x - 3x^2$

(b) $\frac{dy}{dx} = 0$

$6x - 3x^2 = 0$

$3x(2-x) = 0$

$x = 0, x = 2$

Apabila $x = 0$

$y = 3(0)^2 - 0^3 + \frac{1}{2}$

$y = \frac{1}{2}$

$\therefore (0, \frac{1}{2})$

Apabila $x = 2$

$y = 3(2)^2 - 2^3 + \frac{1}{2}$

$y = \frac{9}{2}$

$\therefore (2, \frac{9}{2})$

(c) $\frac{d^2y}{dx^2} = 6 - 6x$

di $(0, \frac{1}{2})$

$\frac{d^2y}{dx^2} = 6 - 6(0)$

$= 6 > 0$

$\therefore (0, \frac{1}{2})$ ialah titik minimum

di $(2, \frac{9}{2})$

$\frac{d^2y}{dx^2} = 6 - 6(2)$

$= -6 < 0$

$\therefore (2, \frac{9}{2})$ ialah titik maksimum

BAB 3
PENGAMIRAN
INTEGRATION

1. $\int (3x^2 + 2)dx = \frac{3x^3}{3} + 2x + c$

$= x^3 + 2x + c$

Bandingkan $tx^3 + 2x + c = x^3 + 2x + c$

$t = 1$

$1^3 + 2(1) + c = 10$

$c = 7$

2. (a) $\int_k^5 [3 - g(y)]dy = 9$

$\int_k^5 3\,dy - \int_k^5 g(y)\,dy = 9$

$[3y]_k^5 - \frac{3}{4} = 9$

$3(5) - 3k = \frac{39}{4}$

$k = \frac{7}{4}$

(b) $\int_1^3 (kx - 6)\,dx = 8$

$\left[\frac{kx^2}{2} - 6x\right]_1^3 = 8$

$\left[\frac{k(3^2)}{2} - 6(3)\right] - \left[\frac{k(1^2)}{2} - 6(1)\right] = 8$

$\frac{9k}{2} - 18 - \frac{k}{2} + 6 = 8$

$4k = 20$

$k = 5$

3. (a) $\frac{1}{2}\left(\frac{2x-1}{x^2}\right)$

$= \frac{1}{2}\left(\frac{2(2)-1}{2^2}\right) - \frac{1}{2}\left(\frac{2(1)-1}{1^2}\right)$

$= -\frac{1}{8}$

(b) $\int_1^2 2f(x)\,dx - \left[\frac{kx^2}{2}\right] = \frac{13}{2}$.

$2(7) - \left(\frac{k(2)^2}{2} - \frac{k(1)^2}{2}\right) = \frac{13}{2}$

$k = 5$

4. (a) $\int g(x)\text{dx} = \int \frac{\text{d}}{\text{dx}}(7x)\text{dx}$

$= 7x + c$

(b) (i) $\int_c^c f(x)\,dx = k$

$k = 0$

(ii) $\int_a^b f(x)dx - \int_c^b f(x)dx$

$= \int_a^b f(x)dx + \int_b^c f(x)dx$

$= 3 + k$

5. (a) $\int_1^2 \frac{2(x-3)(x+3)}{3x^2}\ \text{dx}$

$= \int_1^2 \frac{2(x^2-9)}{3x^2}\ \text{dx}$

$= \int_1^2 \frac{2x^2}{3x^2} - \frac{18}{3x^2}\ \text{dx}$

$= \int_1^2 \frac{2}{3} - 6x^{-2}\ \text{dx}$

$= \left[\frac{2}{3}x + \frac{6}{x}\right]_1^2$

$= \left(\frac{2}{3}(2)+\frac{6}{2}\right) - \left(\frac{2}{3}(1)+\frac{6}{1}\right)$

$= -\frac{7}{3}$

(b) $y = \frac{2x-1}{x^2}$, $\frac{dy}{dx} = 2g(x)$

$$\int 2g(x)dx = \frac{2x-1}{x^2}$$

$$2\int g(x)dx = \frac{2x-1}{x^2}$$

$$\int_{-1}^{1} g(x)dx = \frac{1}{2}\left[\frac{2x-1}{x^2}\right]_{-1}^{1}$$

$$= \frac{1}{2}\left[\frac{2(1)-1}{1^2} - \frac{2(-1)-1}{(-1)^2}\right]$$

$$= 2$$

6. (a)

$$\int_{-3}^{6}(g'(y)-7)dy = \left(g(y)-7y\right)_{-3}^{6} ...[1m,1m]$$

$$= [g(6)-g(-3)-(7(6)-7(-3))]...[1m]$$

$$= (-12-6-63)$$

$$= -81...[1m]$$

(b) Kawasan berlorek daripada $x = 3$ ke $x = 6$ berada di bawah paksi-x.

The shaded region from x = 3 to x = 6 is below the x-axis.

7. (a) $\frac{dp}{dt} = 10t - 7$

$p = \int (10t - 7)\, dt$

$p = 5t^2 - 7t + c$

Apabila $p = 8$, $t = 3$

$8 = 5(3^2) - 7(3) + c$

$c = -16$

$\therefore \quad p = 5t^2 - 7t - 16$

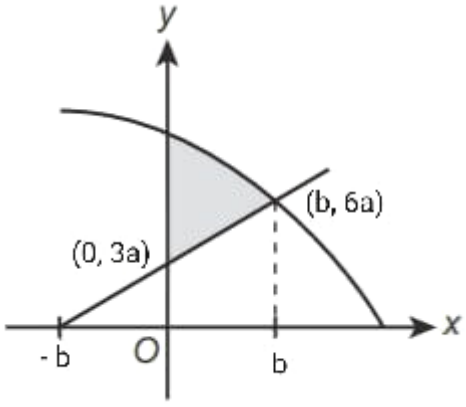
(b) $\int_2^0 f(x)\,dx = -3$, $\int_2^4 f(x)\,dx = 5$

(i) $\int_2^0 f(x)\,dx = -\int_0^2 f(x)dx$
$= -(-3)$
$= 3$

(ii) $\int_0^2 f(x)\,dx - \int_2^4 7f(x)\,dx$
$= \int_0^2 f(x)dx - 7\int_2^4 f(x)dx$
$= -3 - 7(5)$
$= -38$

(iii) $\int_0^2 [f(x) - kx]\,dx = 25$
$\int_0^2 f(x)dx - \int_0^2 kx\,dx = 25$
$-3 - \left[\frac{kx^2}{2}\right]_0^2 = 25$
$-\left[\frac{4k}{2} - 0\right] = 28$
$-2k = 28$
$k = -14$

8. (a)



(b) $\int_0^b f(x)dx = 8 + \int_0^b g(x)dx$

$= 8 + \int_0^b g(x)dx$

$= 8 + \frac{1}{2}(3a + 6a)b$

$= 8 + \frac{9ab}{2}$

9. (a) Apabila $x = p$, $y = 6p - p^2$.

$A(p, 6p - p^2)$

$\frac{dy}{dx} = 6 - 2x = 6 - 2p$

$\frac{10 - (6p - p^2)}{3 - p} = 6 - 2p$

$10 - 6p + p^2 = (6 - 2p)(3 - p)$

$10 - 6p + p^2 = 18 - 12p + 2p^2$

$p^2 - 6p + 8 = 0$

$(p - 2)(p - 4) = 0$

$p = 2$ atau $p = 4$

$p < 2$

$\therefore p = 2$

(b) A (2 , 8)

$Luas = \frac{1}{2}(8 + 10)(1) - \int_2^3 (6x - x^2)dx$

$= 9 - \left[3x^2 - \frac{x^3}{3}\right]_2^3$

$= 9 - \left[3(3)^2 - \frac{3^3}{3} - \left(3(2)^2 - \frac{2^3}{3}\right)\right]$

$= 9 - \left(27 - 9 - 12 + \frac{8}{3}\right)$

$= \frac{1}{3}\ unit^2$

10. (a) $y = x^2 - 9$

$\frac{dy}{dx} = 2x$

Kecerunan garis lurus $PQ = 2$

$2x = 2$

$x = 1$

Apabila $x = 1$,

$y = 1^2 - 9 = -8$

Koordinat titik K ialah $(1, -8)$

(b) Pada paksi-x, $y = 0$

$x^2 - 9 = 0$

$x^2 = 9$

$x = \pm 3$

Lengkung itu memotong paksi-x di titik $(-3,0)$ dan titik $(3,0)$.

Luas rantau berlorek = Luas Δ − Luas rantau yang dibatasi oleh lengkung

$= \frac{1}{2}(5-1)(8) - \int_1^3 y\,dx$

$= 16 - \int_1^3 (x^2 - 9)\,dx$

$= 16 - \left[\frac{x^3}{3} - 9x\right]_1^3$

$= 16 - \left|\left(\frac{3^3}{3} - 9(3)\right) - \left(\frac{1^3}{3} - 9(1)\right)\right|$

$= 16 - \left|-\frac{28}{3}\right|$

$= 16 - \frac{28}{3}$

$= 6\frac{2}{3}\,unit^2$

c) Isipadu kisaran = 40π

$\pi \int_h^0 x^2\,dy = 40\pi$

$\pi \int_h^0 (y+9)\,dy = 40\pi$

$\left[\frac{y^2}{2} + 9y\right]_h^0 = 40$

$0 - \left(\frac{h^2}{2} + 9h\right) = 40$

$h^2 + 18h + 80 = 0$

$(h+10)(h+8) = 0$

$h = -10 \quad atau \quad h = -8\ (ditolak)$

$Maka, h = -10$

11. (a) $9x - y + 4 = 0, m = 9$
$9 = 3(3^2) + k$
$k = -18$

(b) $y = \int 3x^2 - 18dx$
$y = x^3 - 18x + c$

At point (3, – 5), c = 22

$y = x^3 - 18x + 22$

12. (a) $\int_2^m (4x-7)dx = 10$

$$\left[\frac{4x^2}{2} - 7x\right]_2^m = 10$$

$$\left[2x^2 - 7x\right]_2^m = 10$$

$$\left[2(m)^2 - 7(m)\right] - \left[2(2)^2 - 7(2)\right] = 10$$

$$2m^2 - 7m - (8-14) - 10 = 0$$

$$2m^2 - 7m - 4 = 0$$

$$(2m+1)(m-4) = 0$$

$m = -\frac{1}{2}$ atau/or $m = 4$

$m > 0, \therefore m = 4$

(b) Bila $y = 0$;

$$0 = 3x - x^2$$

$$3(3-x) = 0$$

$$x = 0, x = 3$$

Isi padu janaan

$$= \pi\int_0^3 y^2 dx$$

$$= \pi\int_0^3 (3x - x^2)^2 dx$$

$$= \pi\int_0^3 (9x^2 - 6x^3 + x^4)dx$$

$$= \pi\left[3x^3 - \frac{3}{2}x^4 + \frac{1}{5}x^5\right]_0^3$$

$$= \pi\left[\left(3(3)^3 - \frac{3}{2}(3)^4 + \frac{1}{5}(3)^5\right) - \left(3(0)^3 - \frac{3}{2}(0)^4 + \frac{1}{5}(0)^5\right)\right]$$

$= 8.1\pi$ units^3

13. (a) $-8x + 42 = -x^2 + 12x - 26$

$2x^2 - 20x + 42 = 0$

$x^2 - 10x + 21 = 0$

$(x - 3)(x - 7) = 0$

$x = 3 \quad x = 7$

$P\ (3, 1)$

$Q(7, 9)$

(b) $\int_3^7 \{(-x^2 + 12x - 26) - (x^2 - 8x + 16)]dx$

$\int_3^7 (-2x^2 + 20x - 42x\ )dx$

$= \left[-\frac{2x^3}{3} + 10x^2 - 42x\right]_3^7$

$= -\frac{2(7)^3}{3} + 10(7)^2 - 42(7) - (-\frac{2(3)^3}{3} + 10(3)^2 - 42(3))$

$= 21\frac{1}{3}$

14. (a) $P = \int (t^2 + 6t + h)\ dt$

$P = \frac{t^3}{3} + 3t^2 + ht + c$

Bila P = 0, t = 0 ∴ c = 10

$P = \frac{t^3}{3} + 3t^2 + ht + 10$

$613 = \frac{3^3}{3} + 3(3^2) + h(3) + 10$

$h = 189$

(b) $P = \frac{6^3}{3} + 3(6^2) + 189(6) + 10$

$P = 1324$

15. (a) $\int_4^5 f(x)\,dx + \int_5^7 f(x)\,dx + \int_7^{10} f(x)\,dx$
$= \int_7^{10} f(x)\,dx$
$= 7$

(b) $\int_{10}^4 [10\,f(x) - h(x)]dx = 182$
$10(-7) - \left[\frac{h(x)}{2}\right]_{10}^4 = 182$
$50\text{h} - 8\text{h} = 252$
$\text{h} = 6$

16. (a) $\int (x^2 - kx)dx = \left[\frac{1}{3}x^3 - \frac{k}{2}x^2\right]$
$A_{shaded\ region} = \left[\frac{1}{3}x^3 - \frac{k}{2}x^2\right]_k^0 + \left|\left[\frac{1}{3}x^3 - \frac{k}{2}x^2\right]_0^k\right| = 8$
$= \left[\frac{1}{3}(-k)^3 - \frac{k}{2}(-k)^2\right] + \left|\left[\frac{1}{3}(k)^3 - \frac{k}{2}(k)^2\right]\right| = 8$
$k = 2$

(b) $Volume = \pi \int (x^4 - 4x^3 + 4x^2)dx$
$= \pi \left[\frac{1}{5}x^5 - x^4 + \frac{4}{3}x^3\right]_0^2$
$= \pi \left[\frac{1}{5}(2)^5 - (2)^4 + \frac{4}{3}(2)^3\right]$
$= \frac{16}{15}\pi$

17. (a) $x^2 - 9 = 3x - x^2$
$2x^2 - 3x - 9 = 0$
$(2x + 3)(x - 3) = 0$
$x = \frac{-3}{2},\ x = 3$
$Q(0,3)$

(b) $Area = \int_0^3 3x - x^2\,dx + \left|\int_0^3 x^2 - 9\,dx\right|$
$= \left[\left(\frac{3x^2}{2} - \frac{x^3}{3}\right)\right]_0^3 + \left|\left[\left(\frac{x^3}{3} - 9x\right)\right]_0^3\right|$
$= \left[\left(\frac{27}{2} - 9\right) - 0\right] + |[(9 - 27) - 0]|$
$= 4.5 + 18$
$= 22.5$

(c) Volume = $\pi \int_{-9}^{0} y + 4 \, dy$

$= \pi \left[\left(\frac{y^2}{2} + 9y\right)\right]_{-9}^{0}$

$= \pi \left[0 - \left(\frac{81}{2} + (-81)\right)\right]$

$= 40.5\pi$

18. $y = \frac{2x}{x^2+1}$

$$\frac{dy}{dx} = \frac{(x^2+1)(2) - (2x)(2x)}{(x^2+1)^2}$$

$$\frac{dy}{dx} = \frac{2x^2 + 2 - 4x^2}{(x^2+1)^2}$$

$$\frac{dy}{dx} = \frac{-2x^2 + 2}{(x^2+1)^2}$$

$$\frac{dy}{dx} = \frac{-2(x^2 - 1)}{(x^2 + 1)^2}$$

$$\int_0^2 \frac{x^2-1}{3(x^2+1)} \, dx = \frac{-1}{6} \int_0^2 \frac{-2(x^2-1)}{(x^2+1)^2} \, dx$$

$= \frac{-1}{6} \left[\frac{2x}{x^2+1}\right]_0^2$

$= \frac{-1}{6} \left[\left(\frac{2(2)}{2^2+1}\right) - \left(\frac{2(0)}{0^2+1}\right)\right]$

$= \frac{-1}{6} \left(\frac{4}{5} - 0\right)$

$= \frac{-2}{15}$

19. $\frac{dV}{dt}=5t+2$

$V = \int 5t+2 \, dt$

$V=\frac{5t^2}{2}+2t+c$

Apabila $t = 0$ [bekas itu kosong], $V = 0$, maka $c = 0$.

When t = 0 [the container is empty], V = 0, then c = 0.

$V = \frac{5t^2}{2}+2t$ pada / *at* $t = 9$

$V = \frac{5(9)^2}{2}+2(9)$

$= 220.5 \text{ cm}^3$

20 (a) $\frac{dA}{dt} = 200t + 150t^2$

Apabila $t = 5$, $\frac{dA}{dt} = 200(5)+150(5)^2$

$= 4\,750$

Kadar keuntungan harian hasil jualan tiket bas bagi syarikat *K* ialah RM4 750 sehari.

(b) Fungsi keuntungan harian hasil jualan tiket bas bagi syarikat *H*

$= \int 30t^2+40t \, dt$

$= \frac{1}{5}\int 150t^2+200t \, dt$

$= \frac{1}{5}\left[100t^2+50t^3\right]$

$= 20t^2+10t^3$

Maka, syarikat *K* mendapat keuntungan 5 kali ganda lebih daripada syarikat *H*

21 (a) (i) $\int_1^4 f(x)dx = -10$

(ii) $\int_1^4 [x - 4f(x)]\ dx$

$= \int_1^4 x\ dx - 4\int_1^4 f(x)\ dx$

$= \left[\frac{x^2}{2}\right]_1^4 - 4(-10)$

$= \left[\frac{4^2}{2} - \frac{1^2}{2}\right] + 40$

$= \frac{16}{2} - \frac{1}{2} + 40$

$= 47\frac{1}{2}$

(iii) $\int_4^1 [x + 3f(x)dx]$

$= \int_4^1 x\ dx + 3\int_4^1 f(x)dx$

$= \left[\frac{x^2}{2}\right]_4^1 + 3(10)$

$= \left[\frac{1^2}{2} - \frac{4^2}{2}\right] + 30$

$= 22\frac{1}{2}$

(b) $f'(x) = x - 4$

$f(x) = \int (x - 4)\ dx$

$= \frac{x^2}{2} - 4x + c$

Pada $x = 1$, $f(x) = 0$

$0 = \frac{1^2}{2} - 4(1) + c$

$c = \frac{7}{2}$ $\quad \therefore f(x) = \frac{x^2}{2} - 4x + \frac{7}{2}$

22. (a) $\frac{4}{3}\int_0^1 f(x)dx = \left[\frac{x^2}{5x-6}\right]_0^1$

$= -1$

$\therefore \int_0^1 f(x) = -\frac{3}{4}$

$[3a(x)]_0^1 - \int_0^1 f(x) = 9a$

$3a - \left(-\frac{3}{4}\right) = 9a$

$a = \frac{1}{8}$

(b) $m_2 = \frac{1}{5x-7}$; $\frac{dy}{dx} = m_1 = 7-5x$

$\frac{dy}{dx} = 7 - 5x$

$y = 7x - \frac{5x^2}{2} + c$

$4 = 7(4) - 5\frac{4^2}{2} + c$

$c = 16$

$\therefore y = 7x - \frac{5x^2}{2} + 16$

(c) $s = \frac{12t^2}{2} - 4t + c$

$39.5 = 6\left(\frac{25}{4}\right) - 4\left(\frac{5}{2}\right) + c$

$c = 12$

$s = \frac{12t^2}{2} - 4t + 12$

$s = 6(6)^2 - 4(6) + 12$

$= 204\ m$

23. (a) $r = 15cm$

$$V = \pi \int_{-15}^{10} 225 - y^2 dy$$
$$= \pi \left[225y - \frac{y^3}{3}\right]_{-15}^{10}$$
$$= \pi \left[\left(225(10) - \frac{(10)^3}{3}\right) - \left(225(-15) - \frac{(-15)^3}{3}\right)\right]$$
$$= \frac{12500}{3}\pi$$

(b) (i) -10

(ii) $10 - [2x]_{-1}^{2}$

$= 4$

24. (a) Isi padu air di dalam kolam renang

$$= \int_0^5 \left(3t^2+14t\right)\mathrm{dt}$$
$$= \left[\frac{3t^3}{3}+\frac{14t^2}{2}\right]_0^5$$
$$= \left[5^3+7(5)^2\right] - \left[0^3+7(0)^2\right]$$
$$= 300\ \mathrm{m}^3$$

(b) Luas dasar kolam × kedalaman kolam = isi padu kolam

Luas dasar kolam $= \frac{300}{1.2}$

$= 250\ \mathrm{m}^2$

Kos mengecat dasar kolam = 250 × 5

= RM1 250

∴ Encik Razak tidak dapat mengecat keseluruhan dasar kolam renang itu kerana wang yang diperuntukkan adalah kurang daripada kos sebenar

Mr Razak was unable to paint the entire base of the pool because the money allocated was less than the actual cost.

25. (a)

$K(x) = \int_2^8 4x + 2\ dx$

$= \left[\frac{4x^2}{2} + 2x\right]_2^8 \quad @ \quad [2x^2 + 2x]_2^8$

$= \left[\left(2(8)^2 + 2(8)\right) - \left(2(2)^2 + 2(2)\right)\right]$

= 132

(b) $\int_0^m 4x + 2\ dx > 220 \quad @ \quad [2x^2 + 2x]_0^m > 220$

$2m^2 + 2m - 220 > 0$

$(m + 11)(m - 10) > 0$

$m > 10$

$m = 11$

BAB 4

PILIH ATUR DAN GABUNGAN
PERMUTATIONS AND COMBINATIONS

1.
$$\frac{{}^{a}P_{b}}{b!} = \frac{\frac{a!}{(a-b)!}}{b!}$$
$$= \frac{a!}{(a-b)!} \times \frac{1}{b!}$$
$$= \frac{a!}{(a-b)!b!}$$
$$= {}^{a}C_{b}$$

2.
$$\frac{n!}{(n-r)!} = \frac{(n-2)!}{(n-2-r)!}$$
$$n!\,(n-2-r)! = (n-2)!\,(n-r)!$$
$$n(n-1)\cancel{(n-2)!}\,\cancel{(n-2-r)!} = \cancel{(n-2)!}\,(n-r)(n-r-1)\cancel{(n-r-2)!}$$
$$n(n-1) = (n-r)(n-r-1)$$
$$0 = -2nr + r^2 + r$$
$$n = \frac{1+r}{2}$$

3. (i) $6 \times {}^{6}P_{4} \times 3$
6480

(ii) $2 \times {}^{6}P_{4} \times 1$
720

(iii) $3 \times {}^{6}P_{4} \times 1$ or $3 \times {}^{6}P_{4} \times 1$
2520

4. (a) (i) $\frac{9!}{2!2!}$ or $\frac{{}^{9}P_{9}}{2!2!}$
90720

(ii) $\frac{1 \times 7! \times 1}{2!}$
2520

(iii) $\frac{4!}{2!} \times \frac{5!}{2!}$
720

(b) ${}^4P_1 \times {}^7P_3 + {}^4P_2 \times {}^7P_2$
1344

5. (a) ${}^5C_4 + {}^6C_4$
20

(b) ${}^{14}C_4 - 20$
981

(c) ${}^5C_1 \times {}^6C_3 + {}^5C_2 \times {}^6C_2 + {}^5C_3 \times {}^6C_1$ atau ${}^{11}C_4 - {}^6C_4 - {}^5C_4$
310

(d) ${}^3C_1 \times {}^5C_1 \times {}^6C_1 \times {}^{11}C_1$
990

6. (a) ${}^8\mathrm{C}_1 \times {}^7\mathrm{C}_1$
56

(b) ${}^7\mathrm{C}_1 \times {}^6\mathrm{C}_1$
42

(c) ${}^1\mathrm{C}_1 \times {}^6\mathrm{C}_1$
6

7. (a) ${}^6P_4 = 360$

(b) ${}^4C_2 + {}^4C_3 + {}^4C_4$
6 + 4 + 1
11

8. (a) ${}^{6}C_{5}+{}^{5}C_{5}$
7

(b) ${}^{6}C_{4}\times{}^{5}C_{1}$
75

(c) ${}^{6}C_{0}\times{}^{5}C_{5}+{}^{6}C_{1}\times{}^{5}C_{4}+{}^{6}C_{2}\times{}^{5}C_{3}$
181

9. (a) (i) 5!

(ii) $\frac{(n-1)!}{(n-5)!}$

(b) (i) $3!\times 2!\times 4!\times 2!$
576

(ii) $2!\times 6!$
1440

10. (a) $(7-1)!-2(6-1)!$
480

(b) $4!\ (4-1)!$
144

11. (a) (i) ${}^{8}\mathrm{C}_{4}\times{}^{4}\mathrm{C}_{4}$
70

(ii) ${}^{8}\mathrm{C}_{2}\times{}^{6}\mathrm{C}_{2}\times{}^{4}\mathrm{C}_{2}\times{}^{2}\mathrm{C}_{2}$
2520

(b) (i) $({}^{4\times}{}^{7}\mathrm{P}_{2}\times 1)+({}^{4\times}{}^{7}\mathrm{P}_{2}\times 1)+({}^{5\times}{}^{7}\mathrm{P}_{2}\times 2)$
756

(ii) ${}^{5}\mathrm{C}_{2}\times{}^{4}\mathrm{P}_{2}\times{}^{4}\mathrm{P}_{2}$ or ${}^{5}\mathrm{C}_{2}\times{}^{4}\mathrm{C}_{2}\times{}^{4}\mathrm{P}_{4}$
1440

(iii) ${}^{9}P_{4} - \left[(1\times1\times7\times6)+(7\times1\times1\times6)-(7\times6\times1\times1)\right]$

2898

12. $\frac{7!}{2!2!2!} = 630$

13. (a) (i) ${}^{6}C_{1}\times{}^{7}C_{4}$

210

(ii) ${}^{7}C_{3}\times{}^{6}C_{2} + {}^{7}C_{4}\times{}^{6}C_{1} + {}^{7}C_{5}\times{}^{6}C_{0}$

756

(b) (i) $\frac{5!}{2!}$

60

(ii) $\frac{5!}{2!}$

60

(iii) $\frac{7!}{3!2!} - \frac{6!}{3!}$

300

14. (a) (i) ${}^{2}P_{2}\times{}^{5}P_{5}$

240

(ii) ${}^{3}P_{3}\times{}^{4}P_{4}\times 2!$

288

(iii) ${}^{2}P_{2}\times{}^{2}P_{2}\times{}^{3}P_{3}$

24

(b) $(5 - 1)! \times 2!$
48

(c) $\frac{^{11}P_9}{2(9)}$
1108800

15. (a) $^6P_3$
120

(b) $^5P_3$
30

(c) $1 \times 5 \times 1$
5

(d) $^6P_2 - 1$
29

16. $^4P_1 \times {}^6P_3 = 480$

17. $2 \times (4 - 1)! = 12$

18. (a) $2 \times {}^4P_2 \times 3 + 4 \times {}^4P_2$
120

(b) $2 \times {}^4P_2 \times 3 + 2 \times 3 \times 3$
90

19. (a) $4! \times (5-1)!$
576

(b) $4! \times (4-1)!$
144

20. $\frac{4!}{2!} - 3!$
6

21. (a) $3 \times {}^{5}P_{3} + 5 \times {}^{5}P_{4} + 5 \times {}^{5}P_{5}$
600 + 600 + 180
1380

(b) $2 \times 4 \times 3 + 2 \times 5 \times 4 \times 3$
144

(c)) ${}^{5}P_{4} \times {}^{1}P_{1}$
120

BAB 5
TABURAN KEBARANGKALIAN
PROBABILITY DISTRIBUTIONS

1. (a) $X = \{0, 1, 2, 3, 4, 5, 6\}$

(b) $p = 0.25$

$P(X = 0)$

$= {}^{6}C_{0}(0.25)^{0}(0.75)^{6}$

$= 0.1780$

$= 17.80\ \%$

2. (a) $\sigma = \frac{21}{10}$

$\sigma^2 = \frac{21}{10}$

$10p(1-p) = \frac{21}{10}$

$100p^2 - 100p + 21 = 0$

$(10p - 3)(10p - 7) = 0$

$p = \frac{3}{10}$ or $p = \frac{7}{10}$

(b) $P(X < 9)$

$= 1 - P(X = 9) - P(X = 10)$

$= 1 - {}^{10}C_{9}(0.7)^{9}(0.3)^{1} - {}^{10}C_{10}(0.7)^{10}(0.3)^{0}$

$= 0.8507$

3. (a) (i) $P(Z < k) = 1 - \frac{c}{4}$

(ii) $P(|Z| < k) = 0.2580 + c$

$P(-k < Z < k) = 0.2580 + c$

$1 - \frac{c}{4} - \frac{c}{4} = 0.2580 + c$

$1.5c = 0.742$

$c = 0.4947$

(b) $P(Z < -k) = \frac{c}{4}$

$P(Z < -k) = \frac{0.4947}{4}$

$P(Z > k) = 0.1237$

$k = 1.157$

$P(-0.143 - k < Z < 0.093 + k)$

$= P(-0.143 - 1.157 < Z < 0.093 + 1.157)$

$= P(-1.3 < Z < 1.25)$

$= 1 - P(Z > 1.3) - P(Z > 1.25)$

$= 1 - 0.0968 - 0.1056$

$= 0.7976$

$= 79.76\ \%$

4. (a) $P(X \geq M) = 0.10$

$P\left(Z \geq \frac{M-56.5}{6.5}\right) = 0.10$

$\frac{M-56.5}{6.5} = 1.282$

$M = 64.833$

Wee Thern mendapat markah lebih rendah daripada 64.833, jadi dia tidak berhak mendapat hadiah.

Wee Thern scores lower than 64.833, so he is not entitled for the prize.

(b) $P(X \leq M) = 0.02$

$P\left(Z \leq \frac{M-56.5}{6.5}\right) = 0.02$

$\frac{M-56.5}{6.5} = -2.054$

$M = 43.149$

Markah minimum = 44

Minimum mark = 44

(c) $P(X < 62)$

$= P\left(Z < \frac{62-56.5}{6.5}\right)$

$= P(Z < 0.8462)$

$= 1 - 0.1989$

$= 0.8011$

$= 80.11\ \%$

$x = 80.11$

5. (a) $P(X \leq 12) = 0.3538$

$P\left(Z \leq \frac{12-\mu}{8}\right) = 0.3538$

$\frac{12-\mu}{8} = -0.375$

$12 - \mu = -3$

$\mu = 15$

(b) $P(9 < X < 17)$

$= P\left(\frac{9-15}{8} < Z < \frac{17-15}{8}\right)$

$= P(-0.75 < Z < 0.25)$

$= 1 - 0.2266 - 0.4013$

$= 0.3721$

$0.3721 \times 122 = 45.3962$

$= 45$

(c) $P(X > m) = \frac{1133}{5000}$

$P\left(Z > \frac{m-15}{8}\right) = 0.2266$

$\frac{m-15}{8} = 0.75$

$m = 21$

(d) $P(Min \leq X \leq Max)$

$= P(X_1 \leq X \leq X_2)$

$= P\left(\frac{X_1-15}{8} \leq Z \leq \frac{X_2-15}{8}\right)$

$\frac{X_1-15}{8} = -0.842$ and $\frac{X_2-15}{8} = 0.842$

$X_1 = 8.264$ $X_2 = 21.736$

Min = 9 bulan/*months* Max = 21 bulan/*months*

6. (a) $P(Z \geq 1.645) = 0.05$

(b) $0.5 - 0.05 = 0.45$

7. (a) min, $\mu = np$

$2.7 = 5\boldsymbol{v}$

$\boldsymbol{v} = 0.54$

(b) $P(X \geq 1) = 1 - P(X = 0)$

$= 1 - \binom{5}{0}(0.54)^0(0.46)^5$

$= 0.9794$

8. (a) $P(X \leq 51) = P\left(Z < \frac{51-60}{15}\right)$
$= P(Z < -0.6)$
$= 0.2743$

(b) $P(X > \boldsymbol{u}) = 0.13$
$P\left(Z > \frac{\boldsymbol{u}-60}{15}\right) = 0.13$
$\frac{u-60}{15} = 1.127$
$\boldsymbol{u} = 15(1.127) + 60$
$= 76.905$ kg

9. (a) P(X ≥2) = P(X = 2) + P(X=3)
= 0.432 + 0.216
= 0.648

(b) 0.064 + 0.216 + k + 0.432 = 1
k = 0.288

10. (a) X~B(6,0.55)
Sisihan piawai = $\sqrt{\text{npq}}$
$= \sqrt{6 \text{ x}0.55\text{x } 0.45}$
=1.219

(b) P(X>4)= P(X =5) + P(X = 6)
${}^{6}C_{5}$ x $0.55^{5} \times 0.45^{1}$ + ${}^{6}C_{6}$ x0.55^{6} x0.45^{0}
= 0.1359 + 0.02768
= 0.1636

(c) $\mu \geq 9$
np ≥ 9
n(0.55) ≥9
n≥16.36
n =17

11. (a) $p = \frac{1}{5}$

$q = \frac{4}{5}$

$\mu = np$ or $\sigma = \sqrt{npq}$ (Implied)

$= \left(\frac{1}{5}\right)(35)$

$\mu = 7$

$\sigma = \sqrt{35\left(\frac{1}{5}\right)\left(\frac{4}{5}\right)}$

$\sigma = 2.366$

(b) $P(X \geq 8)$

$= P\left(Z \geq \frac{8-7}{2.366}\right)$

= 0.3361

12. (a) (i) P (X > 75) = 0.1

P (Z > $\frac{75-\mu}{\sigma}$) = 0.1

$\frac{75-\mu}{\sigma}$ = 1.282

P (X < 40) = 0.2

P (Z < $\frac{40-\mu}{\sigma}$) = 0.2

$\frac{40-\mu}{\sigma}$ = -0.8416

75 – μ = 1.282 σ

40 – μ = -0.8416 σ

35 = 2.1236 σ

σ = 16.478

μ = 53.875

(b) (i) P (X > 5.96)

= P (Z > $\frac{5.96-6}{0.2}$)

= 0.5793

(ii) P ($\frac{5.8-6}{0.2}$ < Z < $\frac{6.1-6}{0.2}$)

= 0.5328

= 53.28%

13. (a) P (X ≥ 7) = P (X = 7) + P (X = 8) + P (X = 9)

$= {}^{9}C_{7}(\frac{3}{5})^{7}(\frac{2}{5})^{2} + {}^{9}C_{8}(\frac{3}{5})^{8}(\frac{2}{5})^{1} + {}^{9}C_{9}(\frac{3}{5})^{9}(\frac{2}{5})^{0}$

= 0.2318

(b)(i) P (X > 45)

$= P\left(Z > \frac{45-55}{10}\right)$

= 0.8413

$0.8413 = \frac{N(X)}{500}$

$n(X) = 420$

(ii) P (X > A) = 0.1587

$P\left(Z > \frac{A-55}{10}\right) = 0.1587$

$\frac{A-55}{10} = 1$

A = 65

14. (a) $P\left(Z < \frac{224-232}{5}\right)$

$= P(Z < -1.6)$

= 0.0548

(b) $P\left(\frac{232-232}{5} < Z < \frac{w-232}{5}\right) = 0.20$

$P(Z > 0) - P\left(Z > \frac{w-232}{5}\right) = 0.20$

$P\left(Z > \frac{w-232}{5}\right) = 0.5 - 0.20$

= 0.3

$\frac{w-232}{5} = 0.524$

$w = 234.62$

$w \approx 235$

(c) P (X =1)= ${}^{2}C_{1}(0.2)^{1}(0.8)^{1}$

= 0.32

15. (a) (i) $P(X = 3) = {}^{7}C_{3}(0.4)^{3}(0.6)^{4}$
$= 0.2903$

(ii) $P(X \geq 1) = 1 - P(X = 0) > 0.95$
$1 - {}^{n}C_{0}(0.4)^{0}(0.6)^{n} > 0.95$
$1 - (1)(1)(0.6^{n}) > 0.95$
$0.6^{n} < 0.05$
$log\, 0.6^{n} < log\, 0.05$
$n > \frac{log\, 0.05}{log\, 0.6}$
$n > 5.86$
$n = 6$

(b) 250×0.4
$= 100$

(c) $P(Y = n) = 0.265$
${}^{250}C_{250}(p)^{250}(q)^{0} = 0.265$
$log\, p^{250} = log\, 0.265$
$log\, p = \frac{log\, 0.265}{250}$
$p = 0.9947$

BAB 7

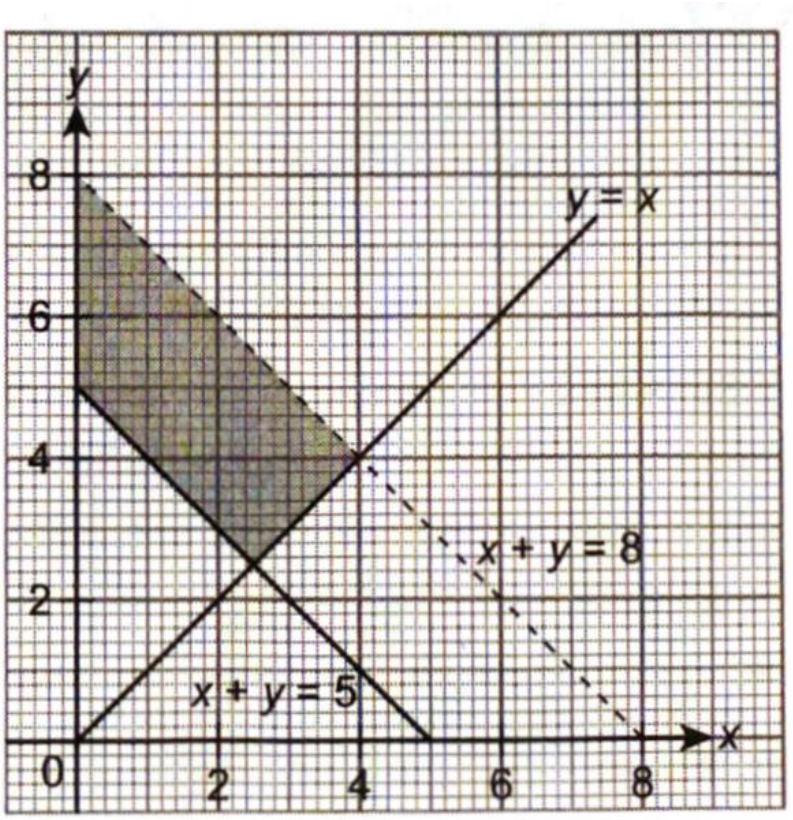
PENGATURCARAAN LINEAR
LINEAR PROGRAMMING

1. (i) $y \geq x$

   (ii) $x + y \geq 5$

   (iii) $x + y < 8$

   Graf



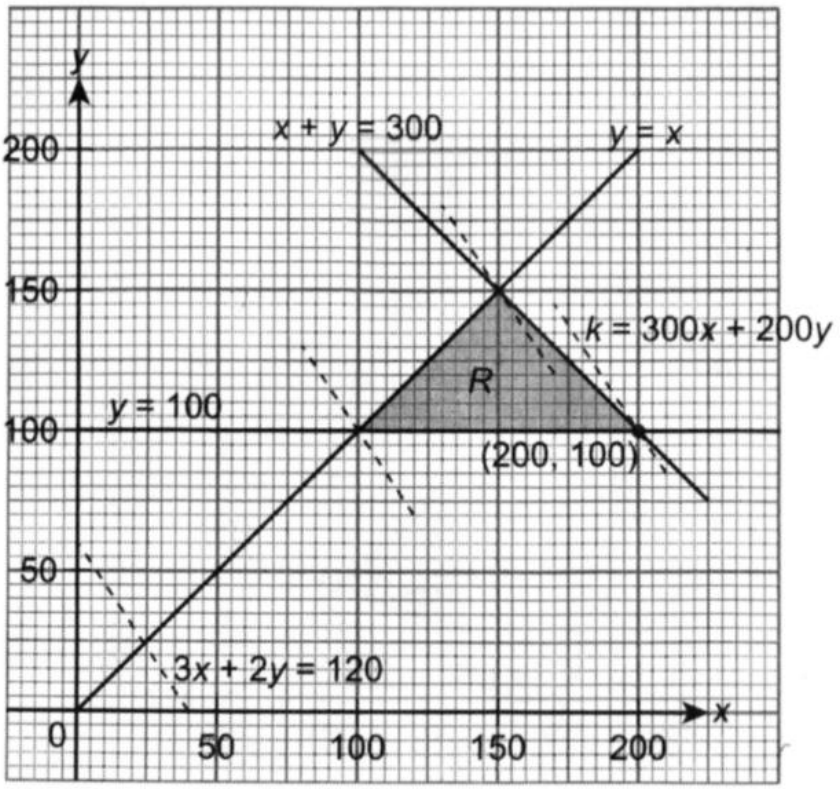
2. Titik Minimum (60, 40)
   Nilai Minimum $2x + 5y = k$
   = 2(60) + 5(40)
   = 320

   Titik Maksimum (120, 80)
   Nilai Maksimum $2x + 5y = k$,

   = 2(120) + 5(80)
   = 640

3. (a) $x + y \leq 300$, $y \leq x$, $y \geq 100$

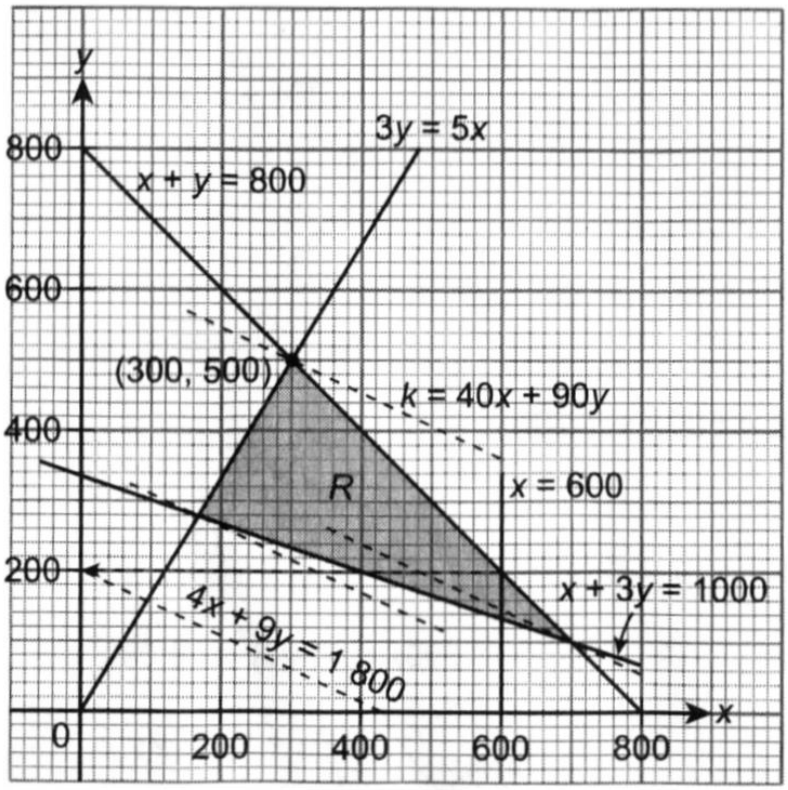
(b) Graf



(c) $300x + 200y$
$= 300(200) + 200(100)$
$= RM80000$

4. (a) $x + y \leq 800$, $x + 3y \geq 1000$, $3y \leq 5x$

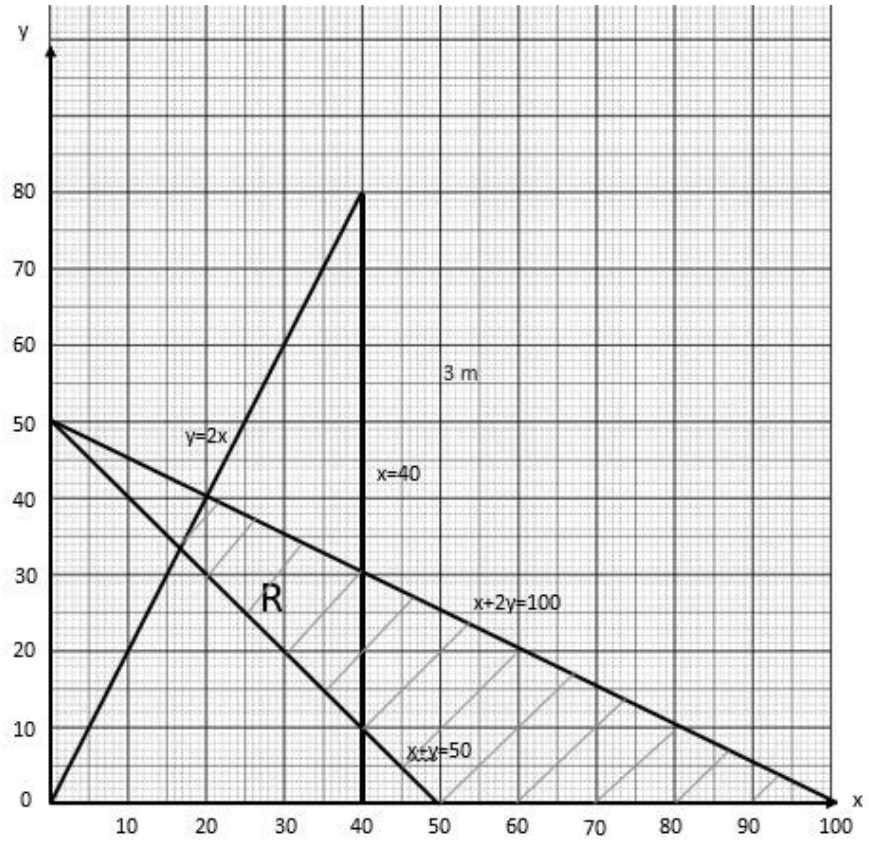
(b) Graf



(c) (i) $40x + 90y$
$= 40(300) + 90(500)$
= RM57000

5. (a) $x \leq 40$, $x + y \geq 50$, $y \leq 2x$, $x + 2y \leq 100$

(b) Graf



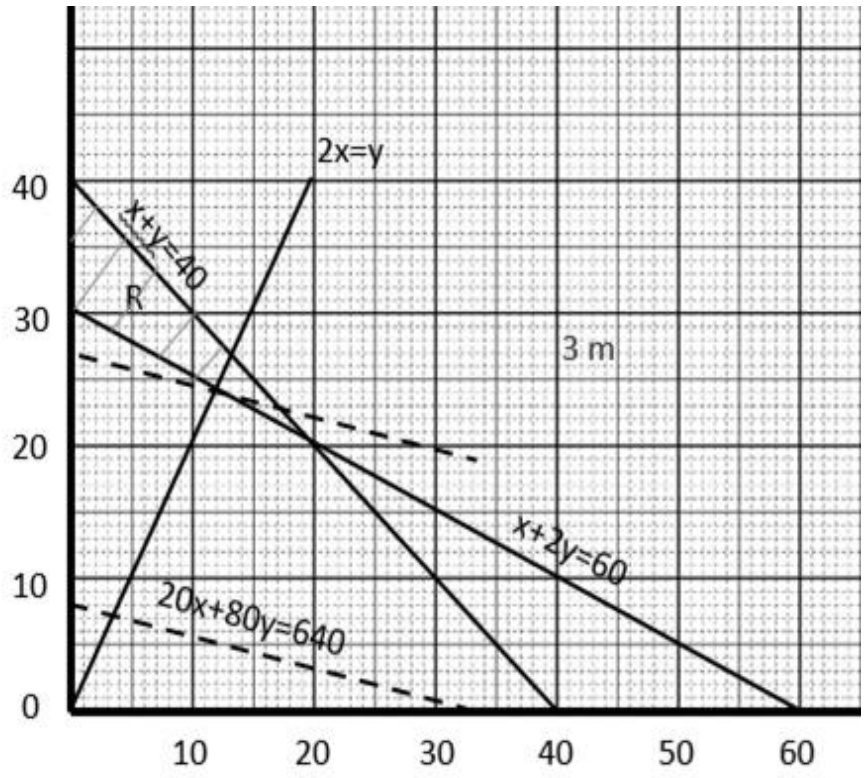
(c) (i) $20 \leq y \leq 35$

(ii) $25 \leq x \leq 33$, $25 \leq y \leq 33$

(iii) 40

6. (a) $x + y \leq 40$, $x + 2y \geq 60$, $2x \leq y$

(b) Graf

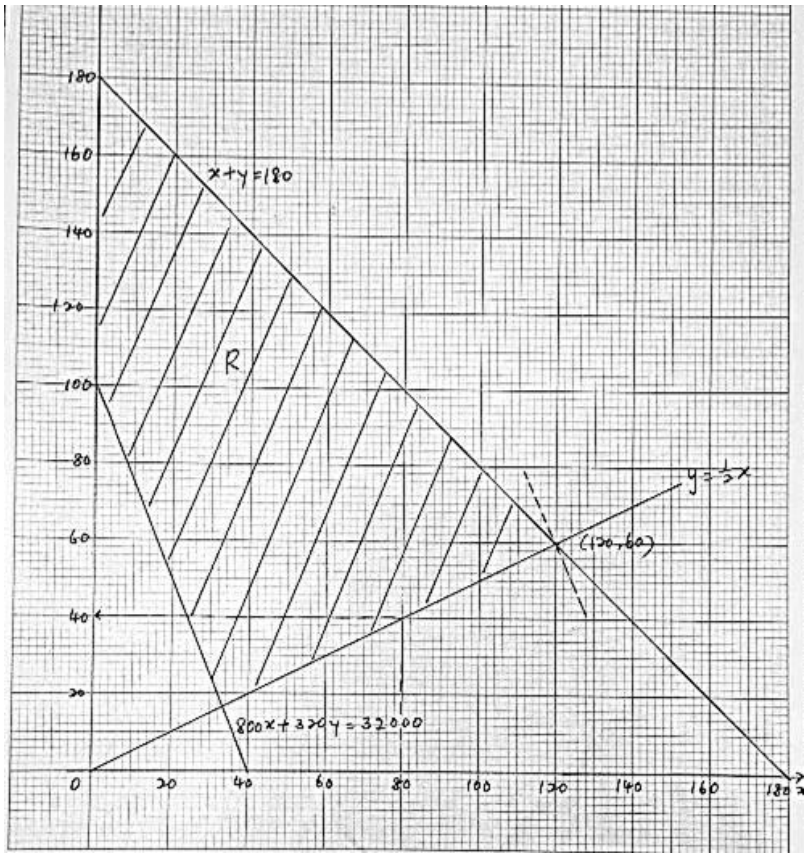


(c) (i) 24

(ii) RM2160

7. (a) $x + y \leq 180$, $y \geq \frac{1}{2}x$, $800x + 320y \geq 32000$

(b) Graf



(c) (i) bila $x = 80$, nilai minimum $y = 40$

Bilangan minimum pelajar untuk kursus Pengurusan Hotel = 40

(ii) $c = 800x + 320y$

Titik maksimum = (120 , 60)

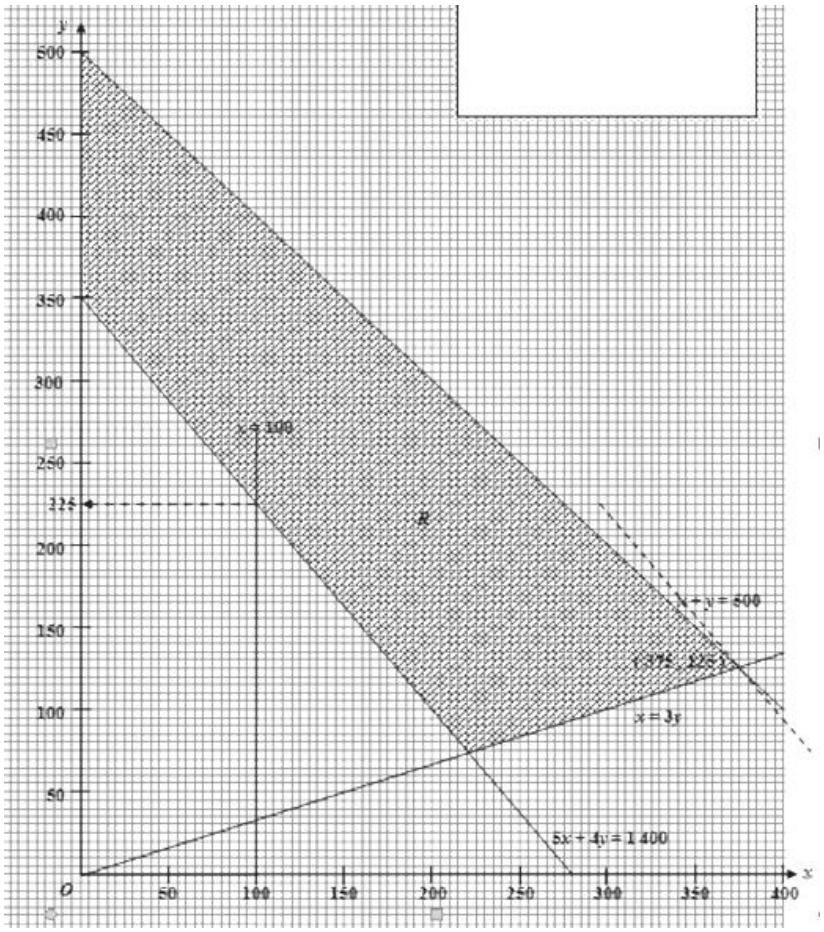
Jumlah yuran maksimum yang boleh dikutip

$= 800(120) + 320(60)$

$= RM115\ 200$

8. (a) $x + y \le 500$, $x \le 3y$, $5x + 4y \ge 1400$

(b) Graf



(c) (i) 225

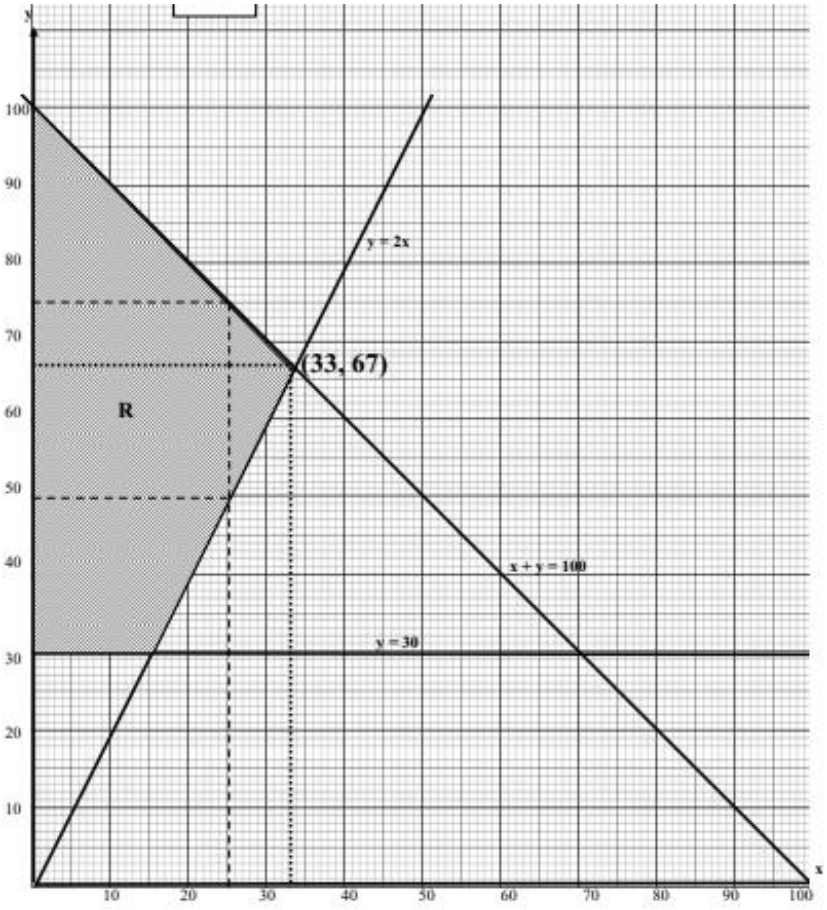
(ii) titik maksimum (375, 125)

15(375) + 12(125)

RM 7125

9. (a) $y \geq 30, \quad x + y \leq 100 , \quad y \geq 2x$

(b) Graf



(c) (i) $50 \leq y \leq 75$

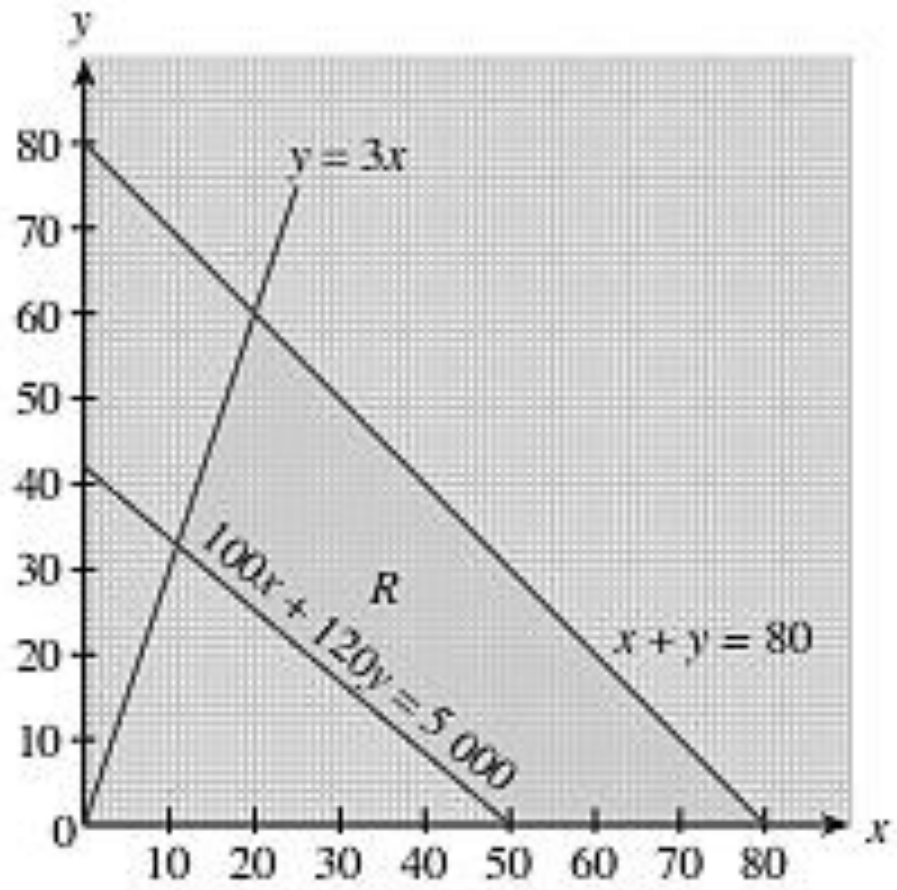
(ii) Titik Maksimum (33, 67)

$=120(33) + 80(67)$

= RM 9320

10. (a) $x + y \leq 80$, $\frac{x}{y} \geq \frac{1}{3}$ or $y \leq 3x$, $100x + 120y \geq 5000$

(b) Graf



(c) (i) 33

(ii) Titik Maksimum (20, 60)

$=100(20) + 120(60)$

= RM 9200

Maximum profit $=\frac{25}{100}$ x 9200 = RM 2300

BAB 8

KINEMATIK GERAKAN LINEAR
KINEMATICS OF LINEAR MOTION

1. (a) $v = t^2 - 6t + k$

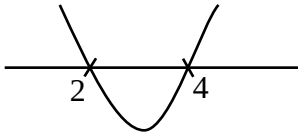
Halaju awal / initial velocity , $t = 0$, $v = 8$

$(0)^2 - 6(0) + k = 8$

$k = 8$

(b) $t^2 - 6t + 8 < 0$

$(t-4)(t-2) < 0$



$2 < t < 4$

(c) $a = \frac{dv}{dt} = 2t - 6$

$2t - 6 < 0$

$t < 3$

$\therefore 0 < t < 3$

2. (a) $a = 0$

$t - 6 = 0$

$t = 6$

$v = \int (t-6)\, dt$

$= \frac{t^2}{2} - 6t + c$

Ketika / When t = 0, v = 5, c = 5,

$v = \frac{t^2}{2} - 6t + 5$

$v_{minimum} = \frac{6^2}{2} - 6(6) + 5$

$= -13 \text{ m s}^{-1}$

(b) Ketika / When $a < 0$,

$t - 6 < 0$

$t < 6$

3. (a) $8\,m\,s^{-1}$

(b) $v < 0$

$t^2 - 6t + 8 < 0$

$(t-2)(t-4) < 0$

$2 < t < 4$

(c) Jumlah jarak yang dilalui dalam 4 saat pertama
Total distance travelled in the first 4 seconds

$= \int_0^2 (t^2 - 6t + 8)dt + \left|\int_2^4 (t^2 - 6t + 8)dt\right|$

$= \left[\frac{t^3}{3} - 3t^2 + 8t\right]_0^2 + \left|\left[\frac{t^3}{3} - 3t^2 + 8t\right]_2^4\right|$

$= \left[\frac{8}{3} - 12 + 16\right] + \left|\left[\frac{64}{3} - 3(16) + 8(4) - \left(\frac{8}{3} - 12 + 16\right)\right]\right|$

$= 8\,m$

4. (a) $v_M = 0, \quad 4 + 3t - t^2 = 0$

$(t-4)(t+1) = 0$

$t = 4 \quad or \quad t = -1$

$\therefore t = 4$

Jarak R dari P / *Distance of R from P*

$s_M = 4(4) + \frac{3(4)^2}{2} - \frac{(4)^3}{3}$

$= \frac{56}{3}$ atau / or 18.67 m

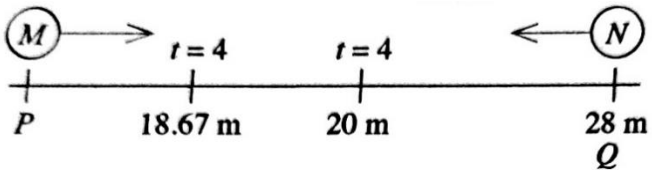
(b) $v_N = -2, \quad s_N = -2t + c$

Apabila / *When* $t = 0, s = 28, \ \therefore c = 28$

Maka / *Thus*, $S_N = -2t + 28$

Apabila / When $t = 4\ s, \quad v_N = -2(4) + 28$

$= 20\ m$



Apabila $t = 4\ s$, jarak antara M dan N / *When* $t = 4\ s$, *the distance between M and N*

$= 20 - 18.67$

$= 1.33\ m$

5. (a) $a = \frac{2}{3}t - 6$

$0 = \frac{2}{3}t - 6$

$t = 9\ \text{s}$

(b) $v = \int a\, dt$

$v = \int \left(\frac{2}{3}t - 6\right) dt$

$v = \frac{t^2}{3} - 6t + c$

$t = 0, v = 9, c = 9$

$\therefore v = \frac{t^2}{3} - 6t + 9$

$v = 0,$

$t^2 - 18t + 27 = 0$

$t = \frac{18 \pm \sqrt{18^2 - 4(1)(27)}}{2}$

$t = 16.34$ or $t = 1.65$

$\therefore t = 1.65$

(c) $s = \int v\, dt$

$s = \int \left(\frac{t^2}{3} - 6t + 9\right)\, dt$

$s = \frac{t^3}{9} - 3t^2 + 9t + c$

$t = 0, s = 0, c = 0$

$\therefore s = \frac{t^3}{9} - 3t^2 + 9t,$

Ketika / *when* $t = 1.65\ s$

$s = \frac{(1.65)^3}{9} - 3(1.65)^2 + 9(1.65)$

$s = 7.182\ m$

6. (a) $a = 2t - 5$

$\frac{dv}{dt} = 2t - 5$

$v = \int (2\text{t} - 5) dt$

$= t^2 - 5t + c$

$t = 0. v = 4\ m\ \text{s}^{-1}$

$4 = 0 - 5(0) + c$

$c = 4,$ Jadi/Therefore,

$v = t^2 - 5t + 4$

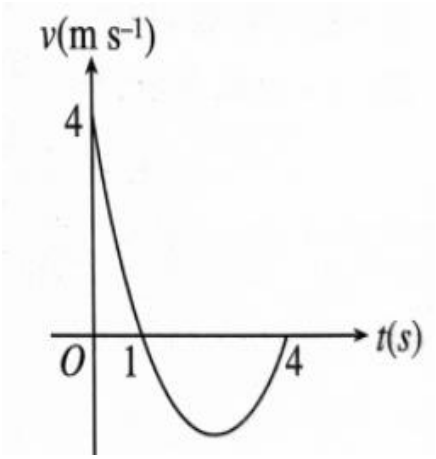
(b) $\text{v} < 0$

$t^2 - 5t + 4 < 0$

$(t - 1)(t - 4) < 0$

$1 < \text{t} < 4$

(c)



(d) Jarak dilalui / *Distance travelled*

$= \int_0^1 (t^2 - 5t + 4)dt + \left|\int_1^4 (t^2 - 5t + 4)dt\right|$ $[1m]$

$= \left[\frac{t^3}{3} - \frac{5t^2}{2} + 4t\right]_0^1 + \left|\left[\frac{t^3}{3} - \frac{5t^2}{2} + 4t\right]_1^4\right|$ $[1m]$

$= \left(\frac{1}{3} - \frac{5}{2} + 4\right) + \left|\left(\frac{64}{3} - 40 + 16\right) - \left(\frac{1}{3} - \frac{5}{2} + 4\right)\right|$

$= 1\frac{5}{6} + \left|-4\frac{1}{2}\right|$

$= 6\frac{1}{3}\text{m}$

7. (a) $v = mt^2 + nt + p$

$6 = m(0)^2 + n(0) + p$

$p = 6$

$v = mt^2 + nt + 6$

$42 = m(3)^2 + n(3) + 6$

$42 = 9m + 3n + 6$

$9m + 3n = 36$

$3m + n = 12$ …….(1)

$\frac{dv}{dt} = 2mt + n$

Substitute $t = 3$,

$\frac{dv}{dt} = 2m(3) + n$

$\frac{dv}{dt} = 6m + n$

Bagi halaju maksimum / *For maximum velocity*, $\frac{dv}{dt} = 0$.

$6m + n = 0$……..(2) [1 m]

(2) – (1), $3m = -12$

$m = -4$

Ganti/ *Substitute* $m = -4$ into (1),

$3(-4) + n = 12$

$-12 + n = 12$

$n = 24$

(b) $v = -4t^2 + 24t + 6$

$0 = -4t^2 + 24t + 6$

$0 = -2t^2 + 12t + 3$

$2t^2 - 12t - 3 = 0$

$t = \frac{-(-12) \pm \sqrt{(-12)^2 - 4(2)(-3)}}{2(2)}$

$t = \frac{12 \pm \sqrt{168}}{4}$

$t = \frac{12 \pm 2\sqrt{42}}{4}$

$t = 3 \pm \frac{1}{2}\sqrt{42}$

Since $t \geq 0$, then $t = 3 + \frac{1}{2}\sqrt{42}$. (Shown)

(c) $s = \int v\, dt$

$s = \int (-4t^2 + 24t + 6)\, dt$

$s = -\frac{4}{3}t^3 + 12t^2 + 6t + c$

Ganti / *Substitute* $t = 0$, $s = 0$,

$0 = -\frac{4}{3}(0)^3 + 12(0)^2 + 6(0) + c$

$c = 0$

$s = -\frac{4}{3}t^3 + 12t^2 + 6t$

Apabila / *When* $t = 3$,

$s = -\frac{4}{3}(3)^3 + 12(3)^2 + 6(3)$

$s = -\frac{4}{3}(27) + 12(9) + 18$

$s = -36 + 108 + 18$

$s = 90$

Jarak yang dilalui dalam masa 3 saat yang pertama / *The distance travelled in the first 3 seconds* = 90 – 0

= 90

8. (a) $a = \frac{dv}{dt} = \frac{3}{4} - \frac{6}{100}t$

$a = \frac{3}{4} - \frac{3}{50}t$

$a = 0,$

$\frac{3}{4} - \frac{3}{50}t = 0$

$t = 12.5s$

(b) $v_{max/\ mak} = \frac{3}{4}(12.5) - \frac{3}{100}(12.5)^2$

$v_{max/\ mak} = 4.6875ms^{-1}$

(c) $s = \int \frac{3}{4}(t) - \frac{3}{100}(t)^2 dt$

$s = \frac{3t^2}{8} - \frac{3t^3}{300} + c$

t = 0, s = 0 $\therefore c = 0$, $s = \frac{3t^2}{8} - \frac{t^3}{100}$

Semasa / *When* $t = 25$, $s = \frac{3}{8}(25)^2 - \frac{(25)^3}{100}$

$s = 78.125\,m$

9. (a) $h = kt^2 + pt$,

($h = s$)

$v = 2kt + p$ when $t = 0$, $v = 10$

$v = 2kt + p$

$p = 10$

$a = 2k$

$-8 = 2k$

$k = -4$

(b) $v = 2kt + p$
$= 2(-4)t + 10$

$v = -8t + 10$

Pada ketinggian maksimum, /*at maximum height*, $v = 0$ $v = -8t + 10$

$0 = -8t + 10$

$8t = 10$

$t = 1.25$ s

(c) $h = -4t^2 + 10t$ pada permukaan laut, / *at the surface of the sea*

$h = -q$ bila/*when* t = 4

$h = -4t^2 + 10t$

$-q = -4(4)^2 + 10(4)$

$= -64 + 40$

$= -24$

$q = 24$

10. (a) $t = 0$

$v_{0=15}$

(b) $a = 0 = 2t - 8$

$t = 4$

$v = 4^2 - 8(4) + 15$

$v = -1$

g = laju minimum

(c) $a = 2t - 8$

$a_4 = 2(4) - 8$

$a_4 = 0$

$a_3 = 2(3) - 8$

$a_3 = -2$

$a = 0 - (-2)$

$a = 2$

(d) $s = \frac{t^3}{3} - 4t^2 + 15t$

$s_0 = \frac{(0)^3}{3} - 4(0)^2 + 15(0)$

$s_0 = 0$

$s_3 = \frac{(3)^3}{3} - 4(3)^2 + 15(3)$

$s_3 = 18$

$s_5 = \frac{(5)^3}{3} - 4(5)^2 + 15(5)$

$s_5 = \frac{50}{3}$

$(18 - 0) + \left[\left(\frac{50}{3} - 18\right)\right]$

$\frac{58}{3}$