3472/2
MATEMATIK
TAMBAHAN
KERTAS 2
2 JAM 30 MINIT

MAJLIS PENGETUA SEKOLAH MALAYSIA (MPSM)
NEGERI PERAK

MODUL KECEMERLANGAN SPM 2025
TINGKATAN 5

MATEMATIK TAMBAHAN
KERTAS 2
2 JAM 30 MINIT

SKEMA JAWAPAN

NO.		BUTIRAN	MARKAH	JUMLAH
1	(*a*)	$S_n = a + ar + ar^2 + \ldots + ar^{n-2} + ar^{n-1}$ $rS_n = ar + ar^2 + ar^3 + \ldots + ar^{n-1} + ar^n$ $rS_n - S_n = ar^n - a$ $S_n = \frac{a(r^n-1)}{r-1}$	1 1 1	**3**
	(*b*)	$r = \dfrac{\frac{1}{4}\pi(4)^2}{\frac{1}{4}\pi(2)^2} = \dfrac{16}{4} = 4$ $B_1 = \frac{1}{4}\pi(2)^2 = \pi$ $B_2 = \pi(4) = 4\pi$ $B_3 = 4\pi(4) = 16\pi$ $= S_7 - S_3$ $= \dfrac{\pi(4^7-1)}{4-1} - \dfrac{\pi(4^3-1)}{4-1}$ $= 5440\pi$	1 1 1 1	**4**
		JUMLAH KESELURUHAN		**7**

MODUL KECEMERLANGAN SPM PERAK 2025 (KERTAS 2)

NO.	BUTIRAN	MARKAH	JUMLAH
2	$y = \dfrac{10-4x}{2}$ atau $x = \dfrac{10-2y}{4}$ atau setara $2x^2 + x(5-2x) - 2(5-2x)^2 - 37x + 98 = 0$ atau $2\left(\dfrac{10-2y}{4}\right)^2 + \left(\dfrac{10-2y}{4}\right)y - 2y^2 - 37\left(\dfrac{10-2y}{4}\right) + 98 = 0$ $(x+2)(x-3) = 0$ atau $(y-9)(y+1) = 0$ $x = -2$, $x = 3$ atau $y = 9$, $y = -1$ $y = 9$, $y = -1$ atau $x = -2$, $x = 3$	1 1 1 1 1	**5**
	JUMLAH KESELURUHAN		**5**

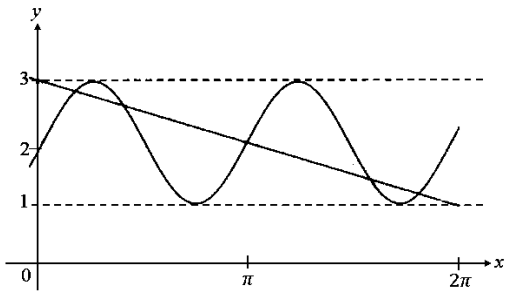
MODUL KECEMERLANGAN SPM PERAK 2025 (KERTAS 2)

NO.		BUTIRAN	MARKAH	JUMLAH
3	(*a*)	<u>ALTERNATIF A</u>	1	
		$A(0,15)$ atau $B(5,0)$		
		$\frac{1}{2}\left\|\left[0(-1)+(-6)(0)+5(15)\right]-\left[15(-6)+(-1)(5)+0(0)\right]\right\|$	1	
		85	1	
		Jarak terdekat, t		
		$85=\frac{1}{2}\times\left(\sqrt{(0-5)^2+(15-0)^2}\right)\times t$	1	
		10.75	1	**5**
		ATAU		
		<u>ALTERNATIF B</u>		
		$y=\frac{1}{3}x+1$	1	
		$-3x+15=\frac{1}{3}x+1$	1	
		$x=4.2$ dan $y=2.4$	1	
		$\sqrt{(4.2-(-6))^2+(2.4-(-1))^2}$	1	
		10.75	1	
	(*b*)	$PA=\frac{1}{2}PB$ (boleh secara tersirat) **atau** $2PA=PB$	1	
		$\sqrt{(x-0)^2+(y-15)^2}=\frac{1}{2}\sqrt{(x-5)^2+(y-0)^2}$	1, 1	**4**
		$3x^2+3y^2+10x-120y+875=0$	1	
			JUMLAH KESELURUHAN	**9**

NO.	BUTIRAN			MARKAH	JUMLAH
4	(*a*)		$a\left[x^2+\frac{b}{a}x+\left(\frac{\frac{b}{a}}{2}\right)^2-\left(\frac{\frac{b}{a}}{2}\right)^2+\frac{c}{a}\right]=0$	1	3
			$a\left(x+\frac{b}{2a}\right)^2-\frac{b^2}{4a}+c=0$	1	
			$x=\frac{-b\pm\sqrt{b^2-4ac}}{2a}$	1	
	(*b*)	(i)	$x^2+5x-24=0$	1	4
		(ii)	$x=\frac{-5\pm\sqrt{5^2-4(1)(-24)}}{2(1)}$	1	
			$x=3,\ x=-8$	1	
			lebar = 3 cm, panjang = 8 cm	1	
				JUMLAH KESELURUHAN	**7**

NO.	BUTIRAN		MARKAH	JUMLAH
5	(*a*)	$\left(3^n\right)^2-30\left(3^n\right)+81=0$	1	4
		$y^2-30y+81=0$	1	
		(terima semua huruf dalam persamaan kecuali *n*)		
		$\left(y-3\right)\left(y-27\right)=0$ **dan** $y=3$, $y=27$	1	
		$n=1$, $n=3$	1	
	(*b*)	$\log_{10}\left(pq^2\right)^3$ atau $\log_{10}q^2$	1	3
		$\log_{10}\left[\frac{\left(p^3q^6\right)\left(p\right)}{q^2}\right]=4$	1	
		$\log_{10}pq=1$	1	
			JUMLAH KESELURUHAN	**7**

NO.			BUTIRAN	MARKAH	JUMLAH
6	(*a*)	(i)	$OA = \sqrt{(7.5)^2 + (15)^2}$ $OA = 16.77$	1	
		(ii)	Lilitan kon = 2(3.142)(7.5) = 47.13 (16.77) θ = 47.13 θ = 2.81 rad	1 1 1	**4**
	(*b*)		Luas = $\frac{1}{2}(16.77)^2(2.81)$ Luas = 395.13 $n = \frac{1300}{395.13}$ $n = 3.29$ Bilangan topi yang dapat dibuat ialah 3	1 1 1	**3**
				JUMLAH KESELURUHAN	**7**

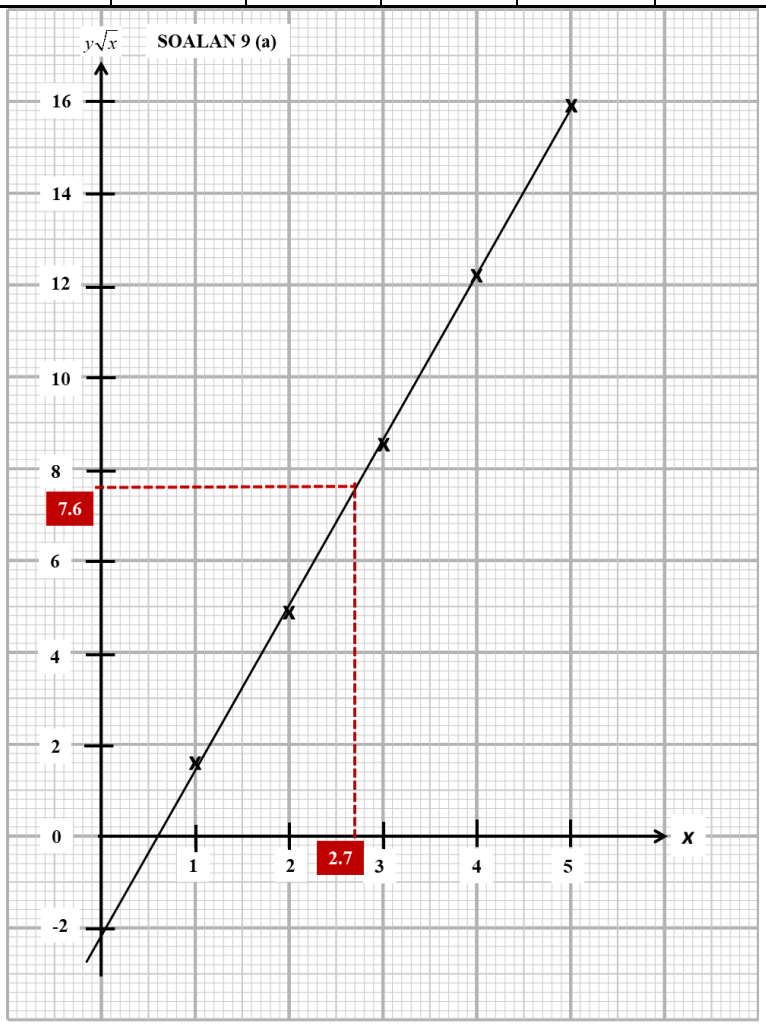
NO.			BUTIRAN	MARKAH	JUMLAH
7	(*a*)		LHS $= \frac{kos\ x}{\sin x} + \frac{\sin x}{kos\ x}$ $= \frac{kos^2 x + sin^2 x}{\sin x\ kos\ x}$ $= \frac{1}{\sin x\ kos\ x}$ $= sek\ x\ kosek\ x$ = RHS	1 1	**2**
	(*b*)	(i)	 Graf sin Graf garis lurus 2 kitaran Anjakan 2 unit ke atas	1 1 1 1	**4**
		(ii)	$y = \sin 2x + 2$ dan $y = -\frac{x}{\pi} + 3$ $\sin 2x + 2 = -\frac{x}{\pi} + 3$ $\sin 2x + \frac{x}{\pi} = 3 - 2$ $\sin 2x + \frac{x}{\pi} = 1$ Bilangan penyelesaian = 5	1 1	**2**
				JUMLAH KESELURUHAN	**8**

NO.	BUTIRAN			MARKAH	JUMLAH
8	(*a*)	(i)	$np = 20$ dan $\sqrt{npq} = 2$ $\sqrt{(20)q} = 2$ $20q = 4$ $q = \frac{1}{5}$ $p = \frac{4}{5}$ $n\left(\frac{4}{5}\right) = 20$ $n = 25$	1 1 1	4
		(ii)	$P(X = 6) = {}^{25}C_{16}\left(\frac{4}{5}\right)^{16}\left(\frac{1}{5}\right)^{9}$ $= 0.02944$	1	
	(*b*)	(i)	$P(X \geq 40) = P\left(Z \geq \frac{40-55}{20}\right)$ $= P(Z \geq -0.75)$ $= 0.7734$ Bil murid lulus = 0.7734 × 150 = 116 orang murid	1 1 1	6
		(ii)	$P(X < k) = \frac{15}{150}$ $P\left(Z < \frac{k-55}{20}\right) = 0.1$ $\frac{k-55}{20} = -1.281$ $k = 29.38$ $k = 29$	1 1 1	
				JUMLAH KESELURUHAN	**10**

NO.		BUTIRAN	MARKAH	JUMLAH
9	(*a*)		1	**1**

x	1	2	3	4	5
$y\sqrt{x}$	1.60	4.81	8.49	12.20	15.88

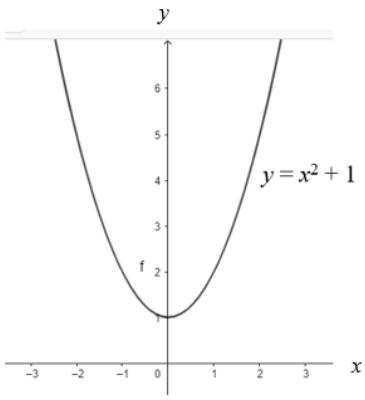
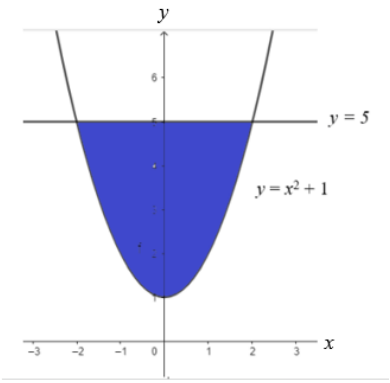
(*b*)



Paksi-paksi betul dan skala seragam dan sekurang-kurangnya satu titik diplot betul.	1	**3**
Semua titik diplot dengan betul.	1	
Garis lurus penyuaian terbaik.	1	

(*c*)	(i)	4.625	1	**5**
	(ii)	$y\sqrt{x} = px + q$	1	
		Kecerunan		
		$p = \dfrac{(12.2) - (0)}{(4) - (0.6)}$	1	
		$p = 3.588$	1	
		Pintasan-y; $q = -2.2$	1	
(*d*)		5.537 *masukkan nilai dalam persamaan linear	1	**1**
			JUMLAH KESELURUHAN	**10**

NO.			BUTIRAN	MARKAH	JUMLAH
10	(*a*)	(i)	$\overrightarrow{AF} = \overrightarrow{AC} + \overrightarrow{CF}$ **atau** $\overrightarrow{AF} = \overrightarrow{AB} + \overrightarrow{BF}$	1	
			$\overrightarrow{AF} = \frac{8}{5}\underset{\sim}{x} + \frac{9}{5}\underset{\sim}{y}$	1	
		(ii)	$\overrightarrow{EF} = \overrightarrow{EA} + \overrightarrow{AF}$ **atau** $\overrightarrow{EF} = \overrightarrow{EC} + \overrightarrow{CF}$	1	**4**
			$\overrightarrow{EF} = -\frac{16}{15}\underset{\sim}{x} + \frac{9}{5}\underset{\sim}{y}$	1	
	(*b*)		$\overrightarrow{ED} = \overrightarrow{EA} + \overrightarrow{AD}$		
			$\overrightarrow{ED} = -\frac{8}{3}\underset{\sim}{x} + \frac{3}{h}\underset{\sim}{y}$		
		(i)	$\overrightarrow{ED} = k\overrightarrow{EF}$		
			$-\frac{8}{3}x + \frac{3}{h}y = k\left(-\frac{16}{15}x + \frac{9}{5}y\right)$	1	
			$-\frac{8}{3} = -\frac{16k}{15}$ ----------(I) dan	1	
			$\frac{3}{h} = \frac{9k}{5}$ ----------(II)		
			(I) ÷ (II)		**6**
			$h = \frac{2}{3}$	1	
		(ii)	Daripada (II)		
			$\frac{3}{\frac{2}{3}} = \frac{9k}{5}$	1	
			$k = \frac{5}{2}$	1	
			$\frac{\overrightarrow{EF}}{\overrightarrow{ED}} = \frac{2}{5}$	1	
				JUMLAH KESELURUHAN	**10**

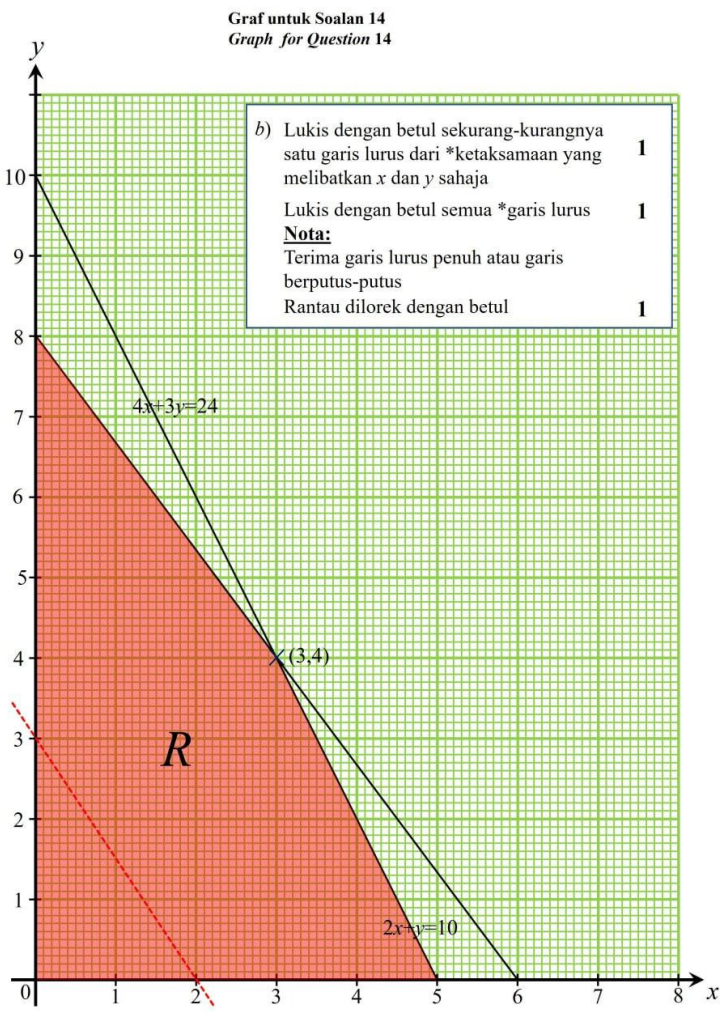
NO.	BUTIRAN			MARKAH	JUMLAH
11	(*a*)				
		Bentuk graf yang betul		1	**2**
		Menunjukkan nilai pintasan-y = 1		1	
	(*b*)	(i)			
			Luas = $\int_1^5 x\,dy$ @ $\int_{-2}^{2} y\,dx$		
			$\int_1^5 (y-1)^{\frac{1}{2}}\,dy$ @ $\int_{-2}^{2} (x^2+1)\,dx$		**8**
			$\left[\dfrac{(y-1)^{\frac{1}{2}+1}}{\left(\frac{1}{2}+1\right)(1)}\right]_1^5$ @ $\left[\dfrac{x^3}{3}+x\right]_{-2}^{2}$	1	
			$\left[\dfrac{((5)-1)^{\frac{1}{2}+1}}{\left(\frac{1}{2}+1\right)(1)}\right]-[0]$ @ $\left[\dfrac{(2)^3}{3}+(2)\right]-\left[\dfrac{(-2)^3}{3}+(-2)\right]$	1	
			$\dfrac{16}{3}\times 2$ @ $20 - 9\dfrac{1}{3}$	1	
			$\dfrac{32}{3}$ @ $10\dfrac{2}{3}$	1	

		(ii)	$\pi(5)^2(4) - \int_{-2}^{2}(x^2+1)^2\,dx$ @	1	
			$\pi\int_{-2}^{2}(5)^2\,dx - \int_{-2}^{2}(x^2+1)^2\,dx$		
			$\pi\left[\frac{x^5}{5}+\frac{2x^3}{3}+x\right]_{-2}^{2}$	1	
			$\pi\left[\frac{(2)^5}{5}+\frac{2(2)^3}{3}+(2)\right]-\left[\frac{(-2)^5}{5}+\frac{2(-2)^5}{5}+(-2)\right]$	1	
			$\frac{1088}{15}\pi$ @ $72\frac{8}{15}\pi$	1	
				JUMLAH KESELURUHAN	**10**

NO.	BUTIRAN			MARKAH	JUMLAH
12	(*a*)	$v_P = 6t+9$		1	**2**
		$t=0 \quad v_P = 6(0)+9 = 9\ ms^{-1}$		1	
	(*b*)	$8t-2>0$		1	**2**
		$t>\frac{1}{4}$		1	
	(*c*)	(i)	$s_Q = \frac{8t^2}{2}-2t+c$	1	**4**
			$s_Q = 4t^2-2t+12$	1	
		(ii)	$s = 4\left(\frac{1}{4}\right)^2 - 2\left(\frac{1}{4}\right)+12$	1	
			$s = 11.75$		
			$s<12$, maka zarah Q tidak melalui titik A	1	
	(*d*)	$s_P = 3t^2+9t = 12$		1	**2**
		$3t^2+9t-12=0$			
		$t^2+3t-4=0$			
		$(t+4)(t-1)=0$		1	
		$t \neq -4, \quad t=1$			
				JUMLAH KESELURUHAN	**10**

NO.		BUTIRAN	MARKAH	JUMLAH
13	(*a*)	$A_{PVR} = \frac{1}{2}nt$ ----------(i) $\sin V = \frac{t}{m}$ $t = m\sin V$ ----------(ii) (ii) masukkan ke dalam (i) $A_{PVR} = \frac{1}{2}nm\sin V$	1 1 1	**3**
	(*b*)	(i) $\sqrt{8^2+4^2}$ atau $\sqrt{6^2+4^2}$ atau $\sqrt{6^2+8^2}$ $8.944^2 = 7.211^2 + 10^2 - 2(7.211)(10)\cos\angle PVR$ $\angle PVR = 60.05°$ (ii) $\frac{1}{2}(7.211)(10)\sin 60.05°$ 31.24	1 1 1 1 1	**5**
	(*c*)	$\frac{1}{2}\times h\times 8.944 = 31.24$ 6.986 / 6.985	1 1	**2**
			JUMLAH KESELURUHAN	**10**

NO.		BUTIRAN	MARKAH	JUMLAH
14	(*a*)	Jumlah kos pembelian Kabinet *P* dan Kabinet *S* mestilah tidak melebihi RM2 000. ("sebanyak-banyaknya", "tidak besar daripada" boleh diterima) Jumlah ruang lantai yang diperlukan oleh Kabinet *P* dan Kabinet *S* mestilah tidak melebihi 288 m^2. ("sebanyak-banyaknya", "tidak besar daripada" boleh diterima)	1 1	**2**
	(*b*)	$400x + 200y \leq 2\,000$ $2x + y \leq 10$ $48x + 36y \leq 288$ $4x + 3y \leq 24$	1 1	**2**

	(*c*)		3	**3**
	(*d*)	Lukis fungsi objektif: muatan penyimpanan fail, $k = 24x + 16y$	1	**1**
	(*e*)	(i) Titik optimum ialah $(3, 4)$ Encik Kelvin patut membeli 3 kabinet *P* dan 4 kabinet *S*	1	**1**
		(ii) Kapasiti penyimpanan maksimum: $k_{max} = 24(3) + 16(4)$ $= 136\ m^2$	1	**1**
			JUMLAH KESELURUHAN	**10**

NO.	BUTIRAN			MARKAH	JUMLAH
15	(*a*)	(i)	$x = 95$	1	**2**
		(ii)	$y = 100$	1	
	(*b*)		$\bar{I} = \dfrac{132.6(1)+95(1)+125(1)+100(1)}{1+1+1+1}$	1	**2**
			113.15	1	
	(*c*)	(i)	$\dfrac{135\times100}{113.15}$	1	**6**
			119.31	1	
		(ii)	$\dfrac{400\times135}{100}$	1	
			$\dfrac{130}{100}\times540$	1	
			Total selling price = 702	1	
			Minimum number of loaves = 280	1	
				JUMLAH KESELURUHAN	**10**