SAMPEL PERCUMA

Trial STPM 2018 Mathematics T Semester 1 Pahang

Set penuh: Kertas Percubaan STPM

Sem 1 · Mathematics T

Sampel ini: 7 muka surat. Set penuh ada:

- 3 fail PDF
- Semester 1: kertas percubaan (trial) negeri, subjek yang dipilih + skema
- Blueprint 30 hari Semester 1 (setiap subjek)
- Semester 3: percubaan 2024, 10 subjek, banyak negeri, soalan + skema dalam satu fail

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Sampel bermula di muka surat sebelah

2018-1-PAH-STATE

Section A [45 *marks*]
Answer **all** *questions in this section.*

1. Prove that $\frac{2\sin4\theta-\sin6\theta-\sin2\theta}{2\sin4\theta+\sin6\theta+\sin2\theta} = \tan^2\theta$. [5 *marks*]
   Hence, find the value of $\tan^2 15°$, leaving your answer in surd form. [3 *marks*]

2. Use the binomial expansions of $\left(\sqrt{2}+1\right)^6$ and $\left(\sqrt{2}-1\right)^6$ to evaluate $\left(\sqrt{2}+1\right)^6+\left(\sqrt{2}-1\right)^6$.
   Hence, show that $197 \le \left(\sqrt{2}+1\right)^6 \le 198$. [7 *marks*]

3. A system of linear equations is given by

$$\begin{aligned} 2x + y + z &= m, \\ 2x - y + 2z &= 0, \\ 2x + y + \beta z &= 3, \end{aligned}$$

   where β and m are real numbers. Write the augmented matrix for the system and show that it may be reduced to

$$\left(\begin{array}{ccc|c} 2 & 1 & 1 & m \\ 0 & -2 & 1 & -m \\ 0 & 0 & \beta-1 & 3-m \end{array}\right)$$ [4 *marks*]

   Hence, determine the values of β and m so that the system of linear equation has

   (*a*) a unique solution, [2 *marks*]
   (*b*) infinitely many solutions, [1 *mark*]
   (*c*) no solution. [1 *mark*]

4. (*a*) Express $z = 1 + \sqrt{3}i$ in the form $r(\cos\theta + i\sin\theta)$, where *r* is the modulus and θ is the argument of the complex number.
   Hence, show that $\left(1+\sqrt{3}i\right)^5 = 16 - 16\sqrt{3}i$. [5 *marks*]

   (*b*) Express $z^6 z^*$ in the form of $x + yi$, where z^* is the conjugate of *z* and $x, y \in R$. [2 *marks*]

5. A conic section has an equation $16x^2 - 9y^2 - 128x + 54y + 31 = 0$.
   (*a*) Show that equation of the conic section represents a hyperbola. [4 *marks*]
   (*b*) Find the vertices, foci and the equations of the asymptotes of the hyperbola. [4 *marks*]

6. Given that $\boldsymbol{a} = p\boldsymbol{i} - \boldsymbol{j} + 4\boldsymbol{k}$, $\boldsymbol{b} = q\boldsymbol{j} + 3\boldsymbol{k}$ and $\boldsymbol{a} \times \boldsymbol{b} = 5\boldsymbol{i} - 9\boldsymbol{j} - 6\boldsymbol{k}$, where p and q are constants.
   (*a*) Determine the values of p and q. [3 *marks*]
   (*b*) Hence, find
      (i) the area of a parallelogram with sides $\boldsymbol{a}$ and $\boldsymbol{b}$. [2 *marks*]
      (ii) the angle between $\boldsymbol{a}$ and $\boldsymbol{b}$. [2 *marks*]

Section B [15 *marks*]
Answer any **one** *question in this section.*

7. (*a*) The function is defined as :

$$\mathrm{h}(x) = |x + 3| - |x - 3|, \qquad x \in R.$$

   (i) Sketch the graph of h. [6 *marks*]
   (ii) State the range of h. [1 *mark*]

   (*b*) The functions f and g are defined as:

$$\mathrm{f}(x) = \frac{x + |x|}{2}, x \in R$$

$$\mathrm{g}(x) = \begin{cases} x - 1, & x < 0, \\ 2, & x > 0. \end{cases}$$

   Sketch the graphs of the function f and g. [4 *marks*]

   From the graphs, determine the continuity of the composite function fog and hence discuss whether the composite function fog is defined. [4 *marks*]

8. (*a*) Given that $u_r = \left(\frac{1}{3}\right)^{2r-3} + \left(\frac{1}{3}\right)^{2r-1}$.

   (i) Express $\sum_{r=1}^{n} u_r$ in terms of $A\left(1 - \frac{B}{9^n}\right)$ and determine the values of A and B. [7 *marks*]

   (ii) Determine the sum to infinity of this series. [2 *marks*]

   (*b*) Evaluate $\sum_{r=1}^{\infty} \frac{1}{10^{2r}}$.

   Hence, express $1.878787\ldots$ $(1.\dot{8}\dot{7})$ as a fraction in its lowest form. [6 *marks*]

2018-1-PAH-STATE-MARKING SCHEME

SOALAN	SKEMA	MARKAH
1	LHS: $\frac{2\sin 4\theta-(sin6\theta+sin2\theta)}{2\sin 4\theta+sin6\theta+sin2\theta}$ $=\frac{2\sin 4\theta-(sin6\theta+sin2\theta)}{2\sin 4\theta+sin6\theta+sin2\theta}$	B1
	$=\frac{2\sin 4\theta-(2sin4\theta cos2\theta)}{2\sin 4\theta+(2sin4\theta cos2\theta)}$ $=\frac{2\sin 4\theta(1-\cos 2\theta)}{2\sin 4\theta(1+cos2\theta)}$ $=\frac{1-cos2\theta}{1+cos2\theta}$ $=\frac{1-(1-2sin^2\theta)}{1+(2cos^2\theta-1)}$ $=\frac{2sin^2\theta}{2cos^2\theta}$ $=tan^2\theta$ R.H.S	M1 A1 M1 A1 [5]
	Substituting $\theta = 15°$ into the identity, $$tan^2 15° = \frac{2sin60° - sin90° - sin30°}{2sin60° + sin90° + sin30°}$$ $$= \frac{2\frac{\sqrt{3}}{2} - 1 - \frac{1}{2}}{2\frac{\sqrt{3}}{2} + 1 + \frac{1}{2}}$$ $= 7 - 4\sqrt{3}$	M1A1 A1 [3]

2		
	$\left(\sqrt{2}+1\right)^6 = \left(\sqrt{2}\right)^6 + \binom{6}{1}\left(\sqrt{2}\right)^5(1) + \binom{6}{2}\left(\sqrt{2}\right)^4(1)^2 + \binom{6}{3}\left(\sqrt{2}\right)^3(1)^3 + \binom{6}{4}\left(\sqrt{2}\right)^2(1)^4 + \binom{6}{5}\left(\sqrt{2}\right)^1(1)^5 + (1)^6$ $\left(\sqrt{2}-1\right)^6 = \left(\sqrt{2}\right)^6 - \binom{6}{1}\left(\sqrt{2}\right)^5(1) + \binom{6}{2}\left(\sqrt{2}\right)^4(1)^2 - \binom{6}{3}\left(\sqrt{2}\right)^3(1)^3 + \binom{6}{4}\left(\sqrt{2}\right)^2(1)^4 - \binom{6}{5}\left(\sqrt{2}\right)^1(1)^5 + (1)^6$	B1 B1
	$\left(\sqrt{2}+1\right)^6 + \left(\sqrt{2}-1\right)^6$	

	$= 2\left[\left(\sqrt{2}\right)^6 + \binom{6}{2}\left(\sqrt{2}\right)^4(1)^2 + \binom{6}{4}\left(\sqrt{2}\right)^2(1)^4 + (1)^6\right]$ $= 2(99) =$ 198	M1 A1
	$\left(\sqrt{2}+1\right)^6 = 198 - \left(\sqrt{2}-1\right)^6$	B1
	$1 < \sqrt{2} < 2$ $0 < \sqrt{2} - 1 < 1$ $0 < \left(\sqrt{2}-1\right)^6 < 1$ $-1 < -\left(\sqrt{2}-1\right)^6 < 0$ $197 < 198 - \left(\sqrt{2}-1\right)^6 < 198$	M1
	$197 < \left(\sqrt{2}+1\right)^6 < 198$	A1
	TOTAL	7M

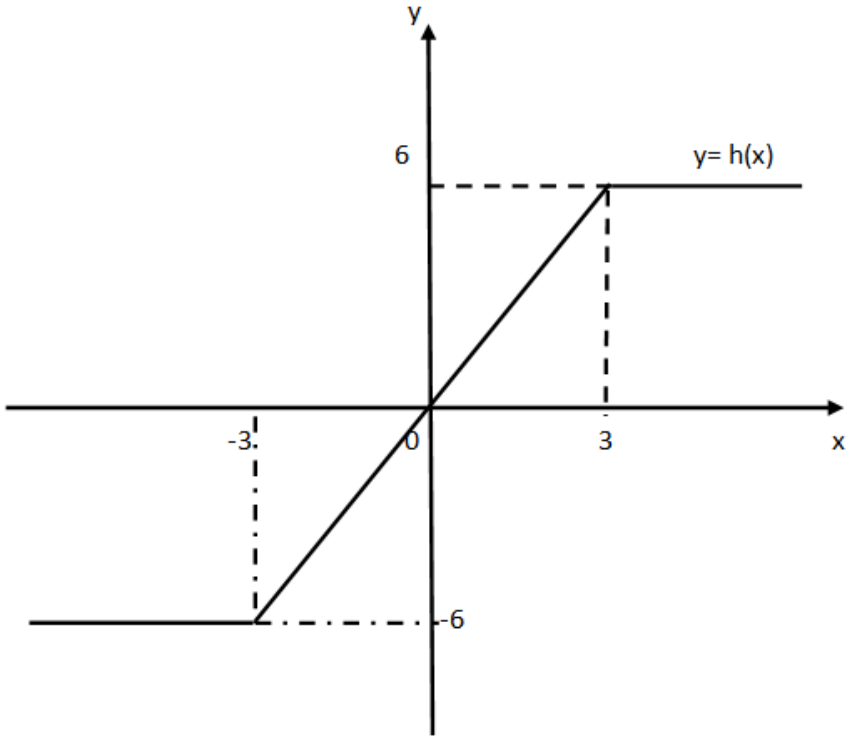
3		
	$\left(\begin{array}{ccc\|c} 2 & 1 & 1 & m \\ 2 & -1 & 2 & 0 \\ 2 & 1 & \beta & 3 \end{array}\right)$	B1
	$\left(\begin{array}{ccc\|c} 2 & 1 & 1 & m \\ 0 & -2 & 1 & -m \\ 0 & 0 & \beta - 1 & 3 - m \end{array}\right)$	M1A1A1
		[4]
	a) $\beta - 1 = 3 - m$	M1
	$\beta \neq 1$	A1
	b) $\beta = 1$ and m=3	B1
	$c)$ $\beta = 1$ and $m \neq 3$	B1
		[4]

4		
	a) $r = \sqrt{1^2 + \left(\sqrt{3}\right)^2} = 2$	B1
	$\theta = tan^{-1}\left(\frac{\sqrt{3}}{1}\right) = \frac{\pi}{3}$	B1
	$z = 1 + \sqrt{3}i = 2(cos\frac{\pi}{3} + isin\frac{\pi}{3})$	B1
	$\left(1 + \sqrt{3}i\right)^5 = 2^5(cos\frac{5\pi}{3} + isin\frac{5\pi}{3})$	M1
	$= 16 - 16\sqrt{3}i$	A1

		[5]
	b) $z^6z^* = z^5zz^* = (16 - 16\sqrt{3}i)2^2$	M1
	$= 64(1 - \sqrt{3}i)$	A1 [2]

5 (a)	$16(x^2 - 8x) - 9(y^2 - 6y) = -31$	B1
	$16[(x-4)^2 - 16] - 9[(y-3)^2 - 9] = -31$	M1 (completing square)
	$16(x-4)^2 - 9(y-3)^2 = 144$	M1
	$\frac{16}{144}(x-4)^2 - \frac{9}{144}(y-3)^2 = 1$ $\frac{(x-4)^2}{9} - \frac{(y-3)^2}{16} = 1$ Hyperbola	A1
(b)	$c^2 = 3^2 + 4^2$ $c = \pm 5$	B1
	Vertices= (7, 3), (1, 3) Foci = (9, 3), (-1, 3) Asymptotes: $3y - 4x + 7 = 0$ and $3y + 4x - 25 = 0$	B1 B1 B1
	TOTAL	8 M

6 (a)	$a \times b = \begin{bmatrix} i & j & k \\ p & -1 & 4 \\ 0 & q & 3 \end{bmatrix}$ $= \begin{vmatrix} -1 & 4 \\ q & 3 \end{vmatrix} i - \begin{vmatrix} p & 4 \\ 0 & 3 \end{vmatrix} j + \begin{vmatrix} p & -1 \\ 0 & q \end{vmatrix} k$	
	$= (-3 - 4q)i - (3p)j + (pq)k$	B1
	Compare with $5i - 9j - 6k$ $-3 - 4q = 5,\ q = -2$ $-3p = 9,\ p = -3$	A1 A1
(b)	$a \times b = 5i - 9j - 6k$ $Area = \sqrt{5^2 + (-9)^2 + (-6)^2}$ $= \sqrt{142}$	M1 A1
	$sin\theta = \frac{\lvert\sqrt{142}\rvert}{\lvert\sqrt{26}\rvert\lvert\sqrt{13}\rvert}$ $sin\theta = 0.6482$ $\theta = 40.4°$	M1 A1
	TOTAL	7M

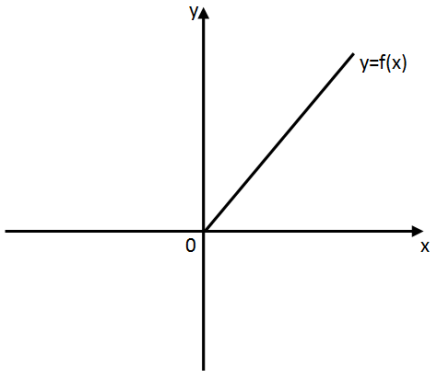
7		
	(a) (i) $h(x) = \|x+3\| - \|x-3\|, x \in R$ $\|x+3\| = \begin{cases} -x-3, x < -3 \\ x+3, x \geq -3 \end{cases}$ $\|x-3\| = \begin{cases} -x+3, x < 3 \\ x-3, x \geq 3 \end{cases}$ For $x < -3$, $h(x) = (-x-3) - (-x+3)$ $= -6$ For $-3 \leq x < 3$, $h(x) = (x+3) - (-x+3)$ $= 2x$ For $x \geq 3$, $h(x) = (x+3) - (x-3)$ $= 6$ Thus $h(x) = \begin{cases} -6, & x < -3 \\ 2x, & -3 \leq x < 3 \\ 6, & x \geq 3 \end{cases}$ Sketch graph of function h is  (ii) Range of h is $\{y \mid -6 \leq y \leq 6\}$ a) $f(x) = \frac{x+\|x\|}{2}, x \in R$ For $x < 0$, $f(x) = \frac{x+(-x)}{2}$=0	M1 M1A1 A1 D1 D1 [6] B1 [1]

For $x > 0, \quad f(x) = \frac{x+(x)}{2} = x$

Therefore, $f(x) = \begin{cases} 0, x < 0 \\ x, x \geq 0 \end{cases}$ M1 A1

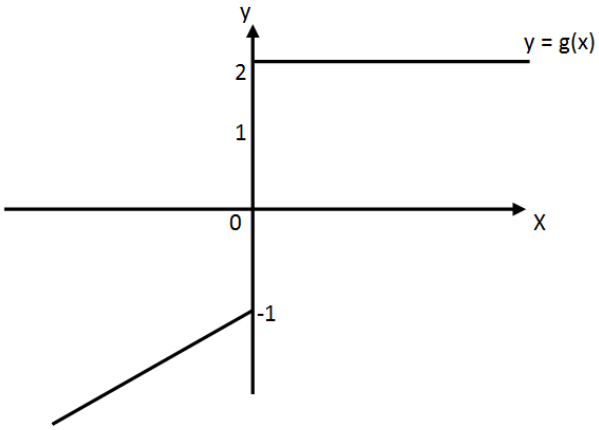
$$g(x) = \begin{cases} x - 1, & x < 0 \\ 2, & x > 0 \end{cases}$$

Sketch of the graph of function f:



D1

Sketch of the graph of function g:



D1

[4]

Since there is a break in the graph of g at x = 0 , then fog is **discontinuous** *(@not continuous)* M1A1

The range of g is the subset of f , then the composite function fog is defined. M1A1

[4]

8.		
(a) (i)	$u_r = \frac{1}{(3)^{2r-3}} + \frac{1}{(3)^{2r-1}}$ $u_r = \frac{1}{\frac{3^{2r}}{3^3}} + \frac{1}{\frac{3^{2r}}{3}}$ $u_r = \frac{27}{3^{2r}} + \frac{3}{3^{2r}}$ $u_r = 30\left(\frac{1}{3^{2r}}\right) = 30\left(\frac{1}{3}\right)^{2r}$	M1 A1

TAMAT SAMPEL

Suka sampel ini?

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- 3 fail PDF
- Semester 1: kertas percubaan (trial) negeri, subjek yang dipilih + skema
- Blueprint 30 hari Semester 1 (setiap subjek)
- Semester 3: percubaan 2024, 10 subjek, banyak negeri, soalan + skema dalam satu fail

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