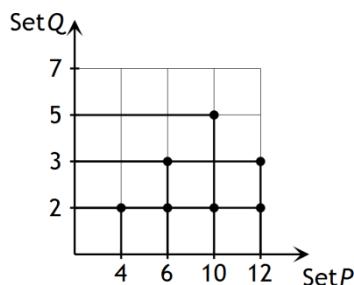




### SPM ADD MATHS PAPER 1

- 1 Diagram 1 shows the relation between set  $P$  and set  $Q$  in the graph form.  
*Rajah 1 menunjukkan hubungan antara set  $P$  dan set  $Q$  dalam bentuk graf.*



**Diagram 1**  
**Rajah 1**

State the  
*Nyatakan*

- (a) relation in the form of ordered pairs.  
*hubungan itu dalam bentuk pasangan tertib.*
- (b) type of the relation.  
*jenis hubungan itu.*
- (c) range of this relation  
*julat hubungan ini*

[3 marks]  
[3 markah]

- 
- 2 The function  $f$  is defined as  $f : x \rightarrow 7x + 5$ . Find  
*Fungsi  $f$  ditakrifkan sebagai  $f : x \rightarrow 7x + 5$ . Cari*

- (a)  $f^{-1}(4)$   
(b)  $f^{-1}(x)$

[3 marks]  
[3 markah]

- 
- 3 The functions of  $f$  and  $g$  are defined as  $f : x \rightarrow 9x + 1$  and  $g : x \rightarrow -x - 7$ . Find the composite function of  $gf$  and the value of  $gf(-5)$ .  
*Fungsi-fungsi  $f$  dan  $g$  ditakrifkan sebagai  $f : x \rightarrow 9x + 1$  dan  $g : x \rightarrow -x - 7$ . Cari fungsi gubahan  $gf$  dan nilai  $gf(-5)$ .*

[3 marks]  
[3 markah]

- 
- 4 The straight line  $y = 8 - x$  does not intersect with the curve  $y = -4x^2 + 2x + p$ .

Find the range of values of  $p$ .

Garis lurus  $y = 8 - x$  tidak bersilang dengan lengkung  $y = -4x^2 + 2x + p$ .

Cari julat nilai  $p$ .

[3 marks]  
[3 markah]

- 5 Solve the quadratic equation  $-7x(2x - 1) = (1 - 6x)(2 - 8x)$ . Give answer correct to four significant figures.

Selesaikan persamaan kuadratik  $-7x(2x - 1) = (1 - 6x)(2 - 8x)$ . Beri jawapan betul kepada 4 angka bererti.

[3 marks]  
[3 markah]

- 
- 6 Diagram 1 shows the graph of a quadratic function  $f(x) = 4(x + s)^2 + 8$ , where  $s$  is a constant. Rajah 1 menunjukkan graf fungsi kuadratik  $f(x) = 4(x + s)^2 + 8$ , di mana  $s$  adalah pemalar.

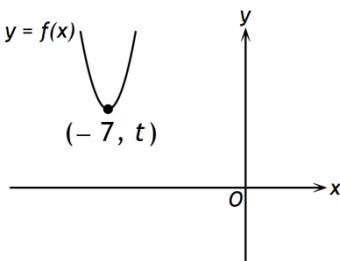


Diagram 1  
Rajah 1

The curve  $y = f(x)$  has a minimum point  $(-7, t)$ , where  $t$  is a constant. State Lengkung  $y = f(x)$  mempunyai titik minimum pada  $(-7, t)$ , di mana  $t$  adalah pemalar.

Nyatakan

- the value of  $s$   
*nilai s*
- the value of  $t$   
*nilai t*
- the equation of the axis of symmetry  
*persamaan paksi simetri*

[3 marks]  
[3 markah]

- 
- 7 Solve the equation  $2^{x+4} - 2^{x+3} = 128$ .  
Selesaikan persamaan  $2^{x+4} - 2^{x+3} = 128$ .

[3 marks]  
[3 markah]



- 
- 8 Solve the equation  $\log_7 (6x + 7) - \log_7 (8x + 2) = 1$ .  
Selesaikan persamaan  $\log_7 (6x + 7) - \log_7 (8x + 2) = 1$ .

[3 marks]  
[3 markah]

- 
- 9 Given that  $\log_2 h = x$  and  $\log_2 k = y$ , express  $\log_8 (\frac{64h}{k})$  in terms of  $x$  and  $y$ .

Diberi  $\log_2 h = x$  dan  $\log_2 k = y$ , ungkapkan  $\log_8 (\frac{64h}{k})$  dalam sebutan  $x$  dan  $y$ .

[3 marks]  
[3 markah]

- 
- 10 The 4th term of a geometric progression is 20. The sum of the 4th term and the 5th term is 25.  
Sebutan ke-4 suatu janjang geometri ialah 20. Hasil tambah sebutan ke-4 dan ke-5 ialah 25.

Find  
Carikan

- (a) the first term and the common ratio of the progression.  
sebutan pertama dan nisbah sepunya janjang itu.  
(b) the sum to infinity of the progression.  
hasil tambah hingga ketakhinggaan janjang itu.

[4 marks]  
[4 markah]

- 
- 11 The first three terms of an arithmetic progression are 9, 19, 29.  
Tiga sebutan pertama suatu janjang aritmetik ialah 9, 19, 29.

Find  
Carikan

- (a) the common difference of the progression.  
beza sepunya janjang itu.  
(b) the sum of the first 40 terms after the 6th term.  
hasil tambah 40 sebutan pertama selepas sebutan ke-6.

[4 marks]  
[4 markah]

- 12 The sum of the first  $n$  terms of geometric progression  $10, -80, 640, \dots$  is  $-4550$ .  
*Hasil tambah  $n$  sebutan pretama bagi janjang geometri  $10, -80, 640, \dots$  ialah  $-4550$ .*

Find

*Carikan*

- (a) the common ratio of the progression.  
*nisbah sepunya janjang itu.*
- (b) the value of  $n$ .  
*nilai  $n$ .*

[4 marks]  
[4 markah]

- 13 The variables  $x$  and  $y$  are related by the equation  $y = px^{-5}$ , where  $p$  is a constant.  
*Pemboleh ubah  $x$  dan  $y$  dihubungkan oleh persamaan  $y = px^{-5}$ , dengan keadaan  $p$  ialah pemalar.*
- (a) Convert the equation  $y = px^{-5}$  to linear form.  
*Tukarkan persamaan  $y = px^{-5}$  kepada bentuk linear.*
- (b) Diagram 2 shows the straight line obtained by plotting  $\log_{10} y$  against  $\log_{10} x$ .  
*Rajah 2 menunjukkan graf garis lurus yang diperoleh dengan memplot  $\log_{10} y$  melawan  $\log_{10} x$ .*

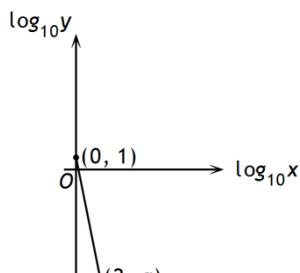


Diagram 2  
*Rajah 2*

Find the value of

*Carikan nilai*

- (i)  $\log_{10} p$ .  
(ii)  $q$ .

[4 marks]  
[4 markah]

- 14 The straight lines  $4x + ay = 2$  and  $10x + 10y = -5$  are parallel. Find the value of  $a$ .  
*Garis lurus  $4x + ay = 2$  dan  $10x + 10y = -5$  adalah selari. Carikan nilai  $a$ .*

[3 marks]  
[3 markah]

- 15 Diagram 3 shows vector  $\vec{OA}$  drawn on a Cartesian plane.

*Rajah 3 menunjukkan vektor  $\vec{OA}$  dilukis pada suatu satah Cartesan.*

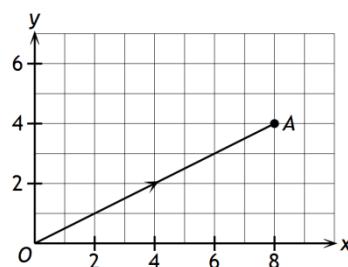


Diagram 3  
Rajah 3

- (a) Express  $\vec{OA}$  in the form  $\begin{pmatrix} x \\ y \end{pmatrix}$ .

*Ungkapkan  $\vec{OA}$  dalam bentuk  $\begin{pmatrix} x \\ y \end{pmatrix}$ .*

- (b) Find the unit vector in the direction of  $\vec{OA}$ .

*Carikan vektor unit dalam arah  $\vec{OA}$ .*

[3 marks]  
[3 markah]

- 16 Diagram 4 shows a parallelogram  $OABC$  drawn on a Cartesian plane.

*Rajah 4 menunjukkan sebuah segi empat selari  $OABC$  dilukis pada suatu satah Cartesan.*

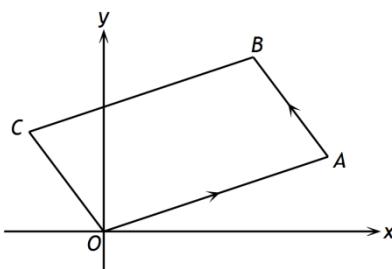


Diagram 4  
Rajah 4



It is given that  $\vec{OA} = 9\hat{i} + 3\hat{j}$  and  $\vec{AB} = -3\hat{i} + 4\hat{j}$ . Find  $\vec{AC}$ .

Diberi bahawa  $\vec{OA} = 9\hat{i} + 3\hat{j}$  dan  $\vec{AB} = -3\hat{i} + 4\hat{j}$ . Carikan  $\vec{AC}$ .

[3 marks]  
[3 markah]

- 
- 17 Solve the equation  $-16 \cos 2x = -36 \sin x - 23$  for  $0^\circ \leq x \leq 360^\circ$

Selesaikan persamaan  $-16 \cos 2x = -36 \sin x - 23$  bagi  $0^\circ \leq x \leq 360^\circ$

[4 marks]  
[4 markah]

- 
- 18 Diagram 5 shows a circle.

Rajah 5 menunjukkan sebuah bulatan

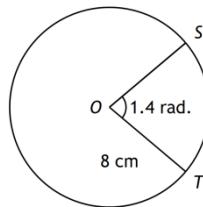


Diagram 5  
Rajah 5

Find the length of minor arc ST.

Carikan panjang lengkuk minor ST.

[2 marks]  
[2 markah]

- 
- 19 Given  $g(x) = \frac{3}{x^2} - \frac{3}{x} - 3x^2$ , evaluate  $g''(-3)$ .

Diberi  $g(x) = \frac{3}{x^2} - \frac{3}{x} - 3x^2$ , nilaikan  $g''(-3)$ .

[3 marks]  
[3 markah]

- 
- 20 The volume of liquid,  $V \text{ m}^3$ , in a tank is given by  $V = \frac{1}{3} h^3 + 15h$ , where  $h \text{ m}$  is the height of the liquid in the tank. Liquid is added into the tank at the rate of  $15 \text{ m}^3 \text{ s}^{-1}$ .



Isi padu cecair,  $V \text{ m}^3$ , dalam sebuah tangki diberi oleh  $V = \frac{1}{3} h^3 + 15h$ , dengan keadaan  $h \text{ m}$  ialah tinggi cecair dalam tangki itu. Cecair dimasukkan ke dalam tangki itu dengan kadar  $15 \text{ m}^3 \text{ s}^{-1}$ .

Find the rate of change of the height of liquid, in  $\text{m s}^{-1}$ , at the instant when its height is 9 m.

Carikan kadar perubahan tinggi cecair, dalam  $\text{m s}^{-1}$ , pada ketika tingginya ialah 9 m.

[3 marks]  
[3 markah]

- 
- 21 Given that  $\int_{-3}^5 f(x) dx = -7$  and  $\int_{-3}^5 [2f(x) + kx] dx = -6$ , find the value of  $k$ .

Diberi  $\int_{-3}^5 f(x) dx = -7$  dan  $\int_{-3}^5 [2f(x) + kx] dx = -6$ , carikan nilai  $k$ .

[3 marks]  
[3 markah]

- 
- 22 A school wants to choose 6 students from a group of 7 boys and 5 girls to participate in a national mathematics contest. Calculate the number of ways the students can be chosen if *Sebuah sekolah ingin memilih 6 orang pelajar daripada sekumpulan 7 orang lelaki dan 5 orang perempuan untuk menyertai suatu pertandingan matematik kebangsaan. Kirakan cara pelajar itu boleh dipilih jika*

(a) there is no restriction.

*tidak ada sebarang sekatan.*

(b) the students chosen consists of 4 boys and 2 girls.

*pelajar yang dipilih terdiri daripada 4 orang lelaki dan 2 orang perempuan.*

[4 marks]  
[4 markah]

- 
- 23 Diagram 1 shows the mass of a group of students.  
*Rajah 1 menunjukkan jisim sekumpulan pelajar.*

46, 48, 49, 67, 76, 53, 73, 64

Diagram 1  
*Rajah 1*

Find the interquartile range for the data.

Carikan julat antara kuartil bagi data itu.

[3 marks]  
[3 markah]



- 
- 24 A box contains 6 brown balls, 5 purple balls and 7 green balls. Two balls are drawn from the box at random, one after another. What is the probability of getting two balls with the same color?

*Sebuah kotak mengandungi 6 biji bola jingga, 5 biji bola ungu dan 7 biji bola hijau. Dua biji bola dikeluarkan dari kotak itu satu demi satu. Apakah kebarangkalian mendapat dua bola yang sama warna?*

[2 marks]  
[2 markah]

- 
- 25 The heights of students in school have a normal distribution with a mean of 159 cm and a standard deviation of 18 cm.

*Ketinggian murid di sebuah sekolah mempunyai taburan normal dengan min 159 cm dan sisisian piawai 18 cm.*

Find

Cari

- (a) the height of students which gives a standard score of 2.5.

*ketinggian murid apabila skor piawai ialah 2.5.*

- (b) the percentage of students with height greater than 129 cm.

*peratus murid yang ketinggiannya lebih daripada 129 cm.*

[4 marks]  
[4 markah]



**Answer:**

- 1 (a)  $\{(4, 2), (6, 2), (6, 3), (10, 2), (10, 5), (12, 2), (12, 3)\}$

(b) Many-to-many relation

*Hubungan banyak dengan banyak*

- (c)  $\{2, 3, 5\}$

- 2 (a) Let  $f^{-1}(4) = k$

So  $f(k) = 4$

$$7k + 5 = 4$$

$$k = -\frac{1}{7}$$

$$\text{Therefore, } f^{-1}(4) = -\frac{1}{7}$$

- (b) Let  $f^{-1}(x) = y$

So  $f(y) = x$

$$7y + 5 = x$$

$$7y = x - 5$$

$$y = \frac{x - 5}{7}$$

$$\text{Therefore, } f^{-1}(x) = \frac{x - 5}{7}$$

- 3 Given  $f(x) = 9x + 1$  and  $g(x) = -x - 7$ .

Diberi  $f(x) = 9x + 1$  dan  $g(x) = -x - 7$ .

$$gf(x) = g(f(x))$$

$$= g(9x + 1)$$

$$= -(9x + 1) - 7$$

$$= -9x - 8$$

$$gf(-5) = -9(-5) - 8$$

$$= 37$$

- 4  $y = 8 - x$

$$y = -4x^2 + 2x + p$$

$$-4x^2 + 2x + p = 8 - x$$

$$-4x^2 + 3x + p - 8 = 0$$

The equation does not have real roots

$$b^2 - 4ac < 0$$

$$(3)^2 - 4(-4)(p - 8) < 0$$

$$9 + 16p - 128 < 0$$

$$16p < 119$$

$$p < \frac{119}{16}$$

- 5  $-7x(2x - 1) = (1 - 6x)(2 - 8x)$

$$-14x^2 + 7x = 48x^2 - 20x + 2$$

$$-62x^2 + 27x - 2 = 0$$



$$\begin{aligned}
 x &= \frac{-(27) \pm \sqrt{(27)^2 - 4(-62)(-2)}}{2(-62)} \\
 &= \frac{-27 \pm \sqrt{233}}{-124} \\
 &= \frac{-27 + \sqrt{233}}{-124} \text{ or } \frac{-27 - \sqrt{233}}{-124} \\
 &= 0.09464 \text{ or } 0.3408
 \end{aligned}$$

- 6 (a)  $s = 7$   
 (b)  $t = 8$   
 (c)  $x = -7$

$$\begin{aligned}
 7 \quad 2^{x+4} - 2^{x+3} &= 128 \\
 2^x 2^4 - 2^x 2^3 &= 2^7 \\
 16(2^x) - 8(2^x) &= 2^7 \\
 8(2^x) &= 2^7 \\
 2^{x+3} &= 2^7 \\
 x + 3 &= 7 \\
 x &= 4
 \end{aligned}$$

$$\begin{aligned}
 8 \quad \log_7(6x + 7) - \log_7(8x + 2) &= 1 \\
 \log_7 \frac{6x + 7}{8x + 2} &= 1 \\
 \frac{6x + 7}{8x + 2} &= 7 \\
 6x + 7 &= 7(8x + 2) \\
 6x + 7 &= 56x + 14 \\
 x &= -\frac{7}{50}
 \end{aligned}$$

$$\begin{aligned}
 9 \quad \log_8 \left( \frac{64h}{k} \right) &= \\
 &= \log_8 64 + \log_8 h - \log_8 k \\
 &= \log_8 8^2 + \frac{\log_2 h}{\log_2 8} - \frac{\log_2 k}{\log_2 8} \\
 &= 2 + \frac{x}{3} - \frac{y}{3}
 \end{aligned}$$

$$\begin{aligned}
 10 \quad (a) \quad T_4 &= 20 \\
 ar^3 &= 20 \quad \text{--- (1)} \\
 T_4 + T_5 &= 25 \\
 20 + ar^4 &= 25 \\
 ar^4 &= 5 \quad \text{--- (2)} \\
 (2) \div (1), \quad & \\
 \frac{ar^4}{ar^3} &= \frac{5}{20}
 \end{aligned}$$



$$r = \frac{1}{4}$$

Substitute  $r = \frac{1}{4}$  into (1),

$$a\left(\frac{1}{4}\right)^3 = 20$$

$$a = 1280$$

(b) Sum to infinity

$$= \frac{a}{1 - r}$$

$$= \frac{1280}{1 - \left(\frac{1}{4}\right)}$$

$$= 1280 \times \frac{4}{3}$$

$$= 1706\frac{2}{3}$$

- 11 (a) Common difference =  $19 - 9$

$$= 10$$

(b) Sum

$$= S_{46} - S_6$$

$$= \frac{46}{2} [2(9) + 45(10)] - \frac{6}{2} [2(9) + 5(10)]$$

$$= 10764 - 204$$

$$= 10560$$

- 12 (a)  $r = \frac{-80}{10}$

$$= -8$$

(b)  $a = 10, r = -8$

$$S_n = -4550$$

$$\frac{a (1 - r^n)}{1 - r} = -4550$$

$$\frac{10 (1 - (-8)^n)}{1 + 8} = -4550$$

$$1 - (-8)^n = -4095$$

$$-8^n = 4096$$

$$-8^n = -8^4$$

$$n = 4$$



13 (a)  $\log_{10} y = \log_{10} p - 5(\log_{10} x)$   
 $= -5(\log_{10} x) + \log_{10} p$

(b) (i)  $\log_{10} p = Y\text{-intercept}$   
 $= 1$   
(ii)  $\log_{10} y = -5(2) + 1$   
 $= -9$   
 $q = \log_{10} y = -9$

14  $4x + ay = 2$

$$y = \frac{-4}{a}x + \frac{2}{a}$$

$$m_1 = \frac{-4}{a}$$

$$10x + 10y = -5$$

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

$$m_2 = -1$$

$$m_1 = m_2$$

$$\frac{-4}{a} = -1$$

$$a = 4$$

15 (a)  $\overrightarrow{OA} = \begin{pmatrix} 8 \\ 4 \end{pmatrix}$

(b) Unit vector in the direction of  $\overrightarrow{OA}$

$$= (8\hat{i} + 4\hat{j}) / \sqrt{8^2 + 4^2}$$

$$= (\underline{8}\hat{i} + \underline{4}\hat{j}) / 8.944$$

$$= \underline{\hat{i}} + \frac{1}{2}\underline{\hat{j}}$$

16  $\overrightarrow{AC}$

$$= \overrightarrow{AO} + \overrightarrow{AB}$$

$$= -\overrightarrow{OA} + \overrightarrow{AB}$$

$$= -(9\underline{i} + 3\underline{j}) + (-3\underline{i} + 4\underline{j})$$

$$= -9\underline{i} - 3\underline{j} - 3\underline{i} + 4\underline{j}$$

$$= -12\underline{i} + \underline{j}$$

17  $-16 \cos 2x = -36 \sin x - 23$

$$-16(1 - 2 \sin^2 x) = -36 \sin x - 23$$

$$-16 + 32 \sin^2 x = -36 \sin x - 23$$

$$32 \sin^2 x + 36 \sin x + 7 = 0$$

$$(8 \sin x + 7)(4 \sin x + 1) = 0$$



$$\sin x = -\frac{7}{8}$$

$$x = 241^\circ 3', 298^\circ 57'$$

or

$$\sin x = -\frac{1}{4}$$

$$x = 194^\circ 29', 345^\circ 31'$$

- 18 Length of minor arc  $ST$

$$= 8 \times 1.4$$

$$= 11.2 \text{ cm}$$

- 19  $y = 3x^{-2} - 3x^{-1} - 3x^2$

$$g'(x) = -6x^{-3} + 3x^{-2} - 6x$$

$$g''(x) = 18x^{-4} - 6x^{-3} - 6$$

$$= \frac{18}{x^4} - \frac{6}{x^3} - 6$$

$$g''(-3) = \frac{18}{(-3)^4} - \frac{6}{(-3)^3} - 6$$

$$= -5\frac{5}{9}$$

- 20  $\frac{dV}{dh} = h^2 + 15$

When  $h = 9$ ,

$$\frac{dV}{dh} = (9)^2 + 15$$

$$= 96$$

$$\frac{dh}{dV} = \frac{1}{96}$$

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

$$= \frac{1}{96} \times 15$$

$$= \frac{5}{32} \text{ m s}^{-1}$$

- 21  $\int_{-3}^5 [2f(x) + kx] dx = -6$

$$2\int_{-3}^5 f(x) dx + \int_{-3}^5 kx dx = -6$$

$$2(-7) + k[\frac{x^2}{2}]_{-3}^5 = -6$$

$$-14 + k(\frac{25}{2} - \frac{9}{2}) = -6$$

$$k = 1$$



22 (a) Number of ways =  ${}^{12}C_6$   
= 924

(b) Number of ways =  ${}^7C_4 \times {}^5C_2$   
= 350

23 Rearrange the data,

46 48 49 53 64 67 73 76

First quartile =  $\frac{48 + 49}{2} = 48.5$

Third quartile =  $\frac{67 + 73}{2} = 70$

Interquartile range

= 70 - 48.5

= 21.5

24 Probability

= P(both brown) + P(both purple) + P(both green)

=  $\frac{6}{18} \times \frac{5}{17} + \frac{5}{18} \times \frac{4}{17} + \frac{7}{18} \times \frac{6}{17}$

=  $\frac{46}{153}$

25 (a)  $\mu = 159$ ,  $\sigma = 18$

$$Z = \frac{X - \mu}{\sigma}$$

$$2.5 = \frac{X - 159}{18}$$

$$45 = X - 159$$

$$X = 204 \text{ cm}$$

(b)  $P(X > 129) = P(Z > \frac{129 - 159}{18})$

=  $P(Z > -1.667)$

=  $1 - P(Z > 1.667)$

=  $1 - 0.0478$

= 0.9522

Percentage = 95.22%