

DUNMAN SECONDARY SCHOOL

CANDIDATE
NAME

CLASS

INDEX
NUMBER

PRELIMINARY EXAMINATION 2025 SECONDARY 4 EXPRESS/ 5 NORMAL ACADEMIC

MATHEMATICS

4052/01

Paper 1

2 hours 15 minutes

Solutions

Qn	Answer
1(a)	Inconsistent y -axis scale
1(b)	The revenue growth appears to be more than doubled from 2020 compared to 2024 when in actual fact only increased from about \$500 000 to \$800 000.

Qn	Answer
2	In Italy, $830 \times 1.4893 = \\$1236.119$ In Singapore, $830 \div 0.6747 = \$1230.176375$ Difference = \$5.94

Qn	Answer
3(a)	$\sin x = \frac{1}{3}$ $x = 19.47122\dots \text{ or } 160.5287\dots$ $= 19.5^\circ \text{ or } 160.5^\circ \text{ (1 d.p.)}$
3(b)	$26^\circ = 0.45378\dots = 0.454 \text{ (3 s.f.)}$

Qn	Answer
4	Amount of liquid in bottles B and C $= 300 \div 15 \times 13 = 260 \text{ ml}$ Amount of liquid in bottle $A = 40 \text{ ml}$ Amount of liquid left in bottle A $= 260 \div 65 \times 7 = 28 \text{ ml}$ $n = 40 - 28 = 12$ <u>OR</u> $2 : 8 : 5$ is equivalent to $10 : 40 : 25$ 75 units rep. 300 ml 1 unit rep. 4 ml $n = 4 \times (10 - 7) = 12$

Qn	Answer
5(a)	$\left(\frac{27a^{12}}{b^3}\right)^{-\frac{2}{3}}$ $= \left(\frac{b^3}{27a^{12}}\right)^{\frac{2}{3}}$ $= \frac{b^2}{9a^8}$
5(b)	$13 \times 9^2 - 4 \times 3^4 = 3^p$ $13 \times 3^4 - 4 \times 3^4 = 3^p$ $3^4(13 - 4) = 3^p$ $3^4 \times 3^2 = 3^p$ $p = 6$

Qn	Answer
6	$F = \frac{k}{r^2}$ $F_1 = \frac{k}{(3r)^2} = \frac{k}{9r^2} = \frac{1}{9} \left(\frac{k}{r^2} \right) = \frac{1}{9} F$ He is not correct since the force should be $\frac{1}{9}$ instead.

Qn	Answer
7(a)	$300 \text{ km} \div 2 \text{ hour} = 150 \text{ km/h}$
7(b)	Since distance is rounded down and time is rounded up, this speed will be lower than the actual speed.
7(c)	227 km/h $= 227 \times 1000 \div 3600$ $= 63.1 \text{ m/s}$

Qn	Answer
8(a)	$16a^2b - 8ab^2$ $= 8ab(2a - b)$
8(b)	$3c - 4d + 3cd - 4$ $= 3c(1 + d) - 4(1 + d)$ $= (3c - 4)(1 + d)$

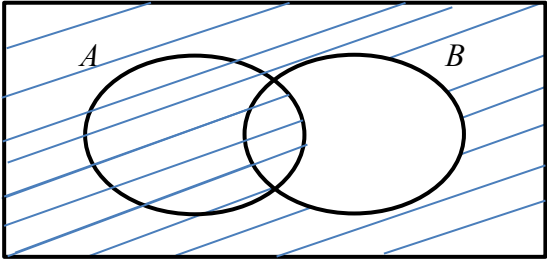
Qn	Answer
9	$29 \text{ cm}^2 : 728.6 \text{ km}^2$ $\sqrt{29} \text{ cm} : \sqrt{728.6} \text{ km}$ $5.3852 \text{ cm} : 26.993 \text{ km} (5 \text{ s.f.})$ $1 \text{ cm} : 5.0124 \text{ km} (5 \text{ s.f.})$ $1 : 501244$ $1 : 5 \times 10^5$ $n = 5 \times 10^5$

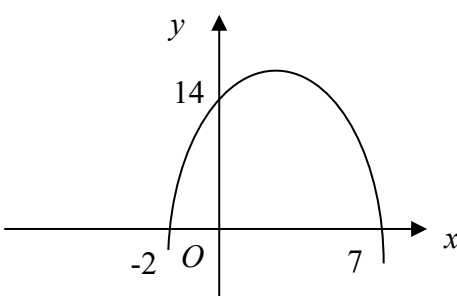
Qn	Answer
10	$\frac{5x}{18} - \frac{5x+12}{54} - \frac{2(x-1)}{27}$ $= \frac{15x - 5x - 12 - 4(x-1)}{54}$ $= \frac{10x - 12 - 4x + 4}{54}$ $= \frac{6x - 8}{54}$ $= \frac{3x - 4}{27}$

Qn	Answer
11	$OD = OB$ (radius of circle) $OC = OA$ (radius of circle) $CD = AB$ (equal chords) Therefore, triangles OAB and OCD are congruent by SSS congruency test.

Qn	Answer
12	$\frac{2x^2 + 7x - 15}{16x^4 - 81}$ $= \frac{(2x-3)(x+5)}{(4x^2)^2 - 9^2}$ $= \frac{(2x-3)(x+5)}{(4x^2-9)(4x^2+9)}$ $= \frac{(2x-3)(x+5)}{(2x-3)(2x+3)(4x^2+9)}$ $= \frac{x+5}{(2x+3)(4x^2+9)}$

Question	Answer
13(a)	$7 - 10x + x^2$ $= x^2 - 10x + 7$ $= (x-5)^2 - 5^2 + 7$ $= (x-5)^2 - 18$
13(b)	$x = 5$

Question	Answer
14(a)(i)	1, 4, 6, 8, 9, 10, 12, 14
14(a)(ii)	Since perfect squares have more than 2 factors, they will never be prime numbers. Hence, $X \cap Y = \phi$
14(b)	ξ 

Question	Answer
15	

Question	Answer
16	$\frac{4}{3}\pi(2r)^3 = 2 \times \frac{1}{3}\pi\left(\frac{2}{3}r\right)^2 \times 10h$ $\frac{32\pi r^3}{3} = \frac{80\pi r^2 h}{27}$ $32r \times 27 = 3 \times 80h$ $864r = 240h$ $\frac{h}{r} = \frac{864}{240}$ $h:r = 18:5$

Question	Answer
17	angle $ABC = 108^\circ$ angle $FBC = 360^\circ - 108^\circ - 100^\circ$ ($\angle$s at a point) $= 152^\circ$ exterior angle $= 180^\circ - 152^\circ = 28^\circ$ for regular polygon $= \frac{360^\circ}{28^\circ}$ $= 12.85\dots$ not whole number For a regular polygon, they have equal angles. Hence, 360° is not divisible by 28°, the second polygon is not regular.

Question	Answer
18(a)	$\sqrt{(-4)^2 + (-3)^2} = 5$
18(b)	gradient = $\frac{-3}{-4} = \frac{3}{4}$ Equation: $y = \frac{3}{4}x + c$ $-5 = \frac{3}{4}(2) + c$ $c = -\frac{13}{2}$ $y = \frac{3}{4}x - \frac{13}{2} \text{ or } -6\frac{1}{2} \text{ or } -6.5$
18(c)	$x\text{-coordinates} = 2 + \frac{3}{4}(4) = 5$ $y\text{-coordinates} = -5 + \frac{3}{4}(3) = -2\frac{3}{4}$ $R = (5, -2.75)$

Question	Answer
19	$16 = ka^0 \Rightarrow k = 16$ $64 = 16a^{-2}$ $a^2 = \frac{1}{4}$ $a = \frac{1}{2} \text{ (rej. -ve)}$

Question	Answer
20	$\frac{A_1}{A_2} = \left(\frac{l_1}{l_2}\right)^2$ $\frac{4}{5} = \left(\frac{l_1}{30}\right)^2$ $\sqrt{\frac{4}{5}} = \frac{l_1}{30}$ $l_1 = 30 \times \sqrt{\frac{4}{5}} = 26.832 \text{ cm (5 s.f.)}$ $\text{length} = 30 - 26.832 = 3.17 \text{ (3 s.f.)}$

Question	Answer
21(a)	Probability = $\frac{5}{9} \times \frac{4}{8} + \frac{4}{9} \times \frac{3}{8} = \frac{4}{9}$
21(b)	Probability = $\frac{5}{9} \times \frac{4}{8} + \frac{4}{9} \times \frac{5}{8} = \frac{5}{9}$

Question	Answer
22(a)	mean = $\frac{15 \times 4.25 + 29 \times 4.75 + 12 \times 5.25 + 34 \times 5.75 + 10 \times 6.25}{100}$ $= 5.225$ mean = \$5225
22(b)	Standard deviation = \$637.87 or \$638
22(c)	Mean remains unchanged, standard deviation becomes smaller

Question	Answer
23(a)	Angle NAB = 52° Angle N ₁ BA = $180^\circ - 52^\circ = 128^\circ$ (interior angles, NA // N ₁ B) Bearing of A from B = $360^\circ - 128^\circ = 232^\circ$
23(b)	BP = 2.1 cm

Question	Answer
24(a)	$5y = 6x - 2 \times 2: 10y = 12x - 4 \text{ -- (1)}$ $2y = 5x - 6 \times 5: 10y = 25x - 30 \text{ -- (2)}$ $(2) - (1): 13x - 26 = 0$ $x = 2, y = 2$ $\therefore (2, 2)$
24(b)	For $py = 3x - 1$ not to intersect with $5y = 6x - 2$, they must be parallel. $y = \frac{3}{p}x - \frac{1}{p}$ $\frac{3}{p} = \frac{6}{5} \Rightarrow p = \frac{5}{2}$ $l_3: y = \frac{6}{5}x - \frac{2}{5}$ Since line l_1 and l_3 have the same equation, they will intersect. Therefore, it is not possible to find a value of p that the lines will not intersect.

Question	Answer
25(a)	$\mathbf{Q} = \begin{pmatrix} 1.20 \\ 1.50 \\ 1.80 \end{pmatrix}$
25(b)	$\mathbf{T} = \mathbf{PQ}$ $= \begin{pmatrix} 60 & 80 & 50 \\ 50 & 90 & 70 \end{pmatrix} \begin{pmatrix} 1.20 \\ 1.50 \\ 1.80 \end{pmatrix}$ $= \begin{pmatrix} 72 + 120 + 90 \\ 60 + 135 + 126 \end{pmatrix}$ $= \begin{pmatrix} 282 \\ 321 \end{pmatrix}$
25(c)	282 and 321 represents the total revenue by Class A and class B respectively.
25(d)	$\mathbf{D} = (0.8 \quad 0.9)$

Question	Answer
26(a)	$2 \times 3^3 = 54$ and $2^3 \times 3^2 = 72$
26(b)(i)	All prime factors have even indices/powers Or $2^4 \times 3^6 = (2^2 \times 3^3)^2$ and therefore, a perfect square
26(b)(ii)	$11664 \div \frac{6}{m}$ $= 2^4 \times 3^6 \div \frac{6}{m}$ $= 2^4 \times 3^6 \times \frac{m}{6}$ $= 2^3 \times 3^5 \times m$ $m = 3$

Question	Answer
27(a)	acceleration = $\frac{5-3}{10-8} = 1 \text{ m/s}^2$
27(b)(i)	Distance = $\frac{1}{2}(T+10) \times 5 = 25 + 2.5T$ OR Distance = $5 \times 10 + \frac{1}{2} \times 5 \times (T-10) = 25 + 2.5T$
27(b)(ii)	Acceleration after 8 seconds = 1 m/s^2 Let speed of B at $T = s \text{ m/s}$ $\frac{s-3}{T-8} = 1$ $s = T - 5$ Distance travelled by B $= 3 \times 8 + \frac{1}{2}(3+s)(T-8)$ $= 24 + \frac{1}{2}(3+T-5)(T-8)$ $= 24 + \frac{1}{2}(T-2)(T-8)$ When A and B meet, $24 + \frac{1}{2}(T-2)(T-8) = 25 + 2.5T$ $\frac{1}{2}(T-2)(T-8) = 2.5T + 1$ $T^2 - 10T + 16 = 5T + 2$ $T^2 - 15T + 14 = 0$ (shown)
27(b)(iii)	$(T-14)(T-1) = 0$ $T = 14$ or $T = 1$ (rej.)