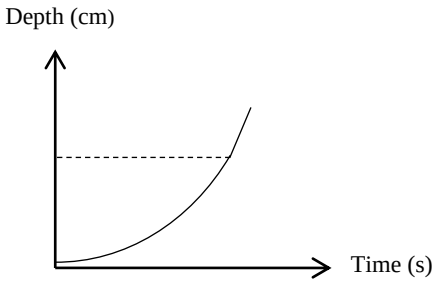
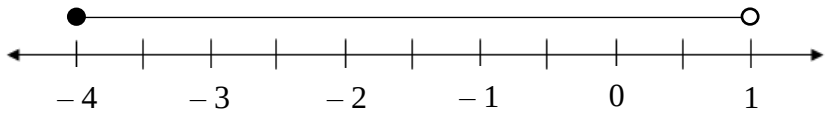
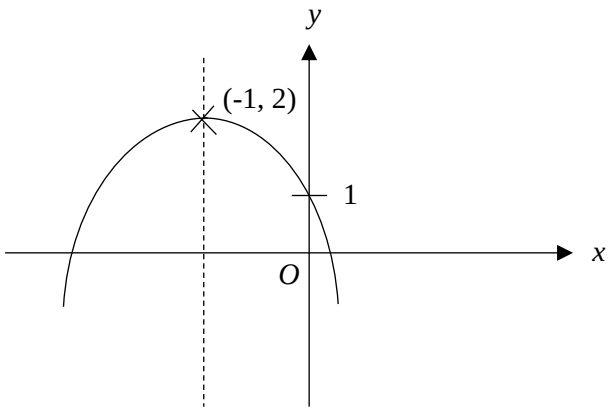
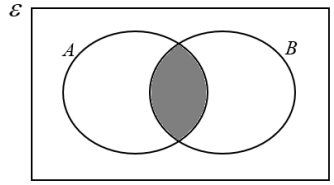
Broadrick Secondary School Prelims P1 2023
Elementary Mathematics - Secondary Four Express
Mark Scheme

Qn	Mark Scheme
1(a)	31.764
1(b)	32
2(a)	$81p^6$
2(b)	7
3(a)	*A*
3(b)	*D*
4	The vertical axis of the bar chart does not start from zero. From the bar chart, it seems like the exchange rate for MYR is more than double for every 1 Singapore dollar in 2022 as compared to 2018. However, by calculation, the increase is only about 7%.
5	1st equation: $y = -ax + 8$ $\frac{2x+3y}{6} = 5$ $2x + 3y = 30$ $3y = -2x + 30$ 2nd equation: $y = -\frac{2}{3}x + 10$ By comparison, $a = \frac{2}{3}$.
6	
7(a)	$2^2 \times 3 = 12$
7(b)	$m = 2^2 \times 3^2 \times 5^2$ $= 900$
8(a)	$-3 \le x + 1$ and $x + 1 < \frac{5-x}{2}$ $-3 - 1 \le x$ $2x + 2 < 5 - x$ $x \ge -4$ $3x < 3$ $x < 1$ Solution: $-4 \le x < 1$
8(b)	

9	$p(3q-1)=2(1+q)$ $3pq-p=2+2q$ $3pq-2q=2+p$ $q(3p-2)=2+p$ $q=\dfrac{2+p}{3p-2}$
10(a)	
10(b)	$x=-1$
11	$\dfrac{2}{x+3}+\dfrac{8}{(3-x)(3+x)}=2$ $\dfrac{2(3-x)+8}{(x+3)(3-x)}=2$ $6-2x+8=2(3x-x^2+9-3x)$ $14-2x=-2x^2+18$ $2x^2-2x-4=0$ $x^2-x-2=0$ $(x+1)(x-2)=0$ $x=-1 \quad \text{or} \quad x=2$
12	Volume of remaining cube $=10\times10\times10-\dfrac{1}{3}\times\left(\dfrac{1}{2}x^2\right)\times x$ $987.652=1000-\dfrac{1}{6}x^3$ $\dfrac{1}{6}x^3=1000-987.652$ $x^3=6(12.348)$ $x=\sqrt[3]{74.088}$ $x=4.2$
13(a)	$=5(y^2+2x)(y^2-2x)$
13(b)	$=3a(x-2y)-b(x-2y)$ $=(x-2y)(3a-b)$
14	A : B : C 1.5 : 1 1 : 0.9 15 : 10 : 9 Box *A* : Box *C* 15 : 9

15	$\angle YXZ = 50°$ (vert. opp. $\angle$s) $\angle XZY = 90°$ (adj. $\angle$s on a st. line) $\angle XYZ = 180 - 90 - 50$ ($\angle$ sum of Δ) $= 40^o$ $\angle EDC = \dfrac{(5-2)\times 180}{5}$ $= 108^o$ $\angle ECD = \angle CED = \dfrac{180-108}{2}$ (base $\angle$s of isos. Δ) $= 36^o$ $\angle CEY = 180 - 36 - 140$ ($\angle$ sum of Δ) $= 4^o$
16(a)	$\dfrac{6-4}{4-8} = \dfrac{y-0}{x-6}$ (Grad. of *AB* and *DC*) $y = -\dfrac{1}{2}x + 3$ --- (1) $\dfrac{4-0}{8-6} = \dfrac{y-6}{x-4}$ (Grad. of *AD* and *BC*) $y - 6 = 2x - 8$ $y = 2x - 2$ --- (2) Sub (2) into (1), $2x - 2 = -\dfrac{1}{2}x + 3$ $4x - 4 = -x + 6$ $5x = 10$ $x = 2$ When $x = 2$, from (2), $y = 2$ Coordinates of $D = (2, 2)$ *(Also accept use of vectors or mid-points)*
16(b)	Length of $AB = \sqrt{(6-4)^2 + (4-8)^2} = \sqrt{20}$ cm *OR* Length of $CD = \sqrt{(2-0)^2 + (2-6)^2} = \sqrt{20}$ cm Length of $BC = \sqrt{(4-0)^2 + (8-6)^2} = \sqrt{20}$ cm *OR* Length of $DA = \sqrt{(6-2)^2 + (4-2)^2} = \sqrt{20}$ cm Since *ABCD* is a parallelogram and their adjacent lengths are equal, *ABCD* is also a rhombus.
17(a)	Retardation is gradient of the speed-time graph. Grad $= \dfrac{0-2}{12-6} = -\dfrac{1}{3}$ Hence retardation is $\dfrac{1}{3}$ km/min^2.
17(b)	Distance travelled is area under the graph.

	$\frac{1}{2}\times 12\times v=\frac{1}{2}\times(2+12)\times 2$ $6v=14$ $v=\frac{7}{3}$
18	$T_1=k\sqrt{L}$ $k=\frac{T_1}{\sqrt{L}}$ $T_{new}=\frac{T_1}{\sqrt{L}}\times\sqrt{9L}$ $T_{new}=3T_1$ % increase = $\frac{3-1}{1}\times 100\%$ = 200 %
19(a)	ε = {1, 2, 3, 4, 6, 9, 12, 18, 36} A = {3, 6, 9, 12, 18, 36} B = {6, 12, 18, 36}
19(b)	$(A\cap B)'$ = {1, 2, 3, 4, 9}
19(c)	
20(a)	\$148
20(b)	C = \$40 x = \$36
20(c)	Method 1: Draw the straight-line graph to show Lionel's plumbing cost. Lionel's claim is valid for plumbing repairs that is less than 2.8 hours but not valid if it is more than 2.8 hours. Method 2: Show working for cost of Lionel's plumbing cost for 2 hours and 3 hours, with the assumption that rate is charged on an hourly basis. Lionel's claim is valid for plumbing repairs that is 2 hours or less but not valid if it is 3 hours or more.
21(a)	Original value = $\frac{289000}{85}\times 100$ = AUD\$340 000
21(b)	Interest = $289000\left(1+\frac{4/2}{100}\right)^{3\times 2}-289000$ = 36460.94 = AUD\$36461 (nearest AUD\$)

21(c)

Price of printer in AUD$ = 4500×1.52
= AUD$6840

Price of printer in SGD$ = $\frac{6840}{1.13}$
= SGD$6053.10 (to nearest cents)

22(a)

Row	Number Triangle	Sum of row	Last element of row
6	31 33 35 37 39 41	216	41

22(b)

n^3

22(c)

$n^2 + n - 1 = 159$
$n^2 + n - 160 = 0$

It is not possible for the last element of the row to be 159 as the quadratic equation cannot be solved to get integer value for *n*.

23(a)

$$C = \begin{pmatrix} 9 \\ 10 \\ 22 \end{pmatrix}$$

23(b)

$$V = \begin{pmatrix} 5 & 15 & 2 \\ 3 & 6 & 1 \end{pmatrix}\begin{pmatrix} 9 \\ 10 \\ 22 \end{pmatrix}$$
$$= \begin{pmatrix} 45+150+44 \\ 27+60+22 \end{pmatrix}$$
$$= \begin{pmatrix} 239 \\ 109 \end{pmatrix}$$

23(c)

The elements in V represents the total cost, in dollars, to make 1 table and 1 chair respectively.

23(d)

$W = \begin{pmatrix} 3 & 12 \end{pmatrix}$

24(a)

Grad = $\frac{10-3}{3-0}$
= $\frac{7}{3}$

Eqn of *PSR* : $y = \frac{7}{3}x + 3$

24(b)

R = (- 1.5 , - 0.5)

24(c)

Area of triangle *PQS* = $\frac{1}{2} \times 8 \times 7$
= 28 units²

25(a)	$\angle OCD = \frac{\pi}{6}$ rad. $\sin\frac{\pi}{6} = \frac{r}{OC}$ $\frac{1}{2} = \frac{r}{OC}$ $OC = 2r$ $R = 2r + r$ $R = 3r$ (Shown)
25(b)	Area of 2 triangles = $\left(\frac{1}{2}\times 2r\times r\times\sin\frac{\pi}{3}\right)\times 2$ $=1.732r^2$ Area of unshaded major sector = $\frac{1}{2}r^2(2\pi - 2\times\frac{\pi}{3})$ $= \pi r^2 - \frac{\pi r^2}{3}$ $= \frac{2\pi r^2}{3}$ Area of sector ABC = $\frac{1}{2}(3r)^2\left(\frac{\pi}{3}\right)$ $=\frac{1}{2}(3r)^2\left(\frac{\pi}{3}\right)$ $= \frac{9\pi r^2}{6} = \frac{3\pi r^2}{2}$ Area of shaded region = $\frac{3\pi r^2}{2} - (1.732r^2 + \frac{2\pi r^2}{3})$ $= r^2(\frac{3\pi}{2} - (1.732 + \frac{2\pi}{3}))$ $= 0.886r^2$ (to 3SF)
26(a)	Mean mass of female members = $\frac{58+59+62+63+65+65+68+70}{8}$ = 63.75 kg
26(b)	Modal mass = 65 kg
26(c)	P(1 male>80 and 1 female <60) = $\frac{2}{7}\times\frac{2}{8}$ $= \frac{1}{14}$
26(d)	$75 \le x < 88$ **If the male member is 75 kg, he can be the 4th, 5th or 6th person in ascending order of mass, with median mass remaining at 75kg.* *If the male is more than 75kg and less than 88kg, he is not the heaviest and he can be the 6th person in ascending order of mass, with median mass remaining at 75kg.*