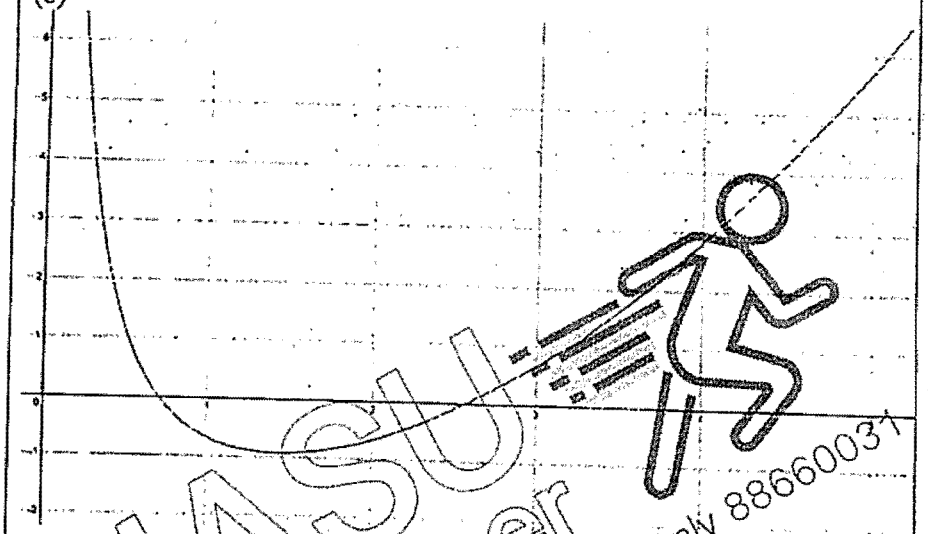
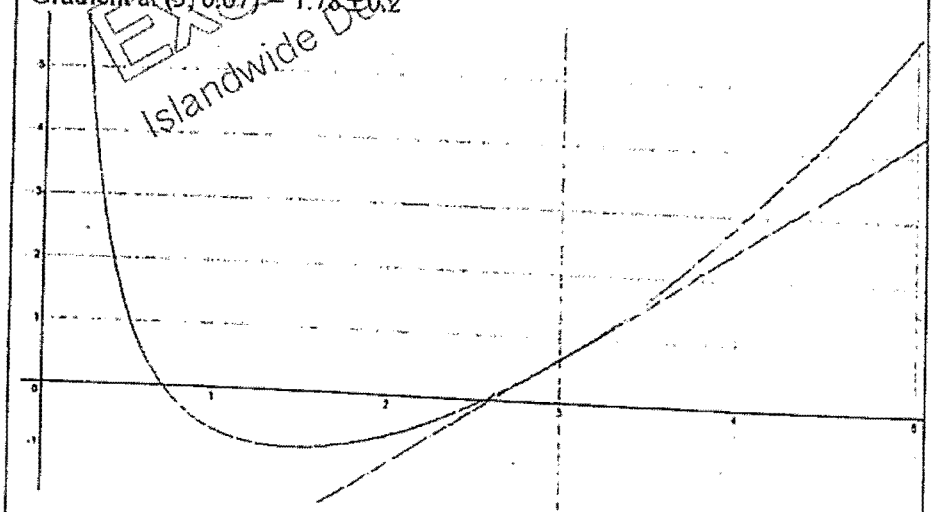
2019 4E5N Prelims EMath P2 Mark Scheme		
Qn	Solution	Marks
1a	$27a^4-3=3\left(9a^4-1\right)$ $=3\left[\left(3a^2\right)^2-1\right]$ $=3\left(3a^2-1\right)\left(3a^2+1\right)$ Comments: Students did not factorise $(9a^4-1)$	M1 A1
1b	(i) $\frac{2(x-1)^2}{4y^3}\div\frac{6y(x-1)}{8y^2}=\frac{2(x-1)^2}{4y^3}\times\frac{8y^2}{6y(x-1)}$ $=\frac{2(x-1)}{3y^2}$ Comments: Students made careless mistake as they cancelled the powers instead of applying the indices rules (ii) $\frac{3}{m-2}-\frac{2}{3m-1}=\frac{3(3m-1)-2(m-2)}{(m-2)(3m-1)}$ $=\frac{7m+1}{(m-2)(3m-1)}$ Comments: Students made mistake when they expand $-2(m-2)$.	B1 M1 A1

1c	$2^{2-x} = \frac{1}{\sqrt[3]{2^{5x+1}}}$ $2^{2-x} = 2^{-\frac{1}{3}(5x+1)}$ $2-x = -\frac{5}{3}x - \frac{1}{3}$ $\frac{2}{3}x = -\frac{7}{3}$ $x = -\frac{7}{2}$ Comments: Students did not apply the indices rules $\frac{1}{a^{-m}} = a^m$, $\sqrt[3]{a} = a^{\frac{1}{3}}$ and $1 = a^0$	M1 A1
1d	(i) $x^2 - 8x - 6 = (x-4)^2 - 16 - 6$ $= (x-4)^2 - 22$ Comments: Majority of the students did it correctly.	B1
	(ii) $(x-4)^2 - 22 = 0$ $(x-4)^2 = 22$ $x = 4 \pm \sqrt{22}$ $x = -0.7$ or $x = 8.7$ (to 1 dp) Comments: Many students did not follow the instruction and use the requested method. Some of them did not correct the answers to one decimal place.	M1 A1, A1
2	(a)(i) 3a - 2b (ii) $\frac{3}{7}$ (3a - 2b) (iii) 2a - b (iv) $a + \frac{1}{2}b$	B1 B1 B1 M1A1

	(v) $\overrightarrow{FD} = \overrightarrow{FB} + \overrightarrow{BC} + \overrightarrow{CD}$ $= -\frac{1}{2}(2\mathbf{a} - \mathbf{b}) + \frac{1}{2}(2\mathbf{b}) + \frac{3}{7}(3\mathbf{a} - 2\mathbf{b})$ $= \frac{2}{7}\mathbf{a} + \frac{9}{14}\mathbf{b}$	M1 A1
	(b)(i) $\frac{2}{3}$	B1
	(ii) $\frac{\text{Area of } \Delta OBA}{\text{Area of } \Delta OCE} = \frac{\frac{1}{2} \times OB \times OA \times \sin BOA}{\frac{1}{2} \times OC \times OE \times \sin BOA}$ $= \frac{\frac{1}{2} \times 1 \times 2 \times \sin BOA}{\frac{1}{2} \times 2 \times 3 \times \sin BOA}$ $= \frac{1}{3}$ <u>Comments:</u> Badly done. Students did not consider the direction of the vectors, answers without vector notation. Could not find the ratio of areas, answers given with units.	M1 A1
3a	(i) $\frac{19600}{98000} \times 100\% = 20\%$	B1
	(ii) **Bank OCC** $A = 78400\left(1 + \frac{\frac{2.78}{2}}{100}\right)^{14} = \$95114.73$ Interest paid $= 95114.73 - 78400 = \$16714.73$ **Bank DBB**	B1 B1

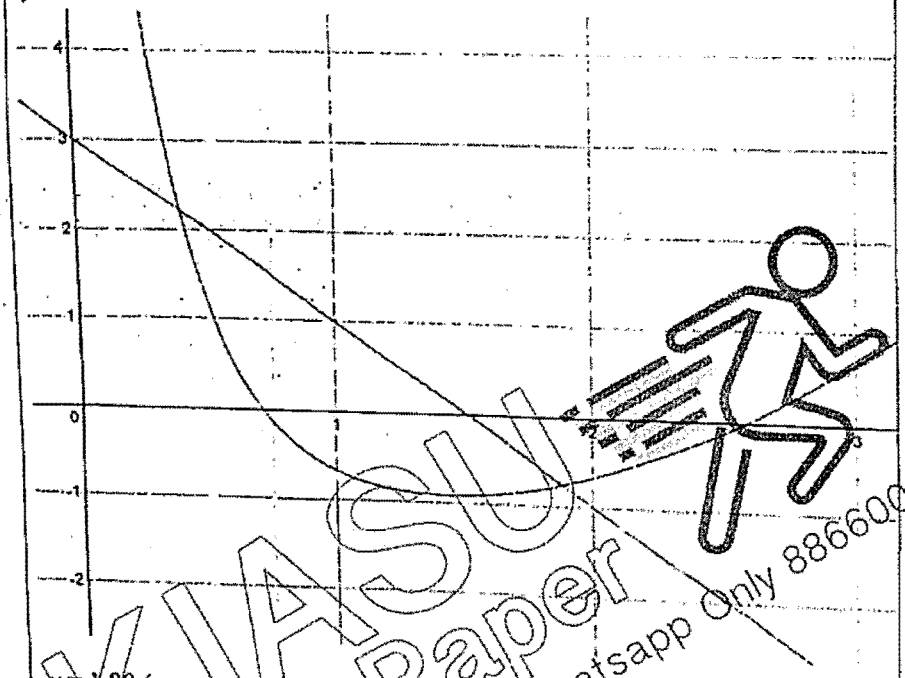
	$I = 78400 \times \frac{2.99}{100} \times 7 = \$16409.12$ Choose Bank DBB as lesser interest charged. Comments: Students thought that the bank with more interest is to be chosen. Forgot that this is a loan.	B1 B1
3b	(i) $2.25 \times 51 = \$114.75$ (ii) $2.08 \times 51 = RM106.08$ (iii)(a) Converting to Singapore dollars, Celine paid $\frac{106.08}{3.05} = \$34.78$ She saves S$79.97 weekly (iii)(b) $\frac{79.97}{114.75} \times 100\% = 69.691\% \approx 69.7\%$ Comments: Students did not give answers correct to 2 decimal places.	B1 B1 M1 A1 B1
4	(a) (i) Angle DAT = 90° (tangent perpendicular to radius Angle AOD = 90° − 40° = 50° (sum of angles in a triangle) (ii) Angle AOC = 50° × 2 = 100° Angle ABC = 100° ÷ 2 = 50° (angle at centre = 2 times angle at Circumference) (iii) Angle ADC = 180° − 50° = 130° (angles in opp segments) (iv) Angle OCD = $\frac{180° - 50°}{2} = 65°$ (Base angles of isosceles triangle) Comments: Students did not write the angle properties properly.	B1 B1 M1 A1 B1 B1

	(b) $\tan 40^\circ = \frac{5}{TC}$ $TC = 5.9588\,cm$ Area of $\Delta OTC = \frac{1}{2} \times 5.9588 \times 5 = 14.897\,cm^2$ Area of sector $ODC = \frac{1}{2} \times (5)^2 \times \frac{50\pi}{180} = 10.908\ cm^2$ Area of shaded region $= 14.897 - 10.908 = 3.989 \approx 3.99\,cm^2$ Comments: Some students could not find the area of sector correctly. Did not convert the angle from degrees to radians correctly or choose the right formula for area of sector.	M1 M1 M1 A1
5	(a) $3^2 = 8^2 + 8^2 - 2(8)(8)\cos ABF$ $\angle ABF = \cos^{-1}\left(\frac{119}{128}\right)$ $= 21.61384575^\circ$ $= 21.6^\circ$ (shown) (b) Length of $BE = \sqrt{12^2 + 8^2} = 14.420\,cm$ Area of triangle $DCE = \frac{1}{2} \times 8 \times 8 \times \sin 21.614^\circ = 11.787\,cm^2$ Perpendicular height from E to $CD = \frac{2 \times 11.787}{8} = 2.94675\,cm$ Angle of elevation $= \sin^{-1}\left(\frac{2.94675}{14.422}\right) = 11.8^\circ$ Comments: Students used the wrong triangle EDB to find angle of elevation of E from B and assumed that $\angle EDB = 90^\circ$. (c)(i) Volume of prism $= 11.787 \times 12 = 141.447\,cm^3 \approx 141\,cm^3$	B1; B1 B1 M1 M1 A1 M1 A1

	(c)(ii)Since volume of prism equals to volume of hemisphere, Radius $= \sqrt[3]{\frac{141.447 \times 3}{2\pi}} = 4.0723\,cm \approx 4.07\,cm$ Comments: Students did not apply the formula to find volume of hemisphere.	M1 A1
6	(a) p = 1.08, q = 5.73 (b)  (c) $x = 0.7 \pm 0.1$ or $x = 2.6 \pm 0.1$ (d) Gradient at (3, 0.67) = 1.78 ± 0.2 	B1, B1 B1: correct plot B1: correct shape B1: correct scale and axes B1 B1 B1: draw the tangent line on graph B1 for the answer

(c)

$y = -2x + 3$



B1

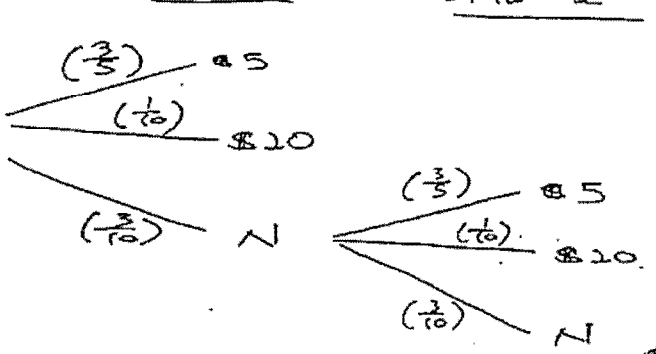
$x = 1.88$ (accept $x = 1.85$ to 1.9)

B1

Comments:

Many students did not answer the part: equation of the line.

7	(a)	B1: draw 1 B1: draw 2



(a)(i) $\frac{3}{10}$ — B1

(ii) $\frac{3}{5}+\frac{1}{10}+\left(\frac{3}{10}\times\frac{3}{5}\right)+\left(\frac{3}{10}\times\frac{1}{10}\right)=\frac{91}{100}$ — M1 A1

(iii) $\left(\frac{91}{100}\right)^2+2\left(\frac{91}{100}\times\frac{9}{100}\right)=\frac{9919}{10000}$ — M1 A1

(b)(i) \$400 — B1

(ii) $470-330=\$140$ — B1

(iii) $\frac{15}{80}\times100\%=18.75\%$ — M1 A1

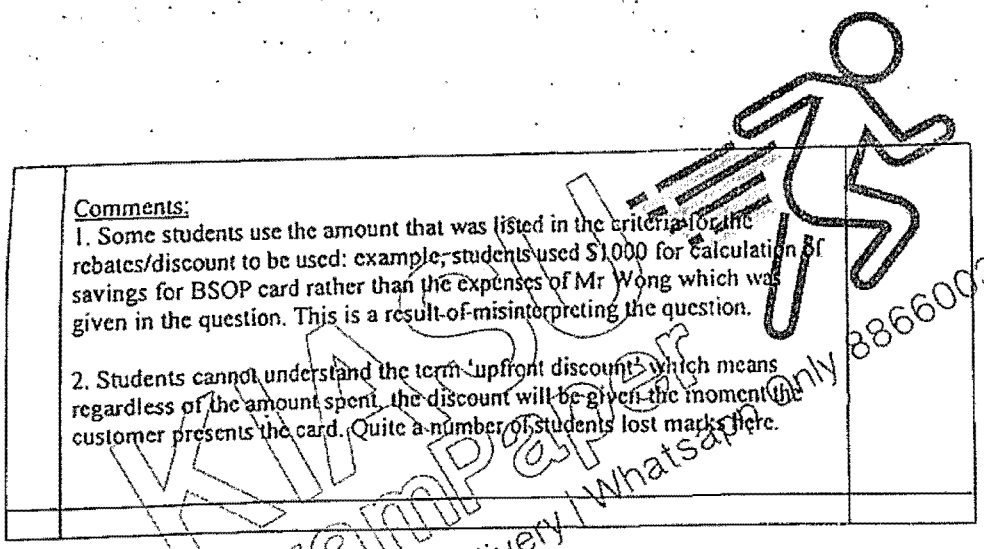
Comments:

1. For part (a), many students drew the tree diagram for the 2nd draw for the cash vouchers side. This would not have happened if they understood the question that once the customer drew a cash voucher, they will not be given a chance to draw again.

2. For part (aiii), many students did not know that they should use the answer to part (aii) to help them find the answer. They went on to use other ways to find the answer which was wrong.

	3. For part (biii), many left their answers as 18.8 (correct to 3 sf), which is not right as the answer is 18.75 which is an exact answer, hence had to penalize students who rounded their answers to 3 sf.	
8	(a) $T_5 = \frac{1}{48}$ (b) $T_4 = \frac{1}{17}$ $T_5 = \frac{1}{26}$ $Sum = \frac{1}{17} + \frac{1}{26} = \frac{43}{442}$ (c)(i) $T_5 = 5^3 + 13 = 138$ (ii) $T_n = n^3 + 2n + 3$ $a = 1, b = 0, c = 2, d = 3$ Comments: This question is ok and most students are able to get full marks. Those who did not made mistakes/gave up the last part which they should not have as it was just an expansion of algebraic expression.	B1 B1 B1 B1 B1 B2: all correct B1: any 1 correct
9	(a)(i) $\text{Bearing} = 270^\circ + \cos^{-1}\left(\frac{11^2 + 5^2 - 8^2}{2 \times 11 \times 5}\right) = 270^\circ + 41.801^\circ \approx 311.8^\circ$ (ii) $\text{Bearing} = 180^\circ - (90^\circ - 41.8^\circ) = 131.8^\circ$ (iii) $\frac{8}{\sin 41.8} = \frac{11}{\sin ABC}$ $\angle ABC (\text{acute}) = 66.4^\circ$ However, angle ABC is obtuse (seen from the diagram), hence actual angle ABC $= 180^\circ - 66.4^\circ = 113.6^\circ$ Reflex $\angle ABC = 360^\circ - 113.6^\circ = 246.4^\circ$ OR	M2 A1 M1 A1 M1 A1 M1 A1 B1 B1

	$\cos ABC = \frac{8^2+5^2-11^2}{2\times5\times8}$ Angle $ABC = 113.5782^\circ$ Reflex $\angle ABC = 360^\circ - 113.5782^\circ = 246.4^\circ$ (to 1 dp) (iv) Area $= \frac{1}{2}\times11\times5\times\sin 41.8 = 18.3\,km^2$ (b) Point B. Point B is nearer to point A than point C <u>Comments:</u> 1. Students lost marks in part (iii), especially those who used sine rule to get the angle ABC. Many did not find the obtuse angle ABC and used the acute angle ABC instead as they have forgotten that $\sin\theta = \sin(180^\circ - \theta)$. 2. Many students leave their answers to 3 sf for angles which is incorrect as it should be to 1 dp. Pls take note of this small but important detail.	
10	<u>CBSH Card</u> Petrol savings = $0.14\times350 + 0.05\times350 = \$66.50$ Dining Savings = $0.05\times400 = 20$ Grocery savings = $0.05\times100 = 5$ Total savings = \$91.50 <u>BSOP Card</u> Petrol savings = $0.15\times350 = \$52.50$ Dining Savings = 0 (as minimum monthly spending on the card is less than \$1000) Grocery savings = $0.05\times100 = 5$ Total savings = \$57.50 <u>CBCO Card</u> Petrol savings = $0.14\times350 + 0.043\times350 = \$64.05$ Dining Savings = $0.05\times400 = 20$ Grocery savings = $0.05\times100 = 5$ Total savings = \$89.05 He should apply for the CBSH card	B1 B1 B1 B1 B1 B1 B1 B1 B1



Comments:
1. Some students use the amount that was listed in the criteria for the rebates/discount to be used: example, students used $1000 for calculation of savings for BSOP card rather than the expenses of Mr Wong which was given in the question. This is a result of misinterpreting the question.

2. Students cannot understand the term 'upfront discount' which means regardless of the amount spent, the discount will be given the moment the customer presents the card. Quite a number of students lost marks here.