

Name: _____

Index No: _____



Anglo-Chinese School (Barker Road)

END-OF-YEAR EXAMINATIONS 2018

SECONDARY TWO
EXPRESS

MATHEMATICS 4048
PAPER ONE

1 hours 15 minutes

READ THESE INSTRUCTIONS FIRST

Write your index number and name on all the work you hand in.
Write in dark blue or black pen.
You may use an HB pencil for any diagrams or graphs.
Do not use staples, paper clips, glue or correction fluid.

Answer **all** questions.

If working is needed for any question it must be shown with the answer.

Omission of essential working will result in loss of marks.

The use of an approved scientific calculator is expected, where appropriate.

If the degree of accuracy is not specified in the question, and if the answer is not exact, give your answer to three significant figures. Give answers in degrees to one decimal place.

For π , use either your calculator value or 3.142, unless the question requires the answer in terms of π .

At the end of the examinations, fasten your work securely together.

The number of marks is given in brackets [] at the end of each question or part question.

The total of the marks for this paper is 60.

For Examiner's Use

For Examiner's Use

Mathematical Formulae*Compound Interest*

$$\text{Total amount} = P \left(1 + \frac{r}{100} \right)^n$$

Mensuration

$$\text{Curved Surface area of cone} = \pi r l$$

$$\text{Surface area of a sphere} = 4\pi r^2$$

$$\text{Volume of a cone} = \frac{1}{3} \pi r^2 h$$

$$\text{Volume of a sphere} = \frac{4}{3} \pi r^3$$

$$\text{Area of a triangle} = \frac{1}{2} ab \sin C$$

$$\text{Arc length} = r\theta, \text{ where } \theta \text{ is in radians}$$

$$\text{Sector area} = \frac{1}{2} r^2 \theta, \text{ where } \theta \text{ is in radians}$$

Trigonometry

$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

$$a^2 = b^2 + c^2 - 2bc \cos A$$

Statistics

$$\text{Mean} = \frac{\sum fx}{\sum f}$$

$$\text{Standard deviation} = \sqrt{\frac{\sum fx^2}{\sum f} - \left(\frac{\sum fx}{\sum f} \right)^2}$$

For
Examiner's
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Use

- 1 Estimate correct to 1 significant figure, the value of
- $$\frac{0.049608 \times 599.867}{0.01965}$$

Answer _____ [2]

- 2 Simplify $(3x-5)(x-6) - x(3x-4)$.

Answer _____ [2]

- 3 Factorise completely
(a) $12x^2 - 21x + 9$,

Answer (b) _____ [2]

- (b) $15ax - 10ay - 21bx + 14by$.

Answer (c) _____ [2]

For
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- 4 Petrol costs x cents per litre. Mr Yip intends to take a road trip during the holidays. Find an expression for the number of litres of petrol that can be bought for y dollars.

Answer _____ litres [2]

- 5 The average capacity of a memory card in a digital camera is 10 GB and each digital photo takes up to 1.3 MB on average. If a salesman claims that the memory card can store more than 7000 photos, is his claim true? Justify your answer with clear working.
(1GB = 10^9 B, 1MB = 10^6 B)

Answer _____
_____ [2]

- 6 Given that $2^n \times \sqrt{2} \div 2^{-5} = 1$, find the value of n .

Answer $n =$ _____ [2]

For
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Use

For
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Use

- 7 (a) Express 12600 as a product of its prime factors.

Answer (a) _____ [1]

- (b) Given that $14700 = 2^2 \times 3 \times 5^2 \times 7^2$. The greatest number that will divide 12600, 14700 and x exactly is 70. What are the least possible values of x .

Answer (b) _____ [2]

- 8 Tom, Sam and Matt compete one lap of a circular track in 12, 15 and 18 minutes respectively. They start together. They run in the same direction and maintain the same lap times.
How many more laps will Tom have completed than Matt when all three of them next meet on the starting line together?

Answer _____ [3]

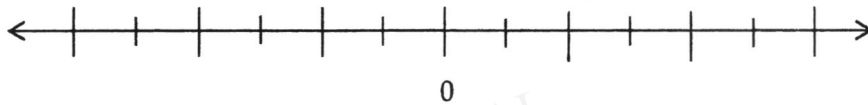
For
Examiner's
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Use

9 (a) Solve the inequality $-3 \leq 3x + 3 < \frac{4x + 9}{2}$.

Answer (a) _____ [2]

(b) Represent the solution set in (a) on the number line below.

Answer _____ [1]



10 P is directly proportional to the square of r and $P = 200$ when $r = 5$.

(a) Express the P in terms of r .

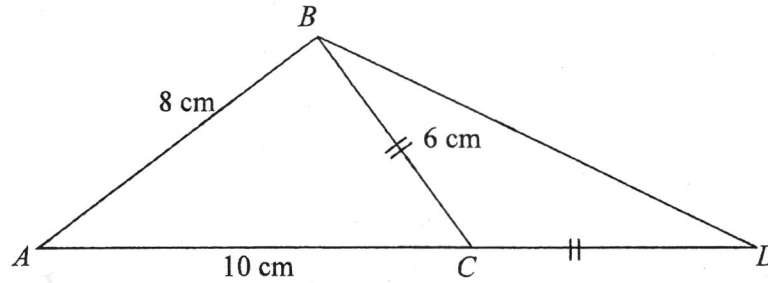
Answer (a) _____ [1]

(b) When r is increased by 300%, find the percentage increase in P .

Answer (b) _____ % [2]

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- 11 In the diagram, $AB = 8$ cm, $AC = 10$ cm, $BC = 6$ cm, $BC = CD$ and ACD is a straight line



- (a) Explain why $\angle ABC$ is a right angle.

Answer _____

[1]

- (b) Without finding any angle, find the area of $\triangle BCD$.

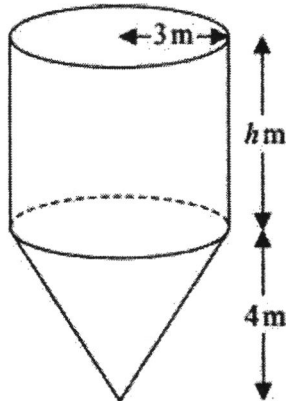
Answer (b) _____ cm^2 [2]

- (c) Write down exact value of $\cos \angle BCD$.

Answer (c) _____ [1]

For
Examiner's
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- 12 A construction company use the following container for sand.



The container is made up of a cylinder on top of a cone. The cylinder has a radius of 3m and a height of h m. The cone has a base radius of 3m and a vertical height of 4m.

The container is initially empty and is then filled with sand from the top at a constant rate.

After 5 hours, the depth of the sand is 6m above the vertex of the cone. After 9 hours, the container is full of sand.

Find the value of h . Give your answer as correct to two decimal places.

You must show all your working.

Answer _____ m [4]

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13 (a) Express $x^2 + 14x + 18$ in the form $(x + a)^2 - b$.

Answer (a) _____ [2]

(b) Hence, solve $x^2 + 14x + 18 = 0$. Give your answers correct to 2 decimal places.

Answer (b) $x =$ _____ or _____ [2]

14 Solve $7a^2 - 28a = 0$.

Answer $a =$ _____ or _____ [2]

For
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Use

- 15** An area of 2160 km^2 is represented on map by an area of 60 cm^2 .
Find

(a) the scale on the map in the form $1 : n$,

Answer (a) _____ [1]

(b) the length of a road on the map, in cm with an actual distance of 27 km.

Answer (b) _____ cm [1]

- 16** On a particular day, the temperature at the summit of Mount Snowy was -15°C and the temperature at the foot of the mountain was 20°C .

(a) Find the difference between these two temperature.

Answer (a) _____ $^\circ \text{C}$ [1]

The height of Mount Snowy is 2655 m. Shaun thinks that at 1400 m, temperature will be at 0°C .

(b) Do you agree with him? Explain your answer.

Answer (b) _____
_____ [2]

(c) Identify one assumption that was made in (b)

Answer (c) _____
_____ [1]

For
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Use

17 Simplify

(a) $\left(\frac{64}{x^{18}}\right)^{-\frac{1}{3}}$,

Answer (a) _____ [2]

(b) $\frac{3a^4}{10ab^2} \div \frac{27a^{-2}}{15b^{-1}}$,

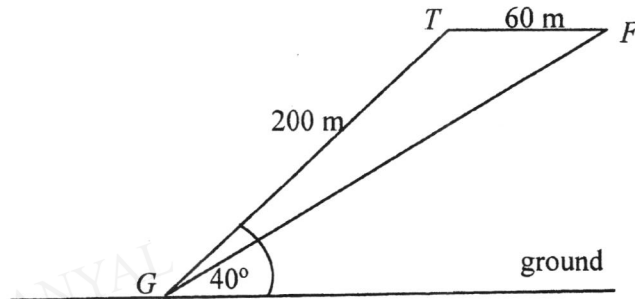
Answer (b) _____ [2]

(c) $\frac{x}{x^2-4} - \frac{2}{2-x}$.

Answer (c) _____ [3]

For
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- 18 Noah went kite flying at Marina Bay. He stands at position G on the ground and releases 200 m of string to fly the kite to position T . The string GT makes an angle of 40° with the ground.



- (a) How high is the kite vertically above the ground assuming that the string is taut?

Answer (a) _____ m [2]

- (b) The wind becomes stronger and the kite is carried 60 m horizontally further away from point T to point F . Noah releases more string, maintaining the height of the kite above the ground. Calculate the length of the string GF .

Answer (b) _____ m [3]

- (c) Calculate the angle that the string GF now makes with the ground.

Answer _____ $^\circ$ [2]

END OF PAPER



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**MATHEMATICS 4048
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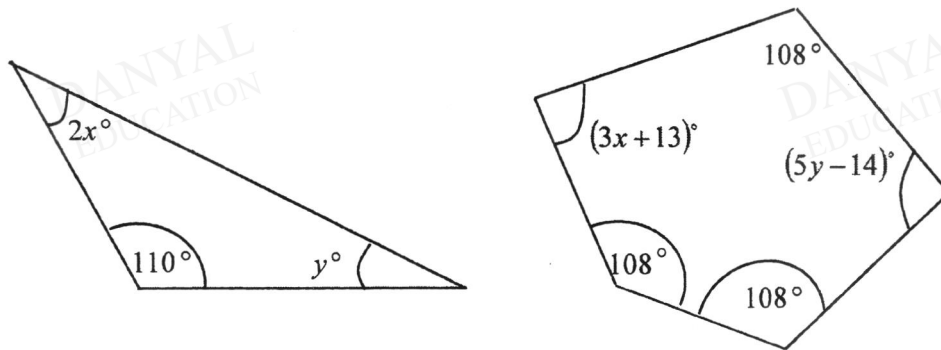
$$\text{Standard deviation} = \sqrt{\frac{\sum fx^2}{\sum f} - \left(\frac{\sum fx}{\sum f} \right)^2}$$

- 1 Marcus invested \$5000 in a bank at an interest rate of 2.5% compounded annually.
 (a) Find the total amount he had at the end of second year. [2]

At the end of second year, Marcus withdrew all the money in the bank and invested it into another bank which offered simple interest rate of 8% per annum.

- (b) Find the minimum number of years he had to leave the money in the bank in order for it to be more than \$10 000. [3]

2



- (a) Using the information shown in the diagrams, write down two equations in x and y . [2]
 (b) Solve these equations to find the values of x and y . [3]

- 3 The terms T_1, T_2, T_3, T_4, T_5 of a sequence are given as follows:

$$T_1 = 1 = 1$$

$$T_2 = 3 = 1 + 2$$

$$T_3 = 6 = 1 + 2 + 3$$

$$T_4 = 10 = 1 + 2 + 3 + 4$$

$$T_5 = 15 = 1 + 2 + 3 + 4 + 5$$

- (a) Write down the next two terms, T_6 and T_7 in the sequence
1, 3, 6, 10, 15, [1]
- (b) The n th term in the sequence is given by $T_n = \frac{1}{2}n(n+1)$.
Explain briefly why 200 is not in the sequence. [1]
- (c) Use the formula to find T_{100} . [1]
- (d) Use your answer to part (c) to find $5 + 10 + 15 + \dots + 500$. [1]
- (e) Hence find the sum of all the whole numbers from 1 to 500 which are **not** multiples of 5. [2]
-
- 4 (a) In a departmental store, the selling price of a shirt was decreased by 25% during sale.
- (i) If the price of the shirt was \$98.80 at first, what was its price during the sale? [1]
- (ii) During the sale for every 2 shirts that a customer purchase, the customer was entitled to purchase a 'purchase with purchase'(PWP) item.
The item the customer is able to purchase is a limited edition golf umbrella at a PWP price of \$9.20.
Mr Lim purchased n shirts during the sale and paid \$472.20 in total including all his entitlements PWP items. Find the value of n . [3]
- (b) (i) Given that $\xi = \{\text{all triangles}\}$, $A = \{\text{isosceles triangles}\}$,
 $B = \{\text{equilateral triangles}\}$ and $C = \{\text{right-angled triangles}\}$.
Draw a Venn diagram representing the sets ξ , A , B and C . [2]
- (ii) A triangle has sides 7 cm, 24 cm and 25 cm. On the same Venn diagram in (b)(i), mark and label the point T to represent this triangle. [1]

- 5 (a) Solve the equation

$$\frac{4x-3}{6} + \frac{x+2}{3} = \frac{5}{2} \quad [3]$$

- (b) (i) Factorise
- $2x^2 - 32y^2$
- . [2]

- (ii) Hence simplify

$$\frac{8xy + 2x^2}{2x^2 - 32y^2} \quad [2]$$

- (c) Make
- x
- the subject of the formula.

$$y = \sqrt{\frac{4x}{px-1}} \quad [3]$$

- 6 Isaac is planning a cycling expedition. He explores two possible routes.

- (a) If he travels on route A, which is 120 km long, he expects to cover
- x
- km per hour. Route B, which is 5 km shorter than route A, has more challenging terrain and he would only be able to cover
- $(x-2)$
- km per hour. Write down an expression, in terms of
- x
- , for the time he expects to take on

- (i) route A, [1]

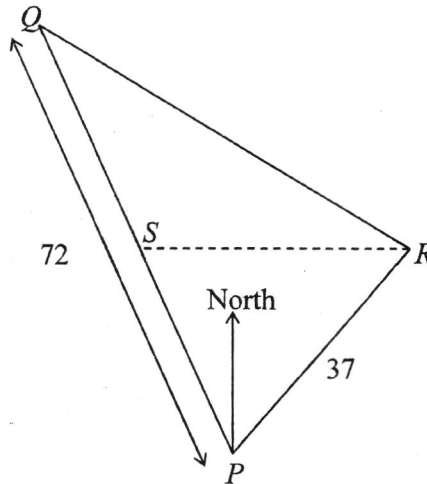
- (ii) route B. [1]

- (b) He estimates that route A will take 40 minutes less than route B. Form an equation in
- x
- and show that it reduces to
- $2x^2 + 11x - 720 = 0$
- . [3]

- (c) Solve the equation
- $2x^2 + 11x - 720 = 0$
- , give your answers correct to 3 decimal places. [3]

- (d) Calculate the time, in hours and minutes, that he expects to take on route B. [2]

- 7 In the diagram, P , Q and R represent three islands.
 PQ is 72 km. The bearing of Q from P is 336° . PR is 37 km. The bearing of R from P is 040° .
 S is due west of R .



- (a) Calculate
- | | |
|-----------------------------------|-----|
| (i) the bearing of P from Q , | [1] |
| (ii) the distance QR , | [3] |
| (iii) the distance RS . | [2] |
- (b) A helicopter is flying 5 km vertically above Island S . A boat is sailing along PR . Find the greatest angle of elevation of the top of the helicopter from the boat. [4]

- 8 Josh and Seth plan to travel from Liverpool to Newcastle. They need to be in Newcastle by 2.00 p.m. and can travel by train or bus. They plan to keep their travelling time and cost to the minimum.
Information that Josh and Seth need is in the table below.

- (a) Calculate the time taken for the train journey. [2]
- (b) Showing all your reasoning and calculations for cost and time, how will you recommend the departure time and mode of transport from Liverpool to Newcastle? [5]

Part of train timetable

Liverpool (depart)	09 25	10 15	11 05	12 00
<p>* Train fare from Liverpool to Newcastle is \$52 for one person. * Train journey from Liverpool to Newcastle is 195 km * Average train speed is 60 km/h</p>				

Part of bus timetable

Depart Liverpool	07 55	08 15	09 00
via	Middlebrough	Manchester	Leeds
Arrive Newcastle	12 45	13 30	14 45
<p>Expected average speed of bus on this journey is 35 miles per hour. The bus fare is charged based on the distance travelled: \$0.15 per kilometre. 1 kilometre is equivalent to 0.62 mile.</p>			

END OF PAPER



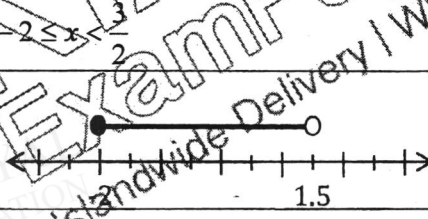
Anglo-Chinese School
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Marking Scheme
Secondary 2 Express Paper 1
End of Year Exams 2018

Qn	Steps/Answer			
1	$\frac{0.049608 \times 599.867}{0.01965}$			
	$= \frac{0.050 \times 600}{0.020}$			
	$= 1500$ $= 2000 \text{ (1 sf)}$			
2	$(3x - 5)(x - 6) - x(3x - 4)$			
	$=$ $3x^2 - 18x - 5x + 30 - 3x^2 + 4x$			
	$= 30 - 19x$			
3 (a)	$12x^2 - 21x + 9$ $= 3(4x - 3)(x - 1)$			
(b)	$15ax - 10ay - 21bx + 14by$ $= (5a - 7b)(3x - 2y)$			
4	$\frac{1}{x} \text{ litres}$ $\frac{100y}{x}$			
5	$\frac{10 \times 10^2}{1.3 \times 10^6}$ $= 7692 > 2000$ His claim is true.			



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Qn	Steps/Answer			
6	$2^{n+\frac{1}{2}+5} = 2^0$			
	$n + \frac{1}{2} + 5 = 0$			
	$n = -5\frac{1}{2}$			
7 (a)	$12600 = 2^3 \times 3^2 \times 5^2 \times 7$			
(b)	70, 490			
8	LCM (12,15,18) = 180 minutes			
	$\frac{180}{12} = 15$			
	$\frac{180}{18} = 10$			
	$15 - 10 = 5$			
9 (a)	$x \geq -2$ and $x < \frac{3}{2}$			
(b)				
10 (a)	$P = kr^2$			
	$P = 8r^2$			
(b)	$P_{new} = 8(4r)^2$			
	$= 16P$			
	Percentage increase			
	$= \frac{16P - P}{P} \times 100$			
	$= 1500\%$			



Qn	Steps/Answer			
11 (a)	Since $6^2 + 8^2 = 10^2$, by converse of Pythagoras Theorem, ABC is a right angle triangle, angle ABC is a right angle			
(b)	Area = $\frac{1}{2}(6)(6)\frac{4}{5}$ =14.4			
(c)	$\cos \angle BCD$ $= -\frac{3}{5}$			
12	$\frac{1}{3} \times \pi \times (3)^2 \times 4$ = 12π $\pi \times (3)^2 \times (6-4)$ = 18π $12\pi + 18\pi$ = 30π $30\pi \times \frac{9}{5}$ = 54π $54\pi = 12\pi + \pi \times (3)^2 \times h$ $54\pi = 12\pi + \pi \times (3)^2 \times h$ $54\pi = 12\pi + 9\pi h$ $42\pi = 9\pi h$ $h = 4.67$			
13 (a)	$(x+7)^2 - 7^2 + 18$ = $(x+7)^2 - 31$			
(b)	$(x+7)^2 - 31 = 0$ $(x+7)^2 = 31$ $(x+7) = \pm\sqrt{31}$ -1.43 or 12.57			
14	$7a(a-4) = 0$ $a = 0$ or 4			

Qn	Steps/Answer			
15 (a)	1 : 600000			
(b)	$\frac{27}{6}$ = 4.5 cm			
16 (a)	35° C			
(b)	$20^{\circ}C - \frac{1400}{2655} \times 35$ = 1.544 $\approx 1.5^{\circ}C$ Disagree as temperature is 1.5° C			
(c)	Assume <u>constant rate of decrease of temperature</u> as you move up the mountain.			
17 (a)	$= \left(\frac{x^{18}}{64}\right)^{\frac{1}{3}}$ $= \frac{x^6}{4}$			
(b)	$\frac{3a^4 \cdot 27a^{-2}}{10ab^2 \cdot 15b^{-1}}$ $= \frac{3a^4}{10ab^2} \times \frac{15b^{-1}}{15b^{-1}a^{-2}}$ $= \frac{a^5}{6a^{-1}b^2}$ $= \frac{a^5}{6b^3}$			



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Marking Scheme
Secondary 2 Express Paper 1
End of Year Exams 2018

Qn	Steps/Answer			
17 (c)	$\frac{x}{x^2 - 4} - \frac{2}{2 - x}$			
	$= \frac{x}{x^2 - 4} + \frac{2}{x - 2}$			
	$= \frac{x + 2(x + 2)}{(x - 2)(x + 2)}$			
	$= \frac{3x + 4}{(x - 2)(x + 2)}$			
18 (a)	Let h be the height of kite above ground			
	$\sin 40^\circ = \frac{h}{200}$			
	$h = 200 \sin 40^\circ$			
	$h = 129$			
(b)	Let X be a point directly below T			
	$\cos 40^\circ = \frac{GX}{200}$			
	$GX = 200 \cos 40^\circ$			
	$GF^2 = (200 \cos 40^\circ + 60)^2 + (200 \sin 40^\circ)^2$			
	$GF = 248.97$			
	≈ 249			
(c)	Let θ be the angle that GF makes with string			
	$\tan \theta = \frac{200 \sin 40^\circ}{200 \cos 40^\circ + 60}$			
	$\theta = \tan^{-1} \frac{200 \sin 40^\circ}{200 \cos 40^\circ + 60}$			
	$\theta = 31.1^\circ$			



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DANYAL EDUCATION

1	(a)	$5000\left(1 + \frac{2.5}{100}\right)^2$ $= \$5253.13$		
	(b)	$5253.13 + 5253.13 \times \frac{8}{100} \times n > 10000$ $5253.13 \times \frac{8}{100} \times n > 4746.87$ $n > \frac{4746.87}{5253.13 \times \frac{8}{100}}$ $n > 11.3$ $n = 12$		
2	(a)	$2x + y + 110 = 180$ $2x + y = 70$ $3x + 13 + 5y - 14 + 3(108) = 540$ $3x + 5y = 217$		
	(b)	$2x + y = 70 \quad \text{---(1)}$ $3x + 5y = 217 \quad \text{---(2)}$ $3x + 5(70 - 2x) = 217$ $-7x = -133$ $x = 19$ $y = 32$		
3	(a)	21, 28		
	(b)	$\frac{1}{2}n(n+1) = 200$ $n^2 + n = 400$ $n^2 + n - 400 = 0$ $n = 19.5, -20.5$ n is not an integer		
	(c)	5050		
	(d)	$5 + 10 + 15 + \dots + 500$		



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Marking Scheme
Secondary 2 Express Paper 2
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			$= 5(1 + 2 + 3 + \dots + 100)$		
			$= 5(5050)$		
			$= 25250$		
	(e)		$T_{500} - 25250$		
			$\frac{1}{2}(500)(500 + 1) - 25250$		
			$= 100000$		
4	(a)	(i)	$\$98.80 \times 75\%$		
			$= \$74.10$		
	(a)	(ii)	For n shirts, number of PWP item purchased		
			$= \frac{n}{2} \times \$9.20$		
			$= \$(4.6n)$		
			Amount spent on n shirts		
			$= \$(74.1n)$		
			$4.6n + 74.1n = 472.2$		
			$78.7n = 472.2$		
			$n = 6$		
	(b)	(i)	ξ		
		(ii)			
5	(a)		$\frac{4x-3}{6} + \frac{x+2}{3} = \frac{5}{2}$		
			$4x-3+2(x+2)=3(5)$		
			$4x-3+2x+4=15$		
			$6x=14$		
			$x = \frac{7}{3}$		
	(b)	(i)	$2x^2 - 32y^2$		

		$2(x^2 - 16y^2)$		
		$2(x+4y)(x-4y)$		

	(b)	(ii)	$\frac{8xy + 2x^2}{2x^2 - 32y^2}$		
			$= \frac{2x(4y + x)}{2(x + 4y)(x - 4y)}$		
			$= \frac{x}{(x - 4y)}$		
	(c)		$y^2 = \frac{4x}{px - 1}$		
			$pxy^2 - y^2 = 4x$		
			$pxy^2 - 4x = y^2$		
			$x(py^2 - 4) = y^2$		
			$x = \frac{y^2}{py^2 - 4}$		
5	(a)	(i)	$\frac{120}{x}$		
	(a)	(ii)	$\frac{115}{x - 2}$		
	(b)		$\frac{115}{x - 2} - \frac{120}{x} = \frac{2}{3}$		
			$115(3)(x) - 120(3)(x - 2) = 2(x)(x - 2)$		
			$345x - 360x + 720 = 2x^2 - 4x$		
			$-15x + 720 = 2x^2 - 4x$		
			$2x^2 - 4x + 15x - 720 = 0$		
			$2x^2 + 11x - 720 = 0$		
	(c)		$x = \frac{-11 \pm \sqrt{11^2 - 4(2)(-720)}}{2(2)}$		
			$x = 16.42192, -21.92192$		
			$x = 16.422, -21.922$ (3dp)		
	(d)		$\frac{115}{16.42192 - 2}$		
			$= 7.97397 \text{ h}$		
			$= 7 \text{ h } 58 \text{ mins}$		
7	(a)	(i)	$180 - 24$		
			$= 156^\circ$		

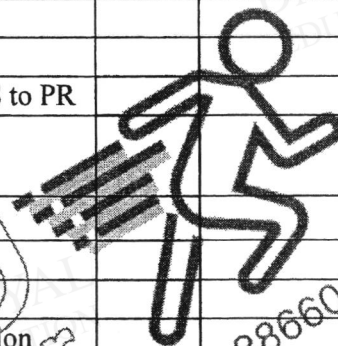


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(a)	(ii)	$\angle QPR = 24^\circ + 40^\circ$		
		$= 64^\circ$		
		$QR^2 = 37^2 + 72^2 - 2(37)(72)\cos 64^\circ$		
		$QR = 64.941$		
		$QR = 64.9 \text{ km}$		
(a)	(iii)	$\frac{RS}{\sin 64^\circ} = \frac{37}{\sin 66^\circ}$		
		$RS = \frac{37}{\sin 66^\circ} \times \sin 64^\circ$		
		$RS = 36.403$		
		$RS = 36.4 \text{ km}$		
(b)		Let x be the shortest distance from S to PR		
		$\sin 50^\circ = \frac{x}{36.403}$		
		$x = 36.403 \sin 50^\circ$		
		$x = 27.886$		
		Let θ be the greatest angle of elevation		
		$\tan \theta = \frac{5}{27.886}$		
		$\theta = 10.2 \text{ (1dp)}$		

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8	(a)	Time taken: $\frac{195}{60}$	M1	
		= 3.25 h	A1	
	(b)	Cost by train		
		= 52×2		
		= \$104	B1	
		To travel by train, they can choose to depart at 0925 or 1015 in order to reach by 2pm.	B1	Two timings for them to choose by train
		Travelling by bus (08 15 dep time)		
		Distance = $5 \frac{1}{4} \times 35 = 183.75$ miles	M1	08 15 departure Distance = $5 \frac{1}{4} \times 35 = 183.75$ miles
		Cost = $2 \left[\frac{183.75}{0.62} \times 0.15 \right] = \88.91	M1	$4 \frac{5}{6} \times 35 = 169.17$ miles Cost = $2 \left[\frac{169.17}{0.62} \times 0.15 \right] = \81.86
		I will suggest to them to travel by train even though it cost more. Time taken is shorter compared to travelling by bus. They can depart later and be more flexible with their timings (0925 or 1015)	B1	Their Reasons Bus/Train Timings

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