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YISHUN TOWN SECONDARY SCHOOL



PRELIMINARY EXAMINATION 2024

SECONDARY 4 EXPRESS

MATHEMATICS PAPER 2 (4052/02)

DATE : 19 August 2024

DAY : Monday

DURATION: 2 h 15 min

MARKS: 90

READ THESE INSTRUCTIONS FIRST

Do not turn over the cover page until you are told to do so.

Write your name, class and class index number in the spaces at the top of this page.

Write in dark blue or black pen.

You may use a pencil for any diagrams or graphs.

Do not use staples, paper clips, highlighters, glue or correction fluid.

Answer **all** the 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 the 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 .

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 90.

	MARKS	
	OBTAINED	FULL
1		6
2		5
3		12
4		7
5		7
6		9
7		10
8		12
9		12
10		10
TOTAL		90

Mathematical Formulae*Compound Interest*

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

Mensuration

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

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

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

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

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

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

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

Trigonometry

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

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

Statistics

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

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

Answer **all** the questions.

- 1 (a) The cash price of a car is \$120 000.
The hire purchase price of the car is \$126 708.
The hire purchase price is a deposit of 40% of the cash price plus 84 equal monthly payments.

Calculate one monthly payment.

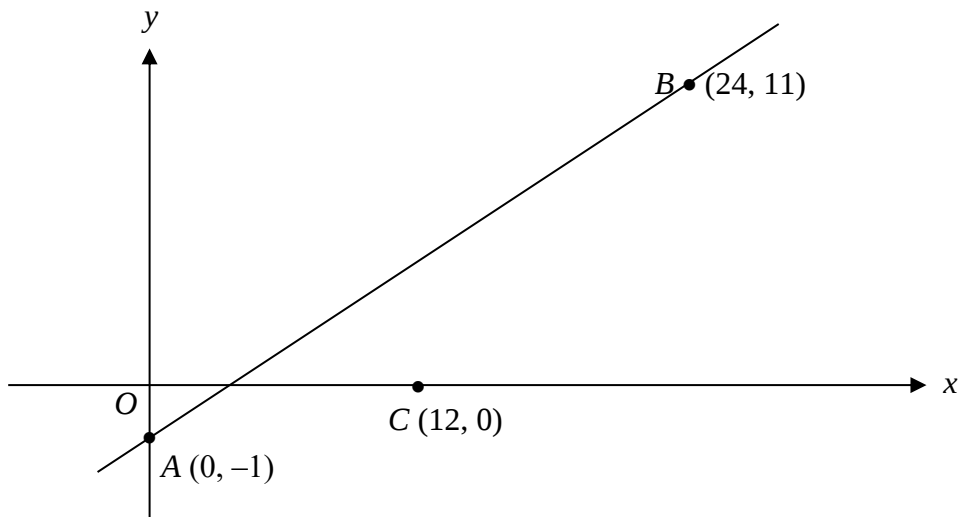
Answer \$ [3]

- (b) Jasice invests in an account that pays compound interest at 3.85% per year.
She leaves the money in the account for 5 years.
At the end of 5 years there is \$11837.50 in the account.

Calculate the amount of money Jasice invested, giving your answer to the nearest dollar.

Answer \$ [3]

2



The diagram shows the points $A(0, -1)$ and $B(24, 11)$.

- (a) Find the equation of line AB .

Answer [2]

- (b) Point $C(12, 0)$ lies on the x-axis.
Find the area of triangle ABC .

Answerunits² [2]

- (c) Find the coordinates of D such that $ABCD$ is a parallelogram.

Answer (..... ,) [1]

3 (a) Simplify $\frac{4a^2}{b^3} \times \left(\frac{64a^9}{b^3} \right)^{-\frac{1}{3}}$.

Answer [3]

(b) Given that $32^{\frac{2}{5}} \div 8^k = 1$, find the value of k .

Answer $k =$ [2]

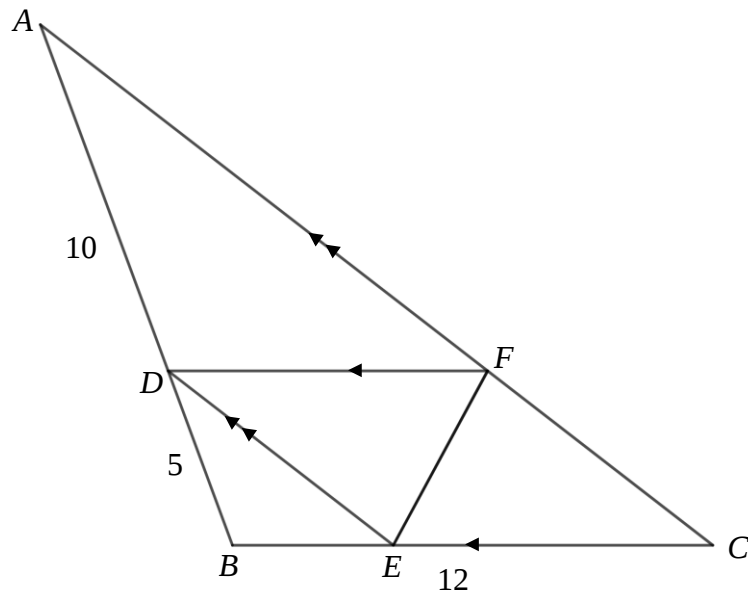
- (c) (i) Express as a single fraction in its simplest form $\frac{x^2 - 2x - 15}{(x-5)^2} + \frac{x}{5-x}$.

Answer [3]

- (ii) Hence solve the equation $\frac{x^2 - 2x - 15}{(x-5)^2} + \frac{x}{5-x} = \frac{x+5}{x-2}$.

Answer $x = \dots\dots\dots$ or $\dots\dots\dots$ [4]

- 4 The diagram shows a triangle ABC such that DF is parallel to BC and AC is parallel to DE . The points D , E and F lie on the line AB , BC and AC respectively.



- (a) Show that triangle ADF is similar to triangle ABC .

Answer

- (b) In the triangle, $DB = 5$ cm, $AD = 10$ cm, $BC = 12$ cm and angle $ABC = 120^\circ$.
 (i) Show that $CF = 7.810$ cm.

Answer

[3]

- (ii) Find angle DAF .

Answer [2]

- 5 Machine X was used to pack chocolates into packets of 100 g.
The masses, in grams, of 40 packets of chocolates packed by Machine X were recorded.

The table below shows the data collected.

Mass (in g)	$85 < x \leq 90$	$90 < x \leq 95$	$95 < x \leq 100$	$100 < x \leq 105$	$105 < x \leq 110$
Frequency	0	15	7	5	13

(a) Calculate

(i) the mean mass,

Answer g [1]

(ii) the standard deviation.

Answer g [1]

Machine Y was also used to pack chocolates.
The results are summarised in the table.

Mass of chocolate packets from Machine Y (in g)
Mean = 98.9
Standard deviation = 2.1

(b) Make two comments comparing the masses of the packets of chocolates packed by Machine X and Machine Y .

.....

 [2]

- (c) POPPYMART just released their latest series, the “Power Girls x CryBaby” collaboration.
There are a total of 12 unique figurines to collect in the whole series and the names of each figurine are listed below in Figure 1.



Figure 1



Figure 2

The figurines are all packed into individual boxes.
The boxes are then randomly packed into a carton of 12 as shown in Figure 2.
Mr Tan randomly selects a carton of these figurines.
The carton consists of the following quantities of figurines.

Figurine Name	A	B	D	F	G	J	K
Quantity	2	1	2	2	1	3	1

- (i) Mr Tan buys three figurines.
The figurines are randomly selected from the carton, one after the other, without replacement.

Find the probability that Mr Tan gets three different figurines, A, J and K.

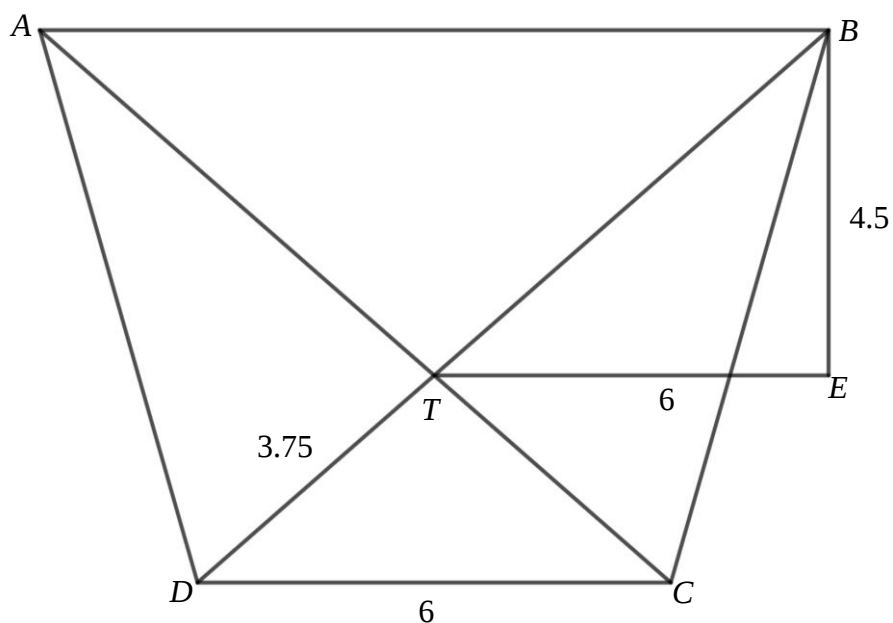
Answer [2]

- (ii) Mr Tan wants to buy a different figurine from the same carton.
A fourth figurine is randomly selected.

Find the probability that he buys a different figurine.

Answer [1]

- 6 The diagram shows a quadrilateral $ABCD$ where T is the point of intersection of AC and BD . Angle $ABE = 90^\circ$, $TD = 3.75$ cm, $DC = TE = 6$ cm and $BE = 4.5$ cm. $CT : CA = 1 : 3$. Triangle ACD is congruent to triangle BDC . Triangle ATB is similar to triangle CTD .



- (a) Show that triangle BET is a right-angled triangle.

Answer

[2]

- (b) (i) Find the area of triangle ATB .

Answer cm^2 [2]

- (ii) Hence, determine the area of triangle CTD .

Answer cm^2 [2]

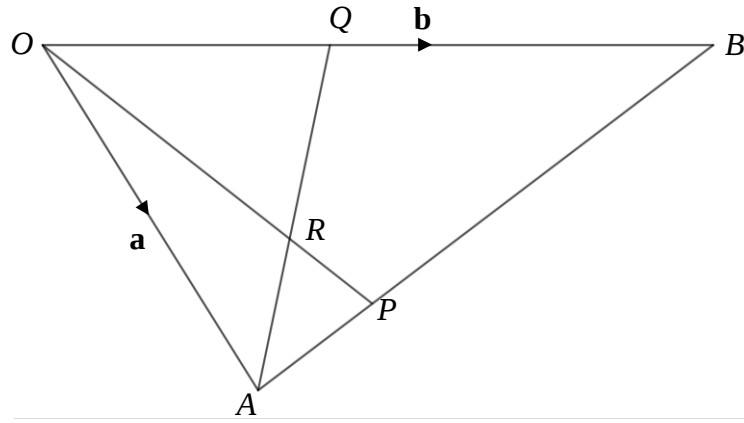
- (iii) Using your answer in (ii), find angle DCT .

Answer [2]

- (c) Explain why a circle can be drawn passing through points A , B , C and D .

.....

 [1]



OAB is a triangle, where $\overrightarrow{OA} = \mathbf{a}$ and $\overrightarrow{OB} = \mathbf{b}$.

P is a point on AB such that $AP : PB = 1 : 3$.

Q is a point on OB such that $OQ : QB = 3 : 4$.

(a) Express, as simply as possible, in terms of $\mathbf{a}$ and/or $\mathbf{b}$,

(i) $\overrightarrow{AB}$,

Answer [1]

(ii) $\overrightarrow{AP}$,

Answer [1]

(iii) $\overrightarrow{OP}$.

Answer [2]

R is the point of intersection of OP and AQ .

(b) Find $\overrightarrow{AQ}$.

Answer [1]

(c) Given that $\overrightarrow{AR} = k\overrightarrow{AQ}$, find $\overrightarrow{OR}$ in terms of k , **a** and **b**.

Answer [2]

(d) Given that $k = \frac{2}{5}$, find

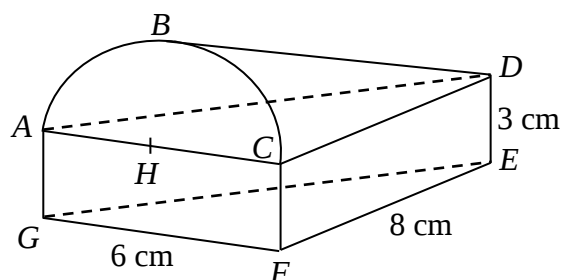
(i) $\frac{\text{area of } \triangle OAQ}{\text{area of } \triangle ORQ}$,

Answer [1]

(ii) $\frac{\text{area of } \triangle ORQ}{\text{area of } \triangle AQB}$.

Answer [2]

- 8 The figure shows a candle which consists of a half cone $ABCD$ and a triangular prism $ACDEFG$.
 H is the midpoint of AC .
 $GF = 6$ cm, $FE = 8$ cm and $DE = 3$ cm.



- (a) Show that $HD = 7.4162$ cm.

Answer

[2]

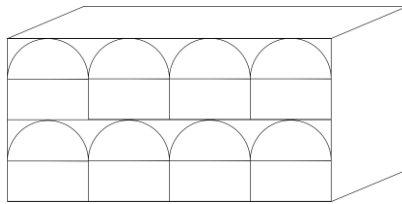
- (b) Calculate the surface area of the candle.

Answer cm^2 [4]

- (c) Calculate the volume of the candle.

Answer cm^3 [3]

- (d) The candles are sold in a box of eight.
The eight candles are packed tightly in a box as shown in the diagram.



Calculate the percentage of the volume of the box that is not occupied by the candles.

Answer % [3]

- 9 (a) Complete the table of values for $y = (x-1)(x^2 + x - 2)$.

x	-3	-2	-1	0	1	2	3
y	-16	0	4	2	0	4	

[1]

- (b) On the grid, draw the graph of $y = (x-1)(x^2 + x - 2)$ for $-3 \leq x \leq 3$.

[3]

- (c) The equation $(x-1)(x^2 + x - 2) = -2.5$ has only one solution.
Explain how this can be seen from your graph.

Answer

.....

 [1]

- (d) By drawing a tangent, find the gradient of the curve at $x = -1.5$.

Answer..... [2]

- (e) (i) On the grid in part (b), draw the line $y = 5x - 5$ for $-3 \leq x \leq 3$.

[2]

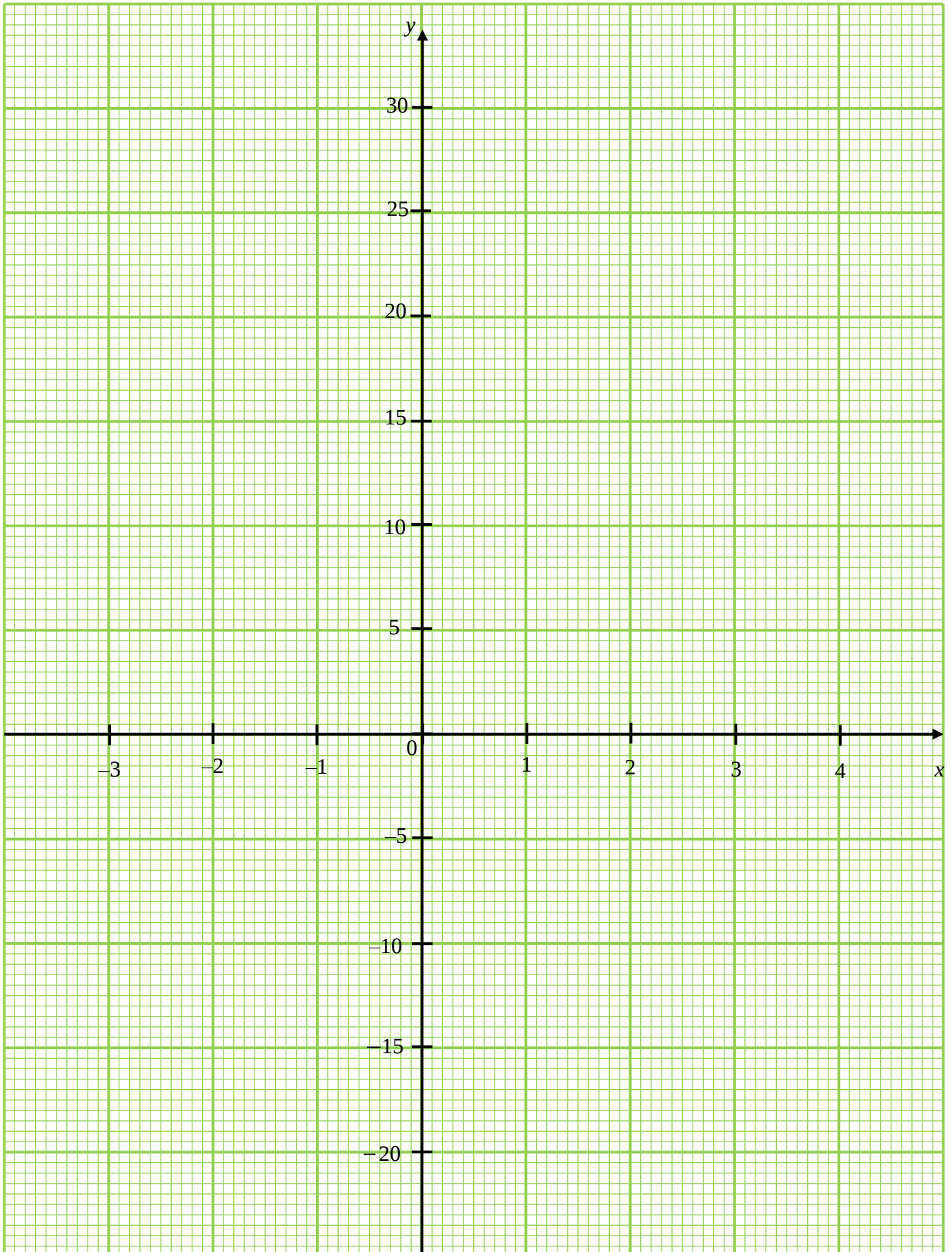
- (ii) Write down the x -coordinates of the points where this line intersects the curve.

Answer $x = \dots\dots\dots$ or $\dots\dots\dots$ [1]

- (iii) These values of x are the solutions of the equation $x^3 - Ax + B = 0$.

Find the value of A and B .

Answer $A = \dots\dots\dots$, $B = \dots\dots\dots$ [2]



- 10 To celebrate the good results of the Secondary 4 Mathematics Preliminary Examination, Mrs Teo wants to order Kallang Fried Chicken for her department teachers.

She wants to place her food delivery order via the GrabEat application on her mobile phone. She gets the help of her colleagues, Mr Pan and Mr Ooi, to collate the food items from all the teachers, as shown in the table below.

Category	Food Item	Quantity
Main	Fried Chicken (Original Flavour)	18
	Fried Chicken (Spicy Flavour)	14
Tenders	Chicken Tenders	28
Sides	Whipped Potato	7
	Coleslaw	2
	Cheese Fries	6
Drinks	Coke	4
	Sprite	7
	Iced Tea	4

On the GrabEat application, the menu for Kallang Fried Chicken and its prices are as follows.

* KALLANG FRIED CHICKEN *



15-PIECE CHICKEN FEAST

- 15 pieces of fried chicken
- 10 pieces of chicken tenders
- 5 sides (Coleslaw or Whipped Potato)

\$79.30



8-PIECE CHICKEN FEAST

- 8 pieces of fried chicken
- 5 pieces of chicken tenders
- 3 sides (Coleslaw or Whipped Potato)
- 4 drinks (Coke or Sprite)

\$54.35

Our Fried Chicken is available in both
Original and Spicy flavours




ALA CARTE



1 FRIED CHICKEN \$4.65



5 PIECE CHICKEN TENDERS \$9.30



1 COLESLAW OR WHIPPED POTATO \$3.30



1 CHEESE FRIES \$5.95



1 COKE OR SPRITE \$3.40



1 ICED TEA \$4.20

+\$1.45 TO UPGRADE SIDES TO CHEESE FRIES
+\$0.80 TO UPGRADE DRINK TO ICED TEA

- (a) (i) Mr Pan decides to order two sets of the 15-Piece Chicken Feast.
The remaining food items will be ordered from the a la carte menu.

Show that the total amount of money spent is \$265.90.

Answer

[3]

- (ii) Mr Ooi thinks that \$265.90 is not the cheapest option of ordering the food items.

Find the cheapest option and its cost, showing your working clearly.

Answer

Answer \$..... [4]

Another department decides to add on to Mrs Teo's order, and the final bill amounts to \$432.80.

She has two modes of payment that she can consider for her cash rebate to offset her next purchase.

GrabEat Wallet	YTSS Credit Card
Earn 950% of your final bill (\$) in points. (eg. If the bill is \$10, you earn 95 points) Redemption 500 points = \$1 cash rebate *Note: Points can only be redeemed in blocks of 500 points.	Earn 3% of your final bill in cash rebate. *Note: A bank fee of \$5.50 will be incurred for use of cash rebate.

- (b) Determine which mode of payment Mrs Teo should use.
Justify your answer with calculations.

Answer

[3]

END OF PAPER

ANSWER KEY

Q1 (a) \$937 (b) \$9800

Q2 (a) $y = \frac{1}{2}x - 1$ (b) 60 (c) $(-12, -12)$

Q3 (a) $\frac{1}{b^2}$ (b) $\frac{2}{3}$ (c)(i) $\frac{3}{x-5}$ (c)(ii) -3.11 or 6.11 (3 s.f.)

Q4 (b)(ii) 26.3°

Q5 (a)(i) 99.5 g (a)(ii) 6.40 g (c)(i) $\frac{3}{110}$ (c)(ii) $\frac{2}{3}$

Q6 (b)(i) 27 (b)(ii) 6.75 (b)(iii) 36.9

Q7 (a)(i) $\mathbf{b} - \mathbf{a}$ (a)(ii) $\frac{1}{4}(\mathbf{b} - \mathbf{a})$ (a)(iii) $\frac{1}{4}(3\mathbf{a} + \mathbf{b})$ (b) $\frac{3}{7}\mathbf{b} - \mathbf{a}$ (c) $\mathbf{a}(1 - k) + \frac{3}{7}k\mathbf{b}$
 (d)(i) $\frac{5}{3}$ (d)(ii) $\frac{9}{20}$

Q8 (b) 140 (c) 102 (d) 61.9%

Q9 (a) 20 (d) $2.8 - 4.7$ (e)(ii) $x = 1$ or 2.19 ± 0.5 (e)(iii) $A = 8, B = 7$

Q10 (b) \$257.80 (c) GrabEat Wallet