Name: _____

Class	Index Number

OUTRAM SECONDARY SCHOOL
PRELIMINARY EXAMINATION
2022

Subject	:	**Mathematics**
Paper No.	:	**4048/02**
Level (Stream)	:	**Secondary Four Express** **Five Normal (Academic)**
Date	:	**29 August 2022**
Duration	:	**2 hour 30 minutes**
Marks	:	**100**

READ THESE INSTRUCTIONS FIRST

Candidates answer on the Question Paper.

Write your name, class and index number 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, highlighters, glue or correction fluid.

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

For Examiner's Use
100

This document consists of **25** printed pages, including this cover page.

Setter: Mr Jeremy Lum

Mathematical Formulae

Compound interest

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

Mensuration

$$\text{Curved Surface area of a cone} = \pi rl$$

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

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

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

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

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

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

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)** In 2020, Tammy earned a total of $38000.
In 2021, he earned $3500 each month.

Calculate the percentage increase in his earnings from 2020 to 2021.

Answer ……...% [2]

(b) A bank offers a savings account with a compound interest rate of 1.8 % per annum.
On 1st January 2022, Tammy deposited $5000 in this account.

Calculate the total interest earned on 31st December 2031.
Give your answer correct to the nearest cent.

Answer $ ……... [3]

(c) The exchange rate between Singapore dollars (SGD) and Swiss franc (CHF) is 1 SGD = 0.7 CHF.
The exchange rate between British pounds (GBP) and Singapore dollars is 1 GBP = 1.73 SGD.

Tammy is planning a trip to Europe. She finds these hotel prices on a website.

Swiss Hotel CHF140 per night
London Hotel GBP120 per night

Tammy books 4 nights in the hotel in Switzerland and 3 nights in the hotel in London. She pays using her credit card.
The credit card company converts the prices to Singapore dollars.
Tammy is charged a fee of 1.8% of the total amount for the currency conversion.

Calculate the total amount of money Tammy pays for the two hotels, including the credit card fee.
Give your answer correct to the nearest dollar.

Answer $ ……... [4]

2 **(a)** Solve the inequality $\frac{4x+3}{2} \geq 1-3x$.

Answer ……..... [2]

(b) Solve these simultaneous equations.

$$3x+2y=-3$$
$$8x-\frac{10}{3}y=-12\frac{1}{3}$$

Answer x = ……...

y = ……... [3]

(c) Solve the equation $\frac{3x}{x-5}+\frac{6}{2x+3}=2$.

Answer x =…….. or …… [4]

(d) Arrange $2^{500}, 3^{300}, 4^{200}$ in ascending order. Show your reasoning clearly.

Answer ……... [2]

(e) Simplify $\left(\frac{x^4}{y^6}\right)^{-2}$, leaving your answer in positive indices only.

Answer ……..... [2]

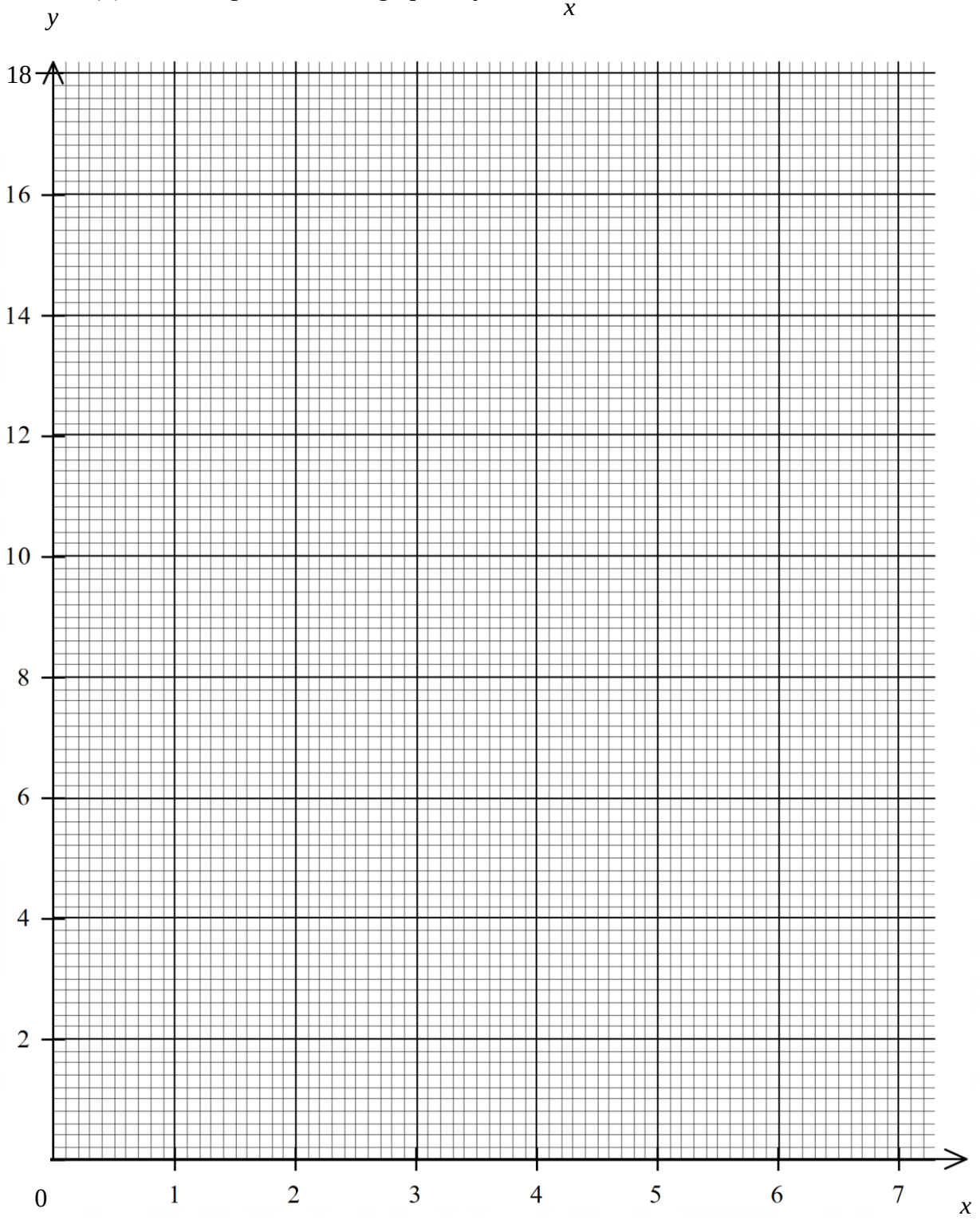
3 **(a)** Complete the table of values for $y = 3x + \frac{5}{x} - 4$.

Give your answer correct to 1 decimal place.

x	0.5	1	1.5	2	3	4	5	6	7
y	7.5	4	3.8		6.7	9.3	12	14.8	17.7

[1]

(b) On the grid, draw the graph of $y = 3x + \frac{5}{x} - 4$ for $0 < x \leq 7$.



[3]

(c) Use your graph to find the solutions of the equation $3x + \frac{5}{x} = 12$ in the range $0 < x \leq 7$.

Answer x = ……... or …… [2]

(d) **(i)** On the grid in part **(b)**, draw the line $2y = 3x + 4$ for $0 \leq x \leq 7$.

[2]

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

Answer x = ……... or ……..... [2]

(iii) These values of x are the solutions of the equation $3x^2 + Ax + B = 0$. Find the values of A and B.

Answer A = ……...

B = ……... [3]

4 A water tank can be filled with water by two pipes in 20 minutes.
The smaller pipe takes 10 minutes longer than the larger pipe to fill the tank.
If the larger pipe takes x minutes to fill the tank,

(a) write down an equation to represent this information and show that it reduces to

$$x^2 - 30x - 200 = 0 .$$

Answer

[3]

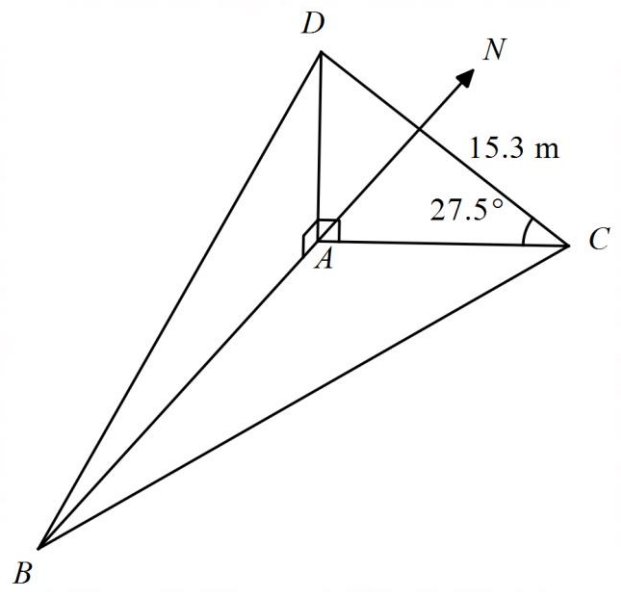
(b) Solve the equation $x^2 - 30x - 200 = 0$.

Answer x = ……... or …… [3]

(c) Find the percentage of the tank that can be filled by the smaller pipe in 20 minutes.

Answer ……..... % [2]

5 *A*, *B* and *C* are three points on horizontal ground.
B is due south of *A* and *C* is due east of *A*.
AD is a vertical pole standing at *A*.



(a) Given that the angle of elevation of *D* from *C* is 27.5°, the bearing of *C* from *B* is 035.6° and $DC = 15.3\,\text{m}$, show that

(i) $AD = 7.06\,\text{m}$,

[1]

(ii) $AC = 13.6\,\text{m}$,

[1]

(iii) $AB = 19.0\,\text{m}$.

[1]

(b) Calculate the angle of depression of *B* from *D*.

Answer ……... [2]

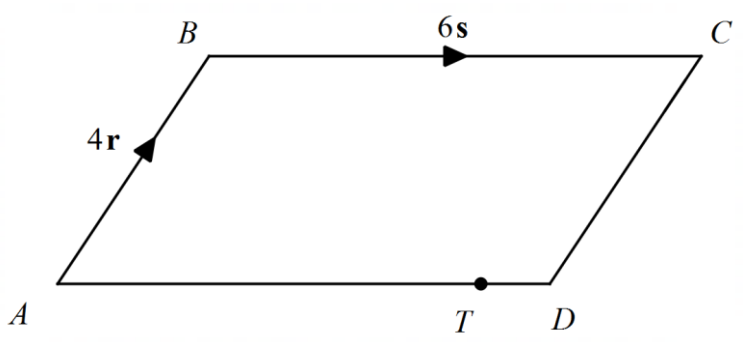
(c) Given further that P is a point on BC such that the angle of elevation of D from P is a maximum, find AP.

Answer …….....m [3]

(d) Find angle BCD.

Answer ……... [3]

6 *ABCD* is a parallelogram.
$\overrightarrow{AB} = 4\boldsymbol{r}$ and $\overrightarrow{BC} = 6\boldsymbol{s}$.
T is the point on *AD* such that $AT : TD = 5 : 1$.



(a) Express $\overrightarrow{TC}$, as simply as possible, in terms of **r** and **s**.

Answer ……... [2]

(b) *P* is a point on *AD* and *Q* is a point on *CD* such that $\overrightarrow{TC} = 3\overrightarrow{PQ}$.

(i) Show that triangles *TCD* and *PQD* are similar.
Give reasons for your answer.

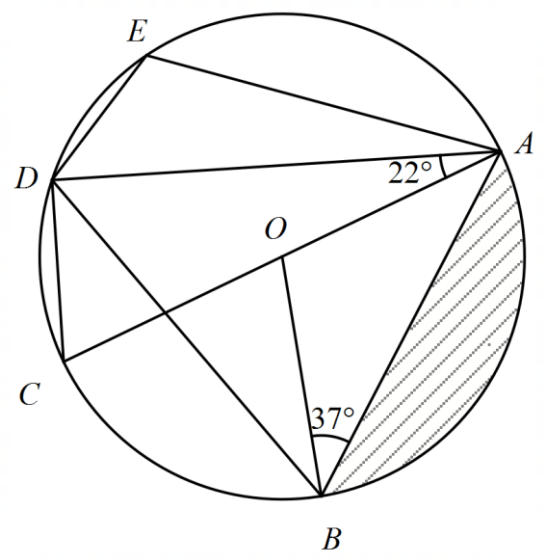
Answer

[3]

(ii) Find the ratio of area triangle *PQD* : area of parallelogram *ABCD*.

Answer ……... [3]

7 In the figure, AC is a diameter of the circle with centre O.
It is given that angle $ABO = 37°$ and angle $CAD = 22°$.



(a) Find, giving reasons for your answer,

(i) angle ADB,

Answer ……... [3]

(ii) angle OBD,

Answer ……... [2]

(iii) angle *AED*.

Answer ……... [1]

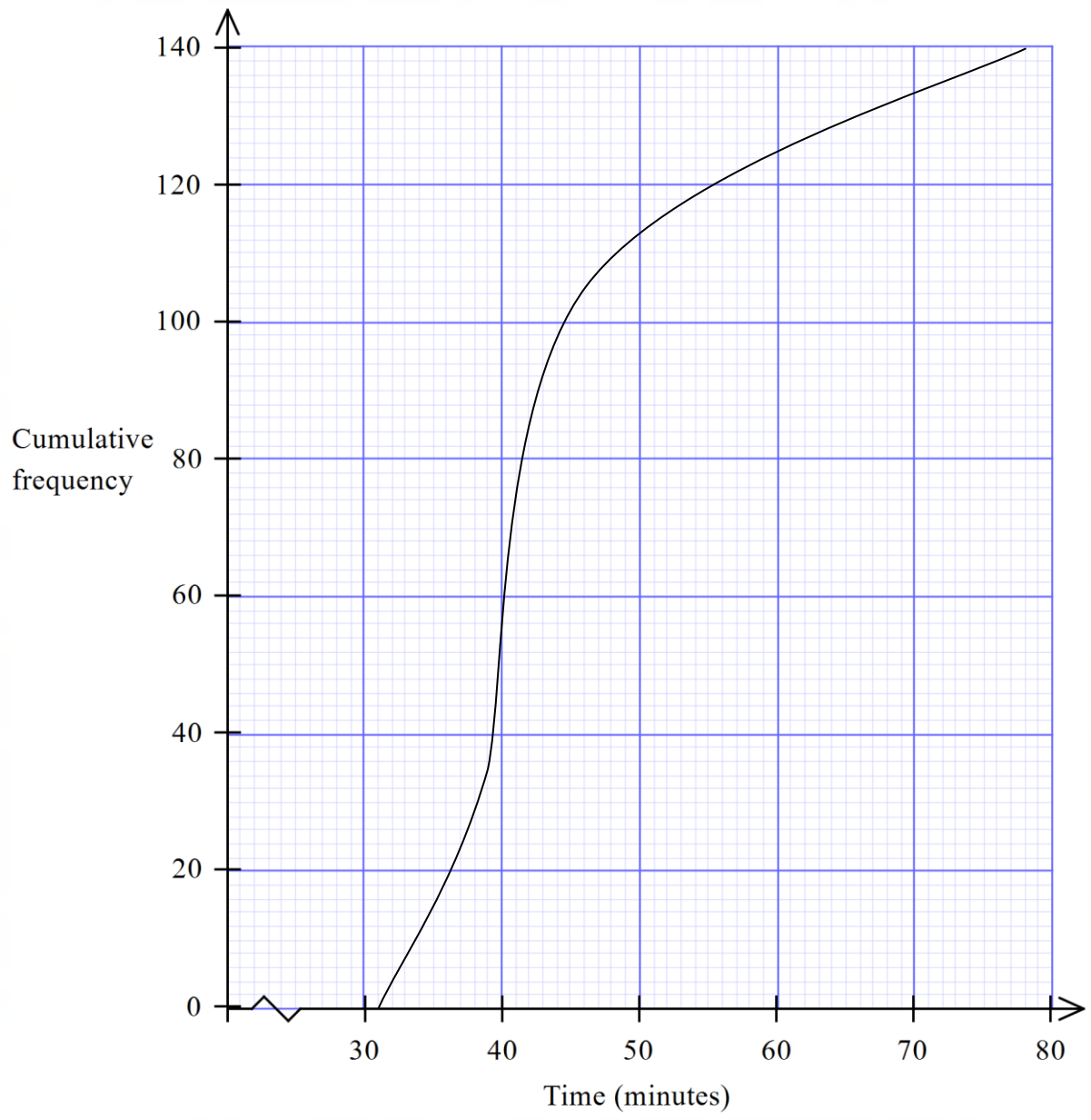
(b) Given that the shaded area is 22.5 cm^2, calculate the radius of the circle.

Answer ……...cm [3]

(c) *F* is a point on *AB* such that $BF = AF$. Calculate *OF*.

Answer ……...cm [2]

8 **(a)** The timings taken by 140 men to complete a 10 km race are recorded.
The cumulative frequency curve below shows the distribution of their times.



Use the curve to estimate the

(i) median time,

Answer ……...min [1]

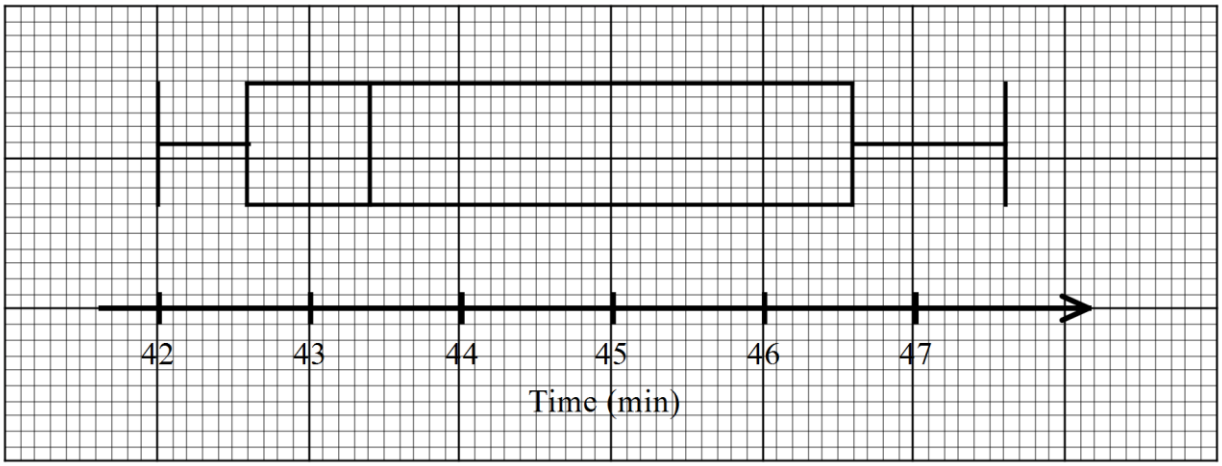
(ii) interquartile range of the time taken,

Answer ……...min [2]

(iii) percentage of the men who took at least one hour to complete the race.

Answer ……..... % [2]

(b) The timings taken by 140 women to complete the 10 km race is shown in the box-and-whisker plot below.



Make two comments comparing the timings of the men and women to run the 10 km race.

1. ……

……

2. ……

…… [2]

(c) The table shows the ages of the 280 people who entered the 10 km race.

Age (x years)		$20 \leq x < 30$	$30 \leq x < 40$	$40 \leq x < 50$	$50 \leq x < 60$
Frequency	Men	45	33	27	35
	Women	33	62	28	17

One person is selected at random.

Find, as a fraction in its lowest terms, the probability that the person is

(i) a man aged 40 or more,

Answer ……. [1]

(ii) aged under 30.

Answer ……. [1]

(d) Two people are selected at random.

Find the probability that **both** of them are women aged under 50.
Give your answer as a decimal correct to three significant figures.

Answer ……. [2]

9 A fitness studio is open for a morning session and an afternoon session for 5 days each week. Every member attends every day for either the morning session or the afternoon session. The members attending are split into three groups, X, Y and Z. The matrix **H** shows the number of members in each group in week 1.

$$\begin{matrix} & \text{X} & \text{Y} & \text{Z} \\ \mathbf{H} = & \end{matrix}\begin{pmatrix} 12 & 15 & 16 \\ 10 & 13 & 14 \end{pmatrix}\begin{matrix} \text{morning} \\ \text{afternoon} \end{matrix}$$

(a) The matrix **B** shows the number of men in each group.

$$\begin{matrix} & \text{X} & \text{Y} & \text{Z} \\ \mathbf{B} = & \end{matrix}\begin{pmatrix} 9 & 10 & 12 \\ 7 & 6 & 9 \end{pmatrix}$$

Find the number of women attending the afternoon session of group Y.

Answer ……. [1]

(b) Each member is charged a fee for each session.
The session fee is \$40 for group X, \$35 for group Y and \$30 for group Z.

Represent the fees in a 3×1 column matrix **F**.

Answer **F** = [1]

(c) Evaluate the matrix **M** = **HF**.

Answer **M** = [2]

(d) State what each element of matrix **M** represents.

Answer

……

…… [1]

(e) Calculate the total amount taken in fees by the fitness studio in one week.

Answer $..... [1]

10 Mr Lim is a 35 years old employee who earns a gross (before CPF contribution) monthly salary of $3700 and credits his salary (after CPF contribution) to a DBS Multiplier account. He has $40000 of savings and spends between $100 to $300 on his DBS credit card each month.

Mr Lim does not insure or invest with any banks.

Information on CPF contribution, DBS Multiplier, OCBC 360 and UOB One accounts can be found on pages 22-24.

(a) How much salary will be credited to his bank account after deduction for his CPF contribution?

Answer $…… [1]

(b) Calculate the annual interest that Mr Tan's savings of $40000 alone, will earn through his DBS multiplier account.

Answer $…… [2]

(c) Mr Lim was promoted and his new gross monthly salary is $4500. Because of the pay rise, Mr Tan decided that he will spend between $500 to $700 on his credit card each month.

Suggest if Mr Lim should change to a OCBC 360 or UOB One account to maximise the interest earned for his $40000 savings alone.

Justify your decision and show any calculations you made clearly.

Answer

……..

…….. [7]

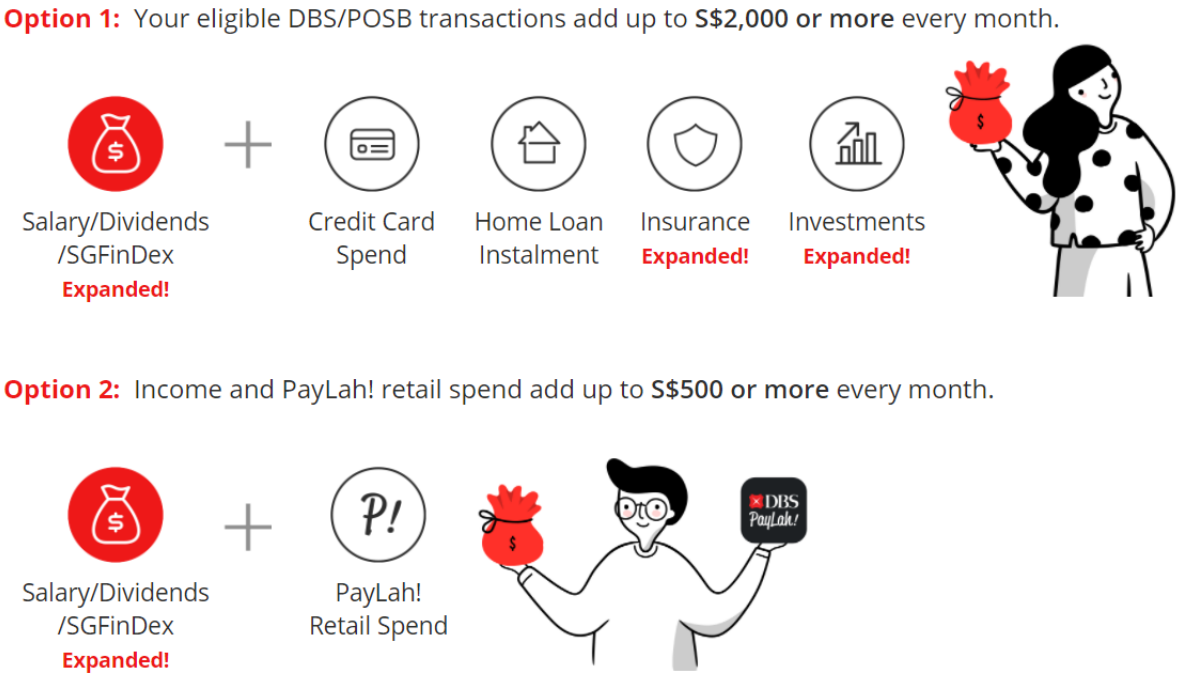
End of Paper

CPF contribution rates

Employee's age (years)	Contribution rates from 1 January 2022 (monthly wages > $750)		
	By employer (% of wage)	By employee (% of wage)	Total (% of wage)
55 and below	17	20	37
Above 55 to 60	14	14	28
Above 60 to 65	10	8.5	18.5
Above 65 to 70	8	6	14
Above 70	7.5	5	12.5

Source:
https://www.cpf.gov.sg/employer/employer-obligations/how-much-cpf-contributions-to-pay

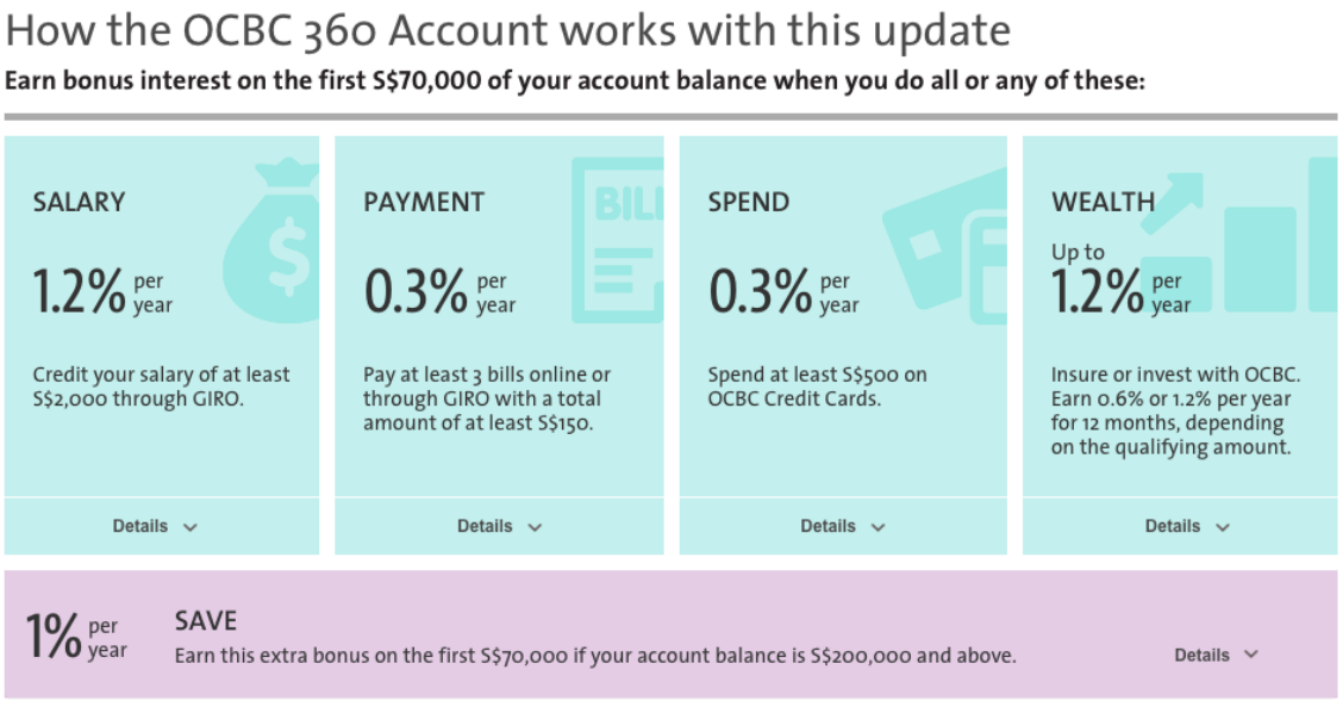
DBS Multiplier account interest rates



Account balances	Total eligible transactions per month					
	< S$2,000	≥ S$2,000 to < S$2,500	≥ S$2,500 to < S$5,000	≥ S$5,000 to < S$15,000	≥ S$15,000 to < S$30,000	≥ S$30,000
First S$25,000 Salary / Dividends / SGFinDex + transactions in 1 category	0.05% p.a.	0.40% p.a.	0.40% p.a.	0.50% p.a.	0.50% p.a.	0.60% p.a.
First S$50,000 Salary / Dividends / SGFinDex + transactions in 2 categories	0.05% p.a.	0.60% p.a.	0.70% p.a.	0.80% p.a.	1.00% p.a.	2.00% p.a.
Next S$50,000 Salary / Dividends / SGFinDex + transactions in 3 categories	0.05% p.a.	1.20% p.a.	1.40% p.a.	1.60% p.a.	1.70% p.a.	3.00% p.a.

Source: https://www.dbs.com.sg/personal/deposits/bank-earn/multiplier#

OCBC 360 account interest rates



You will earn a base interest of 0.05% per year on your entire account balance.

Source: https://dollarsandsense.sg/ocbc-360-revised-interest-rate-heres-much-lesser-account-holders-will-getting/

UOB One account interest rates

Two simple steps to earn up to 2.50% p.a. interest

Here's how you can maximise the interest earned on your savings

Spend min. S$500 monthly on an eligible UOB credit/debit card

+

a) Credit min. salary of S$1,600 monthly into your UOB One Account

or

b) Make 3 GIRO debit transactions per month

Account Balance	Spend min. S$500 (calendar month) on eligible UOB Card Total interest	Spend min. S$500 (calendar month) on eligible UOB Card AND credit your salary OR make 3 GIRO debit transactions Total interest
First S$15,000	0.25%	0.50%
Next S$15,000	0.25%	0.55%
Next S$15,000	0.25%	0.65%
Next S$15,000	0.25%	0.80%
Next S$15,000	0.25%	2.50%
Next S$15,000	0.05%	0.05%

Source: https://www.uob.com.sg/personal/save/everyday-accounts/one-account.page