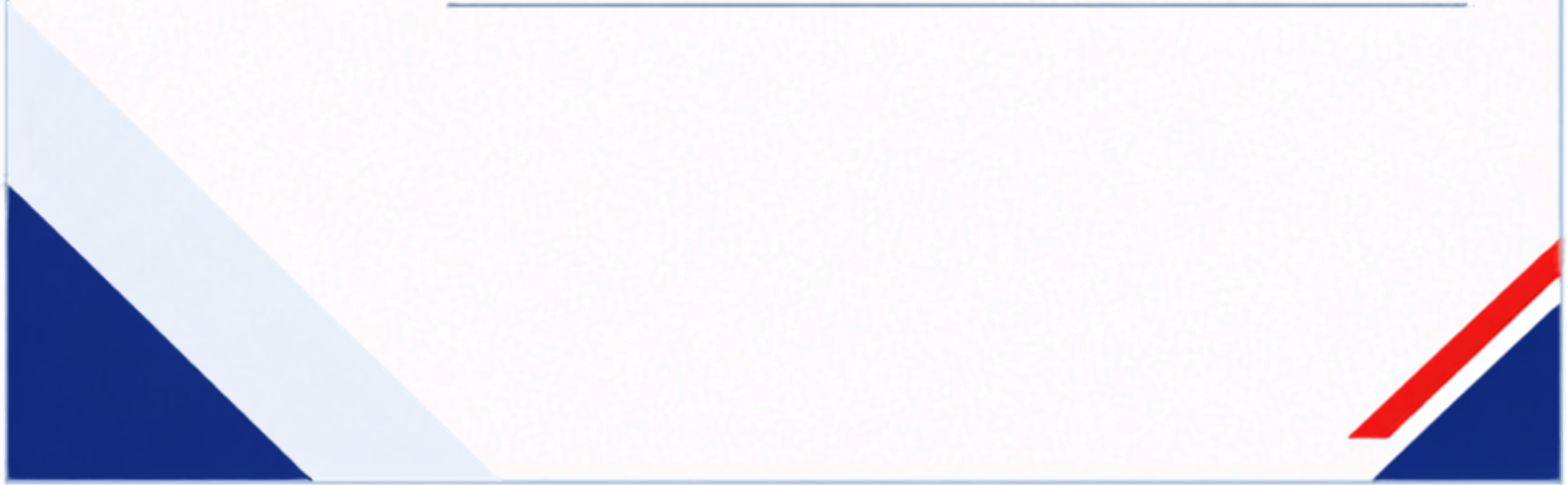




Mathematics Standard 2

Student Workbook

Student name: _____





WESTERN SYDNEY
UNIVERSITY



STUDY AT WESTERN

EXPLORE OUR *PROGRAMS*



DIFFERENT WAYS TO GET INTO UNI

Just because you don't fit the usual entry-mould for uni doesn't mean you can't get in. Maybe you didn't get the ATAR you wanted. Maybe you don't have an ATAR at all. Maybe there were things happening in your life that got in the way of your study.

At Western, there are various pathways into your dream degree. Pathways include:

- Aboriginal and Torres Strait Islander Entry Program
- Schools Recommendation Scheme
- TAFE/Tertiary Education Pathways
- Rural Entry Admission Scheme
- Portfolio and Audition Pathways

westernsydney.edu.au/applicationpathways



SCHOLARSHIPS

Each year, Western offers \$20 million in scholarships for a range of University, government and donor-funded opportunities.

There are over 100 scholarships across a variety of categories:

- Indigenous Scholarships: Dedicated to providing opportunities for Indigenous Australians
- High Potential Scholarships: Recognising excellence, engaged leaders, elite athletes and Western program participants
- Equity Scholarships: To assist students who have experienced disadvantages
- Humanitarian Scholarships: Enabling refugees and asylum seekers to achieve their dreams

westernsydney.edu.au/scholarships

HSC TRUE REWARD

**WESTERN'S EARLY OFFER
PROGRAM FOR YEAR 12 STUDENTS**

Our HSC True Reward program provides an early offer based on your Year 11 or Year 12 subject results relevant to your dream degree, rather than a scaled ATAR.

Apply now to be considered for our upcoming offer rounds.

westernsydney.edu.au/truereward

NEED A BOOST?

See if you're eligible for adjustment factors or special consideration when you apply through UAC.

Receive up to to ten adjustment factors, or points added to your ATAR

westernsydney.edu.au/adjustmentfactors



The College

YOUR PATHWAY TO WESTERN.

Kick-start your uni journey with confidence, with smaller class sizes and personalised support.

Our Diploma courses provide a springboard to diverse career options or your pathway into the second year of a Bachelor degree at Western.

westernsydney.edu.au/thecollege

The Academy

FUTURE THINKING. UNLIMITED POSSIBILITIES.

The Academy is a co-curricular program for students who want to learn, grow and transform as leaders and changemakers. Join our community of leaders by applying for membership to The Academy or enrolling in the Bachelor of Creative Leadership.

westernsydney.edu.au/theacademy

LOVE THESE SUBJECTS? SEE WHERE THEY CAN TAKE YOU! FIND YOUR PATH FROM HSC TO UNIVERSITY.

YOU LOVE ENGLISH? *WHY NOT STUDY:*

- B Communication
- B Screen Media (Arts and Production)
- B Education (Primary)
- B Education (Secondary)
- B Arts
- B Arts (Interpreting and Translation)
- B Laws
- B Performing Arts (Acting)
- B Music
- B Design (Visual Communication)
- B Music
- B International Studies

YOU LOVE STUDIES OF RELIGION? *WHY NOT STUDY:*

- B Arts
- B Social Science
- B Education (Primary)
- B Education (Secondary)

YOU LOVE HISTORY? *WHY NOT STUDY:*

- B Arts
- B International Studies
- B Social Science
- B Education (Primary)
- B Education (Secondary)
- B Tourism and Event Management
- B Planning (Pathway to M Urban Management and Planning)

YOU LOVE VISUAL ARTS? *WHY NOT STUDY:*

- B Architectural Design
- B of Design
- B of Design and Technology
- B of Industrial Design (Honours)

YOU LOVE BUSINESS STUDIES? *WHY NOT STUDY:*

- B Business
- B Accounting
- B Education (Primary)
- B Education (Secondary)
- B Tourism and Event Management
- B Construction Management (Honours)

YOU LOVE LEGAL STUDIES? *WHY NOT STUDY:*

- B Criminology
- B Criminal and Community Justice
- B Cyber Security and Behaviour
- B Policing
- B Laws
- B Social Science
- B Humanitarian and Development Studies
- B Education (Primary)
- B Education (Secondary)
- B Construction Management (Honours)
- B Social Work
- B Youth Work

YOU LOVE COMMUNITY AND FAMILY STUDIES STUDIES? *WHY NOT STUDY:*

- B Arts
- B Criminology
- B Nursing
- B Midwifery
- B Psychology (Honours)
- B Psychological and Social Sciences
- B Social Science
- B Youth Work
- B Social Work
- B Humanitarian and Development Studies
- B Education (Early Childhood)
- B Education (Primary)
- B Education (Secondary)

YOU LOVE PHYSICS? *WHY NOT STUDY:*

- B Science
- B Education (Primary)
- B Education (Secondary)
- B Engineering
- B Architectural Design
- B Industrial Design (Honours)
- B Design and Technology

YOU LOVE CHEMISTRY? *WHY NOT STUDY:*

- B Science
- B Medical Science
- B Education (Primary)
- B Education (Secondary)

YOU LOVE HEALTH AND MOVEMENT SCIENCE? *WHY NOT STUDY:*

- B Health Science
- B Health, Physical Education and Sport
- B Exercise Physiology
- B Exercise Science
- B Sport and Performance Science
- B Occupational Therapy
- B Paramedicine
- B Physiotherapy
- B Podiatric Medicine
- B Speech Pathology
- B Traditional Chinese Medicine
- B Nursing
- B Midwifery
- B Education (Primary)

YOU LOVE MATHEMATICS? *WHY NOT STUDY:*

- B Computer Science
- B Data Science
- B Information and Communication Technology
- B Information Systems
- B Mathematics
- B Engineering
- B Education (Primary)
- B Education (Secondary)
- B Planning (Pathway to M Urban Management and Planning)
- B Accounting

YOU LOVE BIOLOGY? *WHY NOT STUDY:*

- B Health Science
- B Health, Physical Education and Sport
- B Occupational Therapy
- B Paramedicine
- B Physiotherapy
- B Podiatric Medicine
- B Speech Pathology
- B Sport and Performance Science
- B Traditional Chinese Medicine
- B Science
- B Medical Science
- B Nursing
- B Midwifery
- B Education (Primary)
- B Education (Secondary)
- B Clinical Science/Doctor of Medicine

At Western, we have a wealth of support services to help you navigate your university journey:

- Programs to help you settle into uni life as well as your studies
- Student Welfare Service
- Counselling and mental health and wellbeing services
- Disability services

- Members of the ADF – Student Veteran Program
 - Elite athletes and performers support
- westernsydney.edu.au/support

MATHEMATICS STANDARD 2

BACKGROUND KNOWLEDGE

All Mathematics courses are a two-year examinable course, meaning that all content learnt in Stage 6 is examinable. Preliminary content will be examined and is assumed knowledge. The past six year breakdown on Preliminary content versus Common content is outlined below.

	Preliminary Content	Common Content
2019	40%	NA
2020	18%	23%
2021	23%	28%
2022	21%	20%
2023	27%	21%
2024	30%	21%
2025	30%	23%

In preparation for your HSC Examination in October, it is vital that you have in-depth knowledge of both Preliminary and HSC content in all five areas of the syllabus. It also means that if you transferred from the Mathematics Advanced courses in Year 12, you will have some extra revision to complete to ensure you are not disadvantaged.

WHAT DO I NEED TO KNOW TO BE SUCCESSFUL?

Practice makes perfect in any situation and Mathematics is no exception. To be successful, continual practise of time management is crucial for success when it matters. Obviously, knowing the syllabus is also key to succeeding in any Mathematics course. The table below shows the syllabus breakdown for the past six years of Mathematics Standard 2 HSC Examinations.

	Financial Mathematics	Measurement	Algebra	Statistical Analysis	Networks
2019	21	30	19	20	10
2020	21	31	15	20	13
2021	21	30	19	21	9
2022	22	33	10	24	11
2023	27	28	15	18	12
2024	26	28	14	21	11
2025	23	30	12	23	12

Outlined on the following pages are the content points by listed by content areas that you will need to be confident in so that you can be successful on examination day. These are the skills that the HSC questions are constructed to assess.

FINANCIAL MATHEMATICS

You must be confident in:

- ✓ Calculating simple interest (F1.1)
- ✓ Calculating percentage changes, including GST (F1.1)
- ✓ Calculating the straight-line method of depreciation $S = V_0 - Dn$ (F1.1)
- ✓ Performing calculations with income types (F1.2)
- ✓ Performing calculations with annual leave and holiday loading (F1.2)
- ✓ Performing calculations with income tax including allowable deductions, taxable income, tax payable, Medicare levy, PAYG tax and determining if a refund or debt is due (F1.2)
- ✓ Interpreting household bills (F1.3)
- ✓ Understanding the fees and charges associated with purchasing a car including cost price, on-road costs, insurance and stamp duty (F1.3)
- ✓ Understanding the fees and charges associated with the running and maintenance of a car including the different types of insurance available as well as other running costs (F1.3)
- ✓ Preparing and reading a household budget (F1.3)
- ✓ Calculating the future value (FV) or present value (PV) and the interest rate (r) of a compound interest investment using the formula $FV = PV(1 + r)^n$ (F4.1)
- ✓ Solving practical problems involving compounding, for example determine the impact of inflation on prices and wages (F4.1)
- ✓ Working with shares and calculate the appreciated value of items including the calculating the dividend yield of a portfolio of shares (F4.1)
- ✓ Calculating the depreciation of an asset using the declining-balance method using the formula $S = V_0(1 - r)^n$ (F4.2)
- ✓ Solving practical problems involving reducing balance loans, for example determining the total loan amount and monthly repayments (F4.2)
- ✓ Working with credit cards, recognising them as an example of a reducing balance loan. (F4.2)
- ✓ Identifying an annuity – how is it different to a compound interest investment? (F5)
- ✓ Using a table of interest factors to perform annuity calculations. For example: calculating the present or future value of an annuity, the contribution amount required to achieve a given future value or the single sum that would produce the same future value as a given annuity (F5)

ALGEBRA

You must be confident in:

- ✓ Substituting into linear and non-linear expressions (A1)
- ✓ Rearranging the subject of equations (A1)
- ✓ Solving equations derived from substitution or worded scenarios (A1)
- ✓ Performing calculations with medication (A1)
- ✓ Performing calculations with BAC (A1)
- ✓ Constructing straight-line graphs, interpreting the gradient and y-intercept (A2)
- ✓ Direct variation scenarios, including the constant of variation (A2)
- ✓ Using the linear function $y = mx + c$ (A2)
- ✓ Identifying limitations in linear models in a practical context (A2)
- ✓ Developing a pair of simultaneous linear equations to model a practical situation (A4.1)
- ✓ Solving practical problems that involve finding the point of intersection of two straight-line graphs including break-even analysis (A4.1)
- ✓ Using exponential models to solve problems, interpreting the meaning of the intercepts of an exponential graph in a variety of contexts as well as in practical growth ($y = a^x$) and decay ($y = a^{-x}$ ($a > 0$)) (A4.2)

- ✓ Using the quadratic model to solve practical problems involving quadratic functions or expressions of the form $y = ax^2 + bx + c$, identifying the turning point as the axis of symmetry as well as intercepts in practical contexts (A4.2)
- ✓ Recognising that reciprocal functions of the form $y = \frac{k}{x}$, where k is a constant, represent inverse variation, identify the rectangular hyperbolic shape of these graphs and their important features as well as using reciprocal models to solve practical inverse variation problems algebraically and graphically (A4.2)

MEASUREMENT

You must be confident in:

- ✓ Converting units, including distance and capacity (M1.1)
- ✓ Measurement error, including absolute error, bounds, percentage error (M1.1)
- ✓ Standard form (M1.1)
- ✓ Significant figures (M1.1)
- ✓ Perimeter and area of triangles, rectangles, parallelograms, trapezia, circles, sectors of circles and composite shapes (M1.2)
- ✓ Pythagoras' theorem (M1.2)
- ✓ Surface area of solids including but not limited to prisms, cylinders, spheres and composite solids (1.2)
- ✓ Trapezoidal rule (M1.2)
- ✓ Capacity (M1.2)
- ✓ Using units of energy to solve problems involving the amount of energy expended in activities (For example: kilojoules)(M1.3)
- ✓ Converting units, including weight, food energy, electricity energy (M1.3)
- ✓ Energy expenditure (M1.3)
- ✓ Home appliance energy consumption (M1.3)
- ✓ Indicating positions on the Earth's surface (M2)
- ✓ Using the link between longitude and time to find time differences (M2)
- ✓ Calculating times and time differences around the world, including time zones, UTC and the International dateline (M2)
- ✓ Solving problems involving time zones in Australia and in neighbouring nations, making any necessary allowances for daylight saving (M2)
- ✓ Interpreting timetables (M2)
- ✓ Solving practical problems (For example: travelling east and west, incorporating time zones, or internet and phone usage across time zones, or the timing of events broadcast live from states of countries between different time zones) (M2)
- ✓ Using right-angled trigonometry to calculate unknown angles and sides (M6)
- ✓ Performing calculations with the Sine rule: $\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$ (M6)
- ✓ Performing calculations with the Cosine rule: $c^2 = a^2 + b^2 - 2ab \cos C$; $\cos C = \frac{a^2 + b^2 - c^2}{2ab}$ (M6)
- ✓ Calculating the area of a triangle using: $A = \frac{1}{2} ab \sin C$ (M6)
- ✓ Solving practical problems involving Pythagoras' theorem, the trigonometry of right-angled and non-right-angled triangles, angles of elevation and depression and the use of true bearings and compass bearings (M6)
- ✓ Constructing and interpreting radial compass surveys to solve related problems (M6)
- ✓ Using rates to solve and describe practical problems including best buys, speed, heart rate, energy consumption, appliance usage of energy, fuel consumption etc (M7)
- ✓ Solving practical problems involving ratio including map scales, mixtures for building materials, cost per item, dividing a quantity into a given ratio, population estimation (capture-recapture) (M7)

- ✓ Obtaining measurements from scale drawings, including but not limited to maps or building plans, to solve problems including common symbols and abbreviations on plans as well as elevations (M7)
- ✓ Calculating the perimeter or area of a section of land, using the Trapezoidal rule where appropriate, from a variety of sources, including but not limited to a site plan, an aerial photograph, radial surveys or maps that include a scale (M7)
- ✓ Calculating the volume of rainfall over an area from sources including aerial photos, radial surveys or maps that include scale (M7)

STATISTICAL ANALYSIS

You must be confident in:

- ✓ Describing appropriate data collection methods – census, sample (random, systematic, stratified, self-selected) and the advantages and disadvantages of each method. (S1.1)
- ✓ Classifying data as categorical (ordinal/nominal) or numerical (discrete/continuous) (S1.1)
- ✓ Displaying data in various forms including, but not limited to frequency distribution tables, histograms (frequency/ cumulative frequency), dot plots, stem and leaf plots, pareto charts, line graphs (S1.1)
- ✓ Calculating measures of central tendency (mean, mode, median) and measures of location (range, standard deviation, interquartile range) (S1.2)
- ✓ Identifying outliers (S1.2)
- ✓ Describing, comparing and interpreting the distributions of graphical displays and/or numerical datasets by referring to the modality, shape or the measures of central tendency and spread clearly and concisely (S1.2)
- ✓ Constructing and comparing parallel box-plots through completing five number summaries communicating the differences observed between parallel box-plots in the context of the data (S1.2)
- ✓ Using the language associated with theoretical probability and relative frequency (S2)
- ✓ Constructing a sample space for an experiment and use it to determine the number of outcomes (S2)
- ✓ Determining the probabilities associated with simple games and experiments (S2)
- ✓ Using arrays and tree diagrams to determine the outcomes and probabilities for multistage experiments (S2)
- ✓ Solving problems involving simulations or trials of experiments in a variety of contexts using relative frequency as an estimate of probability (S2)
- ✓ Solving problems involving probability and/or relative frequency in a variety of contexts including expected frequency (S2)
- ✓ Constructing a bivariate scatterplot and describing patterns, features and associations of bivariate datasets in terms of the form (linear/non-linear), direction (positive/negative) and strength of any association (strong/moderate/weak) (S4)
- ✓ Calculating and interpreting Pearson's correlation coefficient (r) using technology to quantify the strength of a linear association of a sample (S4)
- ✓ Modelling a linear relationship by fitting an appropriate line of best fit to a scatterplot and using it to describe and quantify associations (S4)
- ✓ Using the appropriate line of best fit, both found by eye and by applying the equation, to make predictions by either interpolation or extrapolation (S4)
- ✓ Implementing the statistical investigation process to answer questions that involve identifying, analysing and describing associations between two numerical variables (S4)
- ✓ Constructing, interpreting and analysing scatterplots for bivariate numerical data in practical contexts including biometric data (S4)
- ✓ Demonstrating an awareness of issues of privacy and bias, ethics, and responsiveness to diverse groups and cultures when collecting and using data (S4)

- ✓ Recognising a normal distribution and identifying that the mean, median and mode are approximately equal in a normal distribution (S5)
- ✓ Calculating a z-score using: $z \text{ score} = \frac{x - \mu}{\sigma}$, and be able to describe the z-score with reference to the mean and standard deviation (S5)
- ✓ Comparing data sets through the use of the z-score (S5)
- ✓ Applying the empirical rule (68/95/99.7) to solve problems (S5)
- ✓ Using z-scores to identify probabilities of events less or more extreme than a given event (S5)

NETWORKS

You must be confident in:

- ✓ Identifying and using network terminology (N2.1)
- ✓ Solving problems involving network diagrams (N2.1)
- ✓ Drawing network diagrams to represent information given in a table (N2.1)
- ✓ Determining the minimum spanning tree of a given network with weighted edges using Prim's, Kruskal's or inspection methods (N2.2)
- ✓ Calculating the shortest path from one place to another in a network with no more than 10 vertices (N2.2)
- ✓ Constructing a network to represent the duration and interdependencies of activities that must be completed during a particular project (N3)
- ✓ Preparing network diagrams from activity charts (N3)
- ✓ Using critical path analysis to determine the minimum time for a project to be completed (N3)
- ✓ Using forward and backward scanning to determine the earliest starting time (EST) and latest starting time (LST) for each activity in the project (N3)
- ✓ Solving small-scale network flow problems, including the use of the 'maximum-flow minimum-cut' theorem by converting information presented in a table into a network diagram and determining the flow capacity of a network and whether the flow is sufficient to meet the demand in various contexts (N3)

Go through the whole paper before starting
Start with the questions you are most confident in
Don't leave any 2+ mark questions blank - make an attempt!!
Be persistent - even if you think you have made a mistake - keep going.
Highlight key terms in a question.
Leave a question if it is taking too long and come back to it later.

SAMPLE HSC QUESTIONS

MULTIPLE CHOICE PRACTISE

1. A student works from 10 am to 1 pm each Sunday and the normal rate of pay is \$30 per hour. The student is paid at the normal rate for morning work and double time for afternoon work.

How much does the student earn each Sunday?

(A) \$90

(B) \$120

(C) \$150

(D) \$180

$$2 \text{ hr } \$30 \times 1 = 60$$

$$1 \text{ hr } \times \$30 \times 2 = 60$$

2. This table is used to calculate income tax for individuals.

Taxable income (\$)	Tax payable
\$0 – \$18 200	Nil
\$18 201 – \$37 000	19c for each \$1 over \$18 200
\$37 001 – \$87 000	\$3572 plus 32.5c for each \$1 over \$37 000
\$87 001 – \$180 000	\$19 822 plus 37c for each \$1 over \$87 000
\$180 001 and over	\$54 232 plus 45c for each \$1 over \$180 000

Based on the table, what is the tax payable on a taxable income of \$86 725?

(A) \$19 219.88

(B) \$19 732.63

(C) \$19 822.00

(D) \$19 924.12

3. What amount must be invested now at 4% per annum, compounded quarterly, so that in five years it will have grown to \$60 000?

(A) \$8919

(B) \$11 156

(C) \$49 173

(D) \$49 316

$$60\,000 = P \left(1 + \frac{0.04}{4}\right)^{20}$$

$$P = \frac{60\,000}{(1.01)^{20}}$$

4. The table gives the present value interest factors for an annuity of \$1 per period, for various interest rates (r) and numbers of periods (N).

Table of present value interest factors					
N \ r	Interest rate per period (as a decimal)				
	0.0075	0.0080	0.0085	0.0090	0.0095
70	54.30462	53.43960	52.59397	51.76724	50.95891
71	54.89293	54.00754	53.14226	52.29657	51.46995
72	55.47685	54.57097	53.68593	52.82118	51.97618
73	56.05643	55.12993	54.22502	53.34111	52.47764
74	56.63169	55.68446	54.75957	53.85641	52.97438

A man plans to invest \$200 each month for 6 years. His investment will earn interest per month at the rate of 9.6% per annum.

$$\div 12 = 0.8\%$$

$$200 \times 54.57097$$

Based on the information in the table, what is the present value of this annuity?

(A) \$10 395.24

(B) \$10 914.19

(C) \$14 400.00

(D) \$15 782.40

5. A sum of \$250 000 was borrowed to buy a house. The interest rate and monthly repayment for the loan are shown in the spreadsheet.

	A	B	C	D	E
1	Home Loan Table			<i>This table assumes the same number of days in each month, ie</i> Interest = Rate/12 × Principal	
2		Amount = \$250 000			
3		Annual Interest Rate = 7.65%			
4		Monthly Repayment (R) = \$1871.94			
5					
6	Month	Principal (P)	Interest (I)	P + I	P + I - R
7	1	\$250 000.00	\$1593.75	\$251 593.75	\$249 721.81
8	2	\$249 721.81	\$1591.98	\$251 313.79	\$249 441.85
9	3	\$249 441.85	\$1590.19	\$251 032.04	
10	4				

What is the total interest charged for the first four months of this loan?

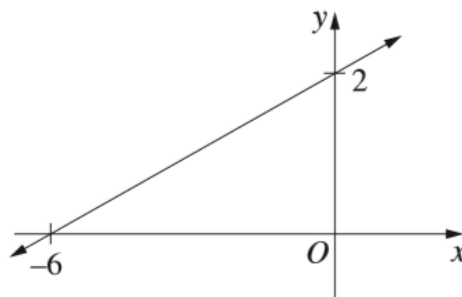
- (A) \$6364.32 (B) \$6366.11 (C) \$6369.67 (D) \$6376.25

6. If $m = \frac{a + 15}{2a}$ and $a = 3$, what is the value of m ?

$$m = \frac{3 + 15}{2 \times 3} = \frac{18}{6}$$

- (A) 3 (B) 5.5 (C) 25.5 (D) 27

7. The diagram shows the graph of a line.



$$m = \frac{2}{6} = \frac{1}{3}$$

$$c = 2$$

What is the equation of this line?

- (A) $y = 3x + 2$ (B) $y = \frac{1}{3}x - 6$ (C) $y = \frac{1}{3}x + 2$ (D) $y = -6x + 2$

8. Which of the following correctly expresses T as the subject of $B = 2\pi \left(R + \frac{T}{2} \right)$?

- (A) $T = \frac{B}{\pi} - 2R$ (B) $T = \frac{B}{\pi} - R$ (C) $T = 2R - \frac{B}{\pi}$ (D) $T = \frac{B}{4\pi} - \frac{R}{2}$

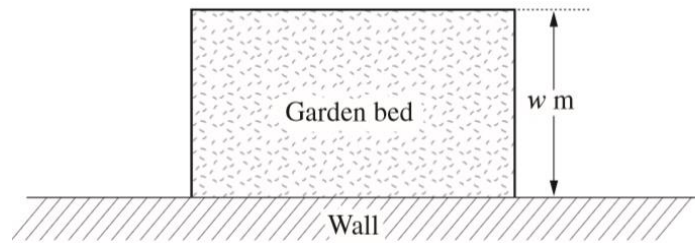
$$\frac{B}{2\pi} = R + \frac{T}{2}$$

$$T = 2 \left(\frac{B}{2\pi} - R \right)$$

$$\frac{B}{2\pi} - R = \frac{T}{2}$$

$$T = \frac{2B}{2\pi} - 2R$$

9. A gardener has created a rectangular garden bed with 24 metres of fencing, using a wall as one side of the bed. The plan for the garden bed is shown, where w metres is the width.



NOT TO SCALE

$$\begin{aligned} 2w + l &= 24 \\ l &= 24 - 2w \\ A &= l \times w \\ A &= (24 - 2w) \times w \\ &= w(24 - 2w) \\ &= 24w - 2w^2 \end{aligned}$$

Which equation gives the area, A , of the garden bed?

- (A) $A = 12w - w^2$ (B) $A = 12w - 2w^2$ (C) $A = 24w - w^2$ (D) $A = 24w - 2w^2$

10. Suppose $y = -1 - 2x$

$$x = 1$$

$$\begin{aligned} y &= -1 - 2 \\ &= -3 \end{aligned}$$

$$x = 6$$

$$\begin{aligned} y &= -1 - 2(6) \\ &= -13 \end{aligned}$$

When the value of x increases by 5, the value of y decreases by

- (A) 1 (B) 2 (C) 5 (D) 10

11. A plumber charges a call-out fee of \$90 as well as \$2 per minute while working.

Suppose the plumber works for t hours.

$$\begin{aligned} &\times 60 / \text{hr} \\ &\$120 \text{ per hour} \end{aligned}$$

Which equation expresses the amount the plumber charges (\$ C) as a function of time (t hours)?

- (A) $C = 2t + 90t$ (B) $C = 90 + 2t$ (C) $C = 120 + 90t$ (D) $C = 90 + 120t$

12. In a school experiment, a student measured a length to be 9.4 cm.

What is the upper limit of accuracy of this measurement?

- (A) 9.41 cm (B) 9.45 cm (C) 9.5 cm (D) 9.9 cm

$$\begin{aligned} 0.1 \times \frac{1}{2} &= 0.05 \\ 9.4 + 0.05 & \end{aligned}$$

13. What is 0.002073 expressed in standard form with two significant figures?

- (A) 2.07×10^{-3} (B) 2.07×10^{-2} (C) 2.1×10^{-2} (D) 2.1×10^{-3}

$$2.1 \times 10^{-3}$$

14. Part of a train timetable is shown.

Amesham	13.37	13.47	...	13.55
Bickford	13.43	...	14.00	14.02
Clipsbury	...	14.02	...	14.11
Doppleton	14.05	14.12	14.20	14.24
Evesbury	14.17	14.29	...	14.43
Frampton	14.38	...	14.47	14.55

Kris arrives at Amesham station at 1.45 pm and needs to get to Frampton as quickly as possible.

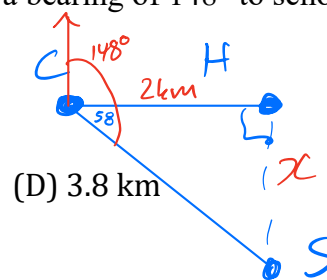
Assuming all trains run to schedule, what is the EARLIEST time that Kris can arrive at Frampton station?

- (A) 2.29 pm (B) 2.38 pm (C) 2.47 pm (D) 2.55 pm

15. Abby walks 2 km due west from home to a coffee shop. She then walks on a bearing of 148° to school, which is due south of her home.

How far south, to the nearest 0.1 km, is Abby from home?

- (A) 1.1 km (B) 1.2 km (C) 3.2 km (D) 3.8 km



16. The table shows the average energy used, in kilojoules per kilogram of body mass, by a person walking for 30 minutes at different speeds.

Walking speed	Energy used in 30 minutes
3 km/h	5.53 kJ/kg
5 km/h	7.37 kJ/kg

at 3 km/h
 5.53 kJ/kg
 $\times 65 \text{ kg}$
 359.45 kJ burnt in 30 mins

$359.45 \div 30 \text{ mins}$
 $= 11.9817 \text{ kJ/min}$
 Needs to burn 305.432 kJ
 11.9817 kJ/min
 305.432 kJ

Sam, who weighs 65 kg, drinks a regular cappuccino made with full cream milk. It contains 73 kilocalories.

$$\times 4.184 = 305.432 \text{ kJ}$$

For approximately how long must Sam walk at 3 km/h to burn off the energy contained in the cappuccino? (1 kilocalorie = 4.184 kJ)

- (A) 20 minutes (B) 25 minutes (C) 90 minutes (D) 120 minutes

17. During a flood, 1.5 hectares of land was covered by water to a depth of 17 cm.

How many kilolitres of water covered the land?

(1 hectare = 10 000 m^2 and 1 m^3 = 1000 L)

- (A) 2.55 kL (B) 2550 kL (C) 255 000 kL (D) 2 550 000 kL

$$1.5 \text{ HA} = 15000 \text{ m}^2$$

$$15000 \times 0.17 = 2550 \text{ m}^3$$

$$2550 \text{ m}^3 \times 1000 = 2550000 \text{ L}$$

$$\div 1000 = 2550 \text{ kL}$$

18. The heights of the players in a basketball team were recorded as 1.8 m, 1.83 m, 1.84 m, 1.86 m and 1.92 m. When a sixth player joined the team, the average height of the players increased by 1 centimetre. $\bar{x}_1 = 1.85$, $\bar{x}_2 = 1.86$

What was the height of the sixth player?

$$1.86 = \frac{9.25 + x}{6}$$

$$11.16 = 9.25 + x$$

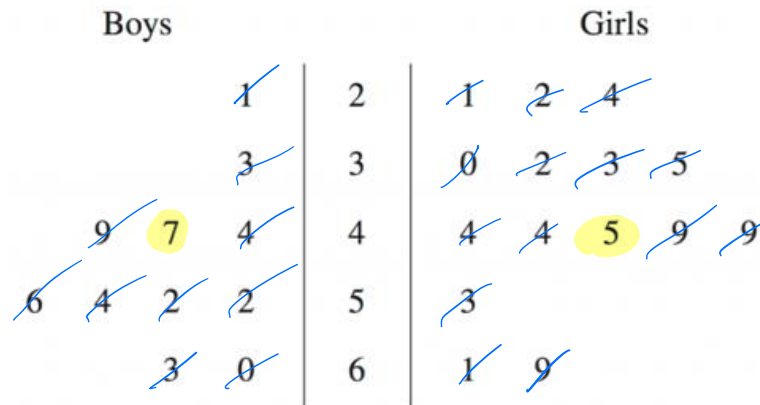
(A) 1.85 m

(B) 1.86 m

(C) 1.91 m

(D) 1.93 m

19. This back-to-back stem-and-leaf plot displays the test results for a class of 26 students.



What is the median test result for the class?

(A) 44

(B) 46

(C) 48

(D) 49

20. Two unbiased dice, each with faces numbered 1, 2, 3, 4, 5, 6, are rolled.

What is the probability of a 6 appearing on at least one of the dice?

(A) $\frac{1}{6}$

(B) $\frac{11}{36}$

(C) $\frac{25}{36}$

(D) $\frac{5}{6}$

$$\frac{1}{6} \times \frac{1}{6} = \frac{1}{36}$$

$$\frac{1}{6} \times \frac{5}{6} = \frac{5}{36}$$

$$\frac{5}{36} + \frac{5}{36} = \frac{10}{36} = \frac{5}{18}$$

21. In an experiment, a standard six-sided die was rolled 72 times. The results are shown in the table.

Number on die	Frequency
1	6
2	12
3	10
4	20
5	9
6	15

$$\frac{1}{6} \times 72 = 12$$

Which number on the die was obtained the expected number of times?

(A) 1

(B) 2

(C) 3

(D) 6

$$\frac{40}{52} \times \frac{12}{52} = \frac{30}{169}$$

22. A deck of 52 playing cards contains 12 picture cards. Two cards from the deck are drawn at random and placed on a table.

What is the probability, correct to four decimal places, that exactly one picture card is on the table?

- (A) 0.0498 (B) 0.1810 (C) 0.3550 (D) 0.3620

23. The head circumference (in cm) of a population of infant boys is normally distributed with a mean of 49.5 cm and a standard deviation of 1.5 cm.

Four hundred of these boys are selected at random and each boy's head circumference is measured.

The number of these boys with a head circumference of less than 48.0 cm is closest to

- (A) 3 (B) 10 (C) 64 (D) 272

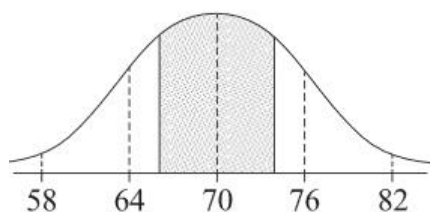
24. Which of the following would be most likely to have a positive correlation?

- (A) The population of a town and the number of schools in that town
(B) The price of petrol per litre and the number of litres of petrol sold
(C) The hours training for a marathon and the time taken to complete the marathon
(D) The number of dogs per household and the number of televisions per household

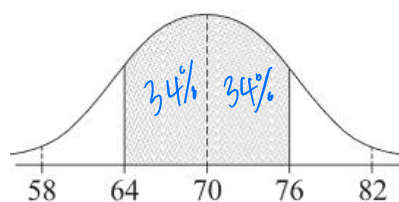
25. The scores on an examination are normally distributed with a mean of 70 and a standard deviation of 6. Michael received a score on the examination between the lower quartile and the upper quartile of the scores.

Which shaded region most accurately represents where Michael's score lies?

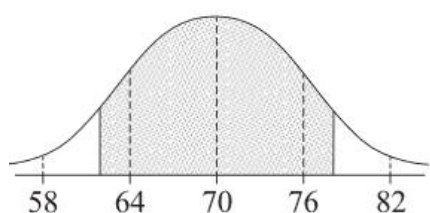
(A)



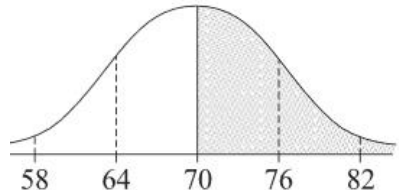
(B)



(C)

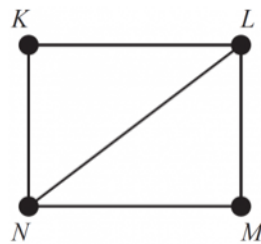


(D)



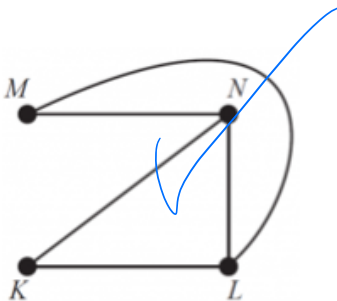
26. The graph below represents a friendship network. The vertices represent the four people in the friendship network: Kwan (K), Louise (L), Milly (M) and Narelle (N).

An edge represents the presence of a friendship between a pair of these people. For example, the edge connecting K and L shows that Kwan and Louise are friends.

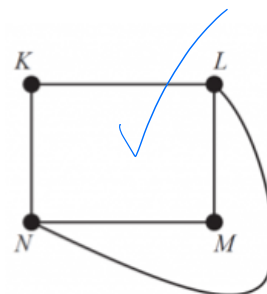


Which one of the following graphs does not contain the same information?

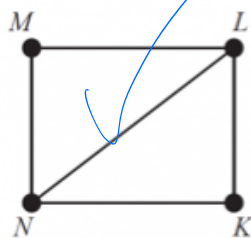
(A)



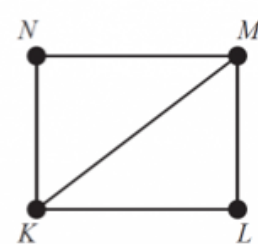
(B)



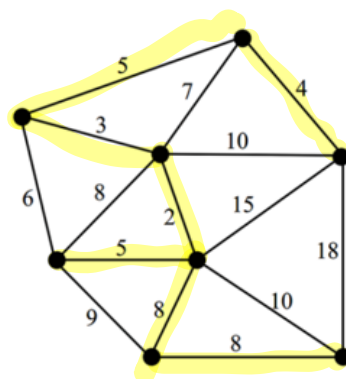
(C)



(D)



27.



$$6 + 4 + 5 + 3 + 2 + 5 + 8$$

For the network above, the length of the minimal spanning tree is

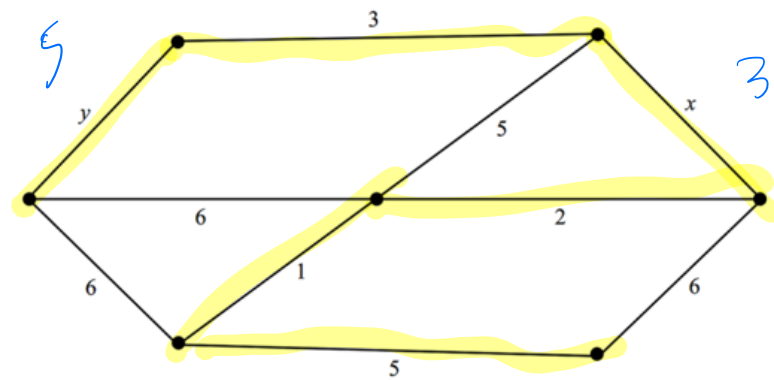
(A) 30

(B) 31

(C) 35

(D) 39

28. The minimal spanning tree for the network below includes two edges with weightings x and y .



The length of the minimal spanning tree is 19.

The values of x and y could be

$$y + 11 + x = 19$$

(A) $x = 1, y = 7$

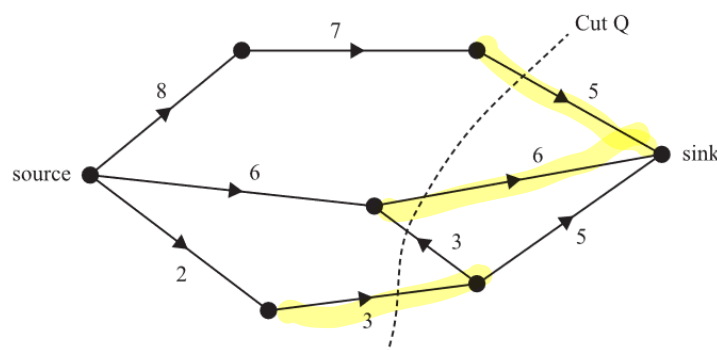
(B) $x = 2, y = 5$

(C) $x = 3, y = 5$

(D) $x = 4, y = 5$

29. The flow of water through a series of pipes is shown in the network below.

The numbers on the edges show the maximum flow through each pipe in litres per minute.



$$5 + 6 + 3$$

The capacity of Cut Q , in litres per minute, is

(A) 11

(B) 13

(C) 14

(D) 17

30.Andy, Brian and Caleb must complete three activities in total (K, L and M).

The table shows the person selected to complete each activity, the time it will take to complete the activity in minutes and the immediate predecessor for each activity.

Person	Activity	Duration	Immediate predecessor
Andy	K	13	—
Brian	L	5	K
Caleb	M	16	L

All three activities must be completed in a total of 40 minutes.

The instant that Andy starts his activity, Caleb gets a telephone call.

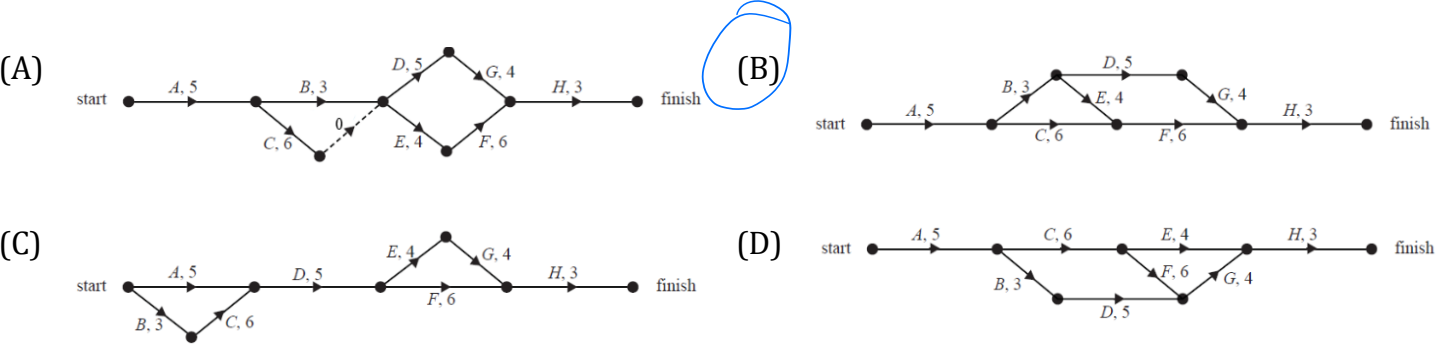
The maximum time, in minutes, that Caleb can speak on the telephone before he must start his allocated activity is

- (A) 5
- (B) 13
- (C) 18
- (D) 24

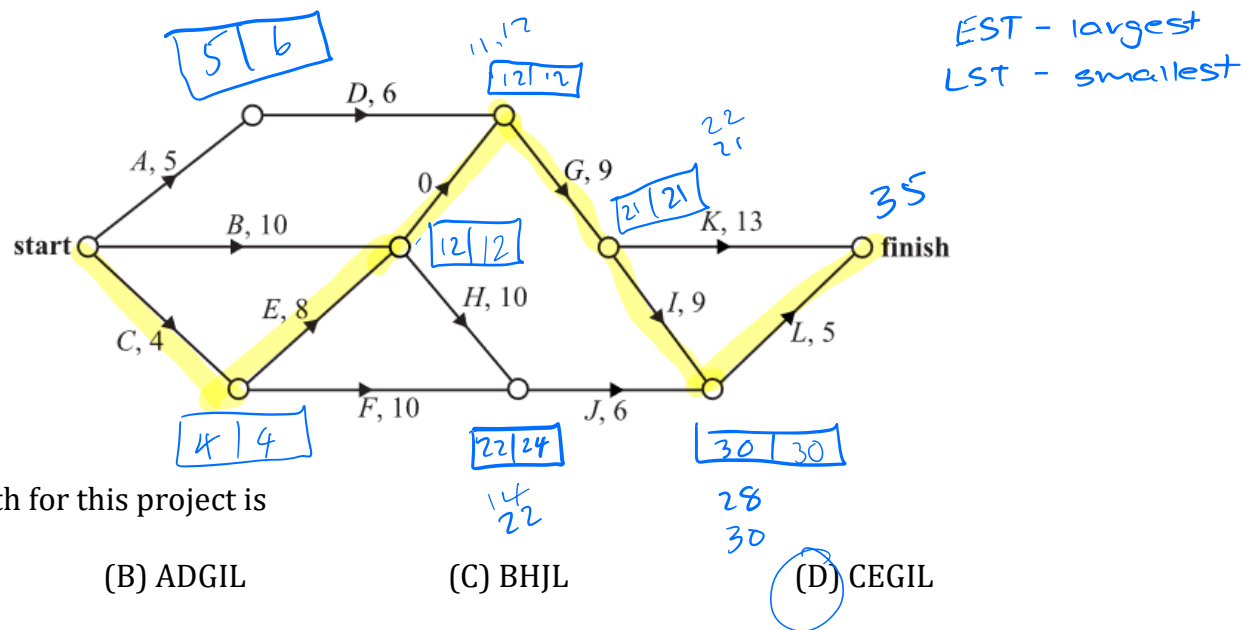
31.The table below shows, in minutes, the duration, the earliest starting time (EST) and the latest starting time (LST) of eight activities needed to complete a project.

Activity	Duration	EST	LST
A	5	0	0
B	3	5	5
C	6	5	6
D	5	8	9
E	4	8	8
F	6	12	12
G	4	13	14
H	3	18	18

Which one of the following directed graphs shows the sequence of these activities?



32. A project has 12 activities. The network below gives the time (in hours) that it takes to complete each activity.



MULTIPLE CHOICE QUESTION TIPS AND TRICKS

Read Q twice (at least)

Eliminate obvious wrong answers

Make a judgment as to the most correct answer

Look for qualification words (always, must)

Notice negatives (should not be any in the HSC)

Use grammatical clues

Never leave any blank!

EXTENDED RESPONSE PRACTISE

Question 33 (2 marks)

Heather used her credit card to purchase a plane ticket valued at \$3950 on 28 January 2020. She made no other purchases on her credit card account in January. She paid the January account in full on 19 February 2020.

2

The credit card account has no interest free period. Compound interest is charged daily at the rate of 20% per annum, including the date of purchase and the date the account is paid.

How much interest did she pay, to the nearest cent?

$$r = \frac{20\%}{365}$$

$$19 \text{ days feb} + 4 \text{ days Jan} = 23 \text{ days}$$

$$A = 3950 \left(1 + \frac{20\%}{365}\right)^{23} = 4000.082$$

$$I = A - P \Rightarrow 4000.082 - 3950 = \$50.08$$

Question 34 (2 marks)

Ralph buys a utility vehicle with a market value of \$56 750.

2

Stamp duty is calculated on the vehicle as follows:

- 3% of market value up to \$45 000
- 5% of market value over \$45 000

Calculate the amount of stamp duty payable by Ralph.

$$3\% \times 45\,000 = \$1\,350$$

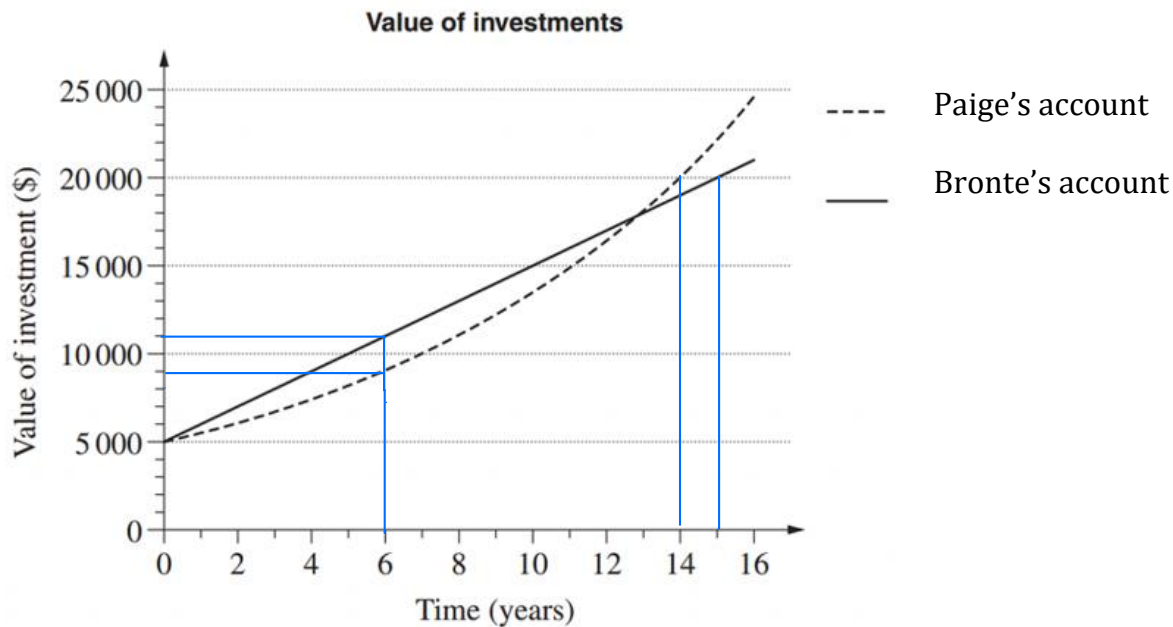
$$56\,750 - 45\,000 = \$11\,750$$

$$5\% \times 11\,750 = \$587.50$$

$$\text{Total} = \$12\,337.50$$

Question 35 (4 marks)

Paige and Bronte each have money to invest and choose different investment accounts. The graph shows the values of their investments over time.



(a) How much was Paige's original investment?

1

\$5000

(b) At the end of 6 years, which investment will be worth the most and by how much?

2

Bronte by \$2000
 $11000 - 9000 = 2000$

(c) Paige's investment will reach a value of \$20 000 first.

1

How much longer will it take Bronte's investment to reach a value of \$20 000?

1 year

Question 36 (3 marks)

Cathy wants to borrow money to buy a house. The bank sent her an email with the following table attached.

Monthly repayments

Amount borrowed	Term of loan				
	10 years	15 years	20 years	25 years	30 years
	120 months	180 months	240 months	300 months	360 months
\$80 000	\$940.62	\$764.52	\$669.15	\$617.42	\$587.01
\$90 000	\$1091.95	\$860.09	\$752.80	694.63	\$660.36
\$100 000	\$1213.28	\$955.65	\$836.44	\$771.82	\$733.76
\$110 000	\$1334.60	\$1051.22	\$920.08	\$849.00	\$807.14
\$120 000	\$1455.93	\$1146.78	\$1003.73	\$926.18	\$880.52
\$130 000	\$1577.26	\$1242.35	\$1087.37	\$1003.56	\$953.89
\$140 000	\$1698.59	\$1337.91	\$1171.02	\$1080.54	\$1027.27
\$150 000	\$1819.91	\$1433.48	\$1254.66	\$1157.72	\$1100.65
\$160 000	\$1941.24	\$1529.04	\$1338.30	\$1234.91	\$1174.02

- (a) Cathy decides that she can afford \$1000 per month on repayments.

1

What is the maximum amount she can borrow, and how many years will she have to repay the loan?

\$130 000 over 30 years

- (b) Imogen intends to borrow \$160 000 over 15 years from the same bank.

2

If she chooses to borrow \$160 000 over 20 years instead, how much more interest will she pay?

15 yrs: $1529.04 \times 180 = 275,227.20$
 $I = 275,227.2 - 160,000 = 115,227.20$

20 yrs: $1338.30 \times 240 = 321,192$
 $I = 321,192 - 160,000 = 161,192$

Difference: $161,192 - 115,227.20 = \$45,964.80$ more
 in interest

Question 37 (3 marks)

The formula below can be used to calculate the required dosages of medicine for children aged 1–12 years.

$$d = \frac{yA}{y + 12}$$

where D = dosage for children aged 1–12 years

y = age of child (in years)

A = adult dosage

How much medicine should be given in total to an ^{1.5 yrs} 18-month-old child between ^{14 hrs} 9 am and 11 pm if each adult dosage is 45 mL? The medicine is to be taken every 6 hours with the first dose given at 8 am.

3

$$d = \frac{1.5 \times 45}{1.5 + 1} = 5 \text{ mL per dose}$$

$$8 \text{ am} + 6 \text{ hrs} = 2 \text{ pm} + 6 \text{ hrs} = 8 \text{ pm}$$

10 mL between 9 - 11 pm

Question 38 (5 marks)

Two friends, Anka and Budi, sold their cupcakes at the school cake stall.

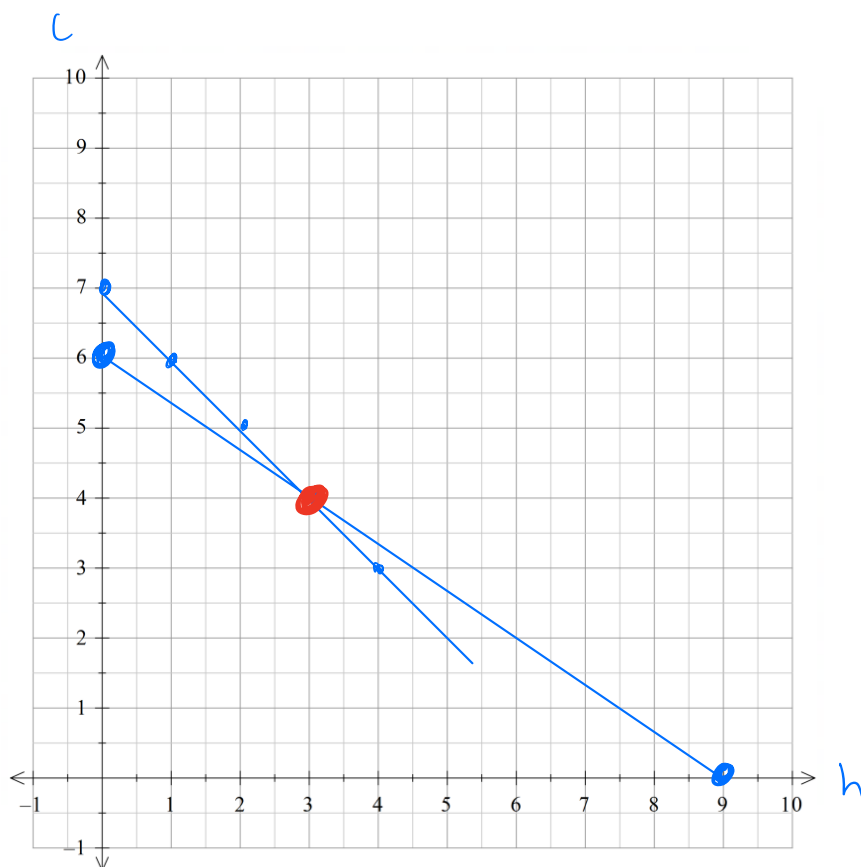
Anka sold her cupcakes for \$2 each while Budi sold his for \$3 each. Their combined sales for the first hour were \$18.

If Anka sold x cupcakes and Budi sold y cupcakes, then the following equation can be formed:
 $2x + 3y = 18$.

In the first hour, the friends sold a total of 7 cupcakes between them.

Find the number of cupcakes each of the friends sold during this time, by forming a second equation and solving the simultaneous equations graphically.

5



①
 $2x + 3y = 18$
y-int $3y = 18$
 $y = 6$
x-int $2x = 18$
 $x = 9$

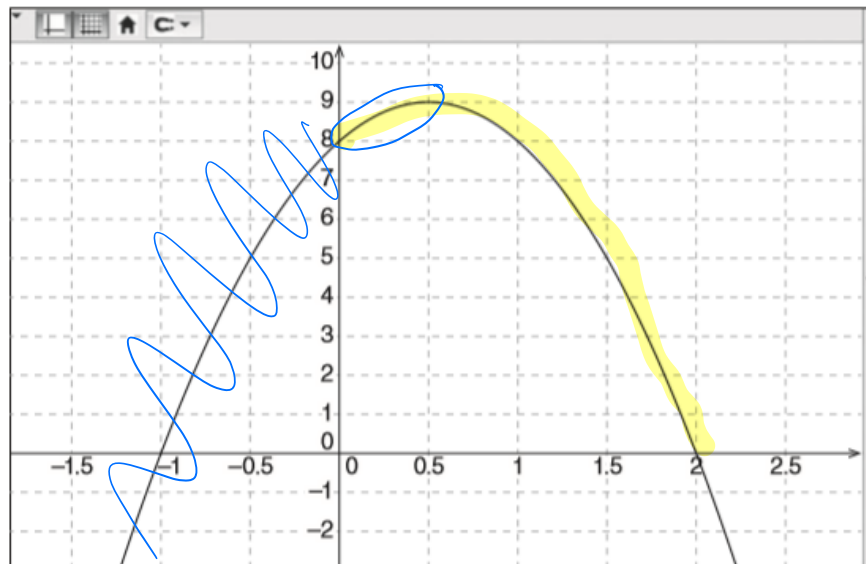
simultaneous equation: $x = 3$
 $y = 4$

② $x + y = 7$
 $y = -x + 7$
sub $x = 3$ & $y = 4$ into ① ②
 $2(3) + 3(4) = 18$ ✓
 $3 + 4 = 7$ ✓

Anka sold 3 Budi sold 4 cupcakes

Question 39 (4 marks)

A diver springs upwards from a diving board, then plunges into the water. The diver's height (metres) above the water as it varies with time (seconds) is modelled by an equation. Graphing software is used to produce the graph of this equation.



- (a) Complete the following sentences, based on the given graph. 2

The diver is above the water for a period of 2 secs. The maximum height that the diver reaches above the diving board is 1 metre.

- (b) The student knows that only part of this curve applies to the model for the divers' height above the water. On the graph drawn, show or highlight clearly the part of this curve that applies for the diver throughout his dive. Explain why this is the case. 2

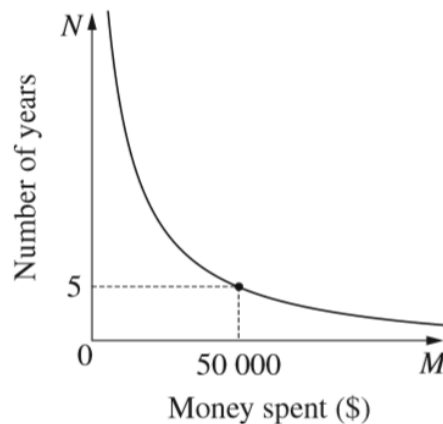
Diver's height cannot be negative i.e. $t > 2$ is ignored

There is no negative time i.e. $t < 0$ is ignored.

Question 40 (2 marks)

The number of years N required to carry out a project varies inversely with how much money $\$M$ is spent on it.

If $\$50\,000$ is spent on the project, it takes 5 years to complete, as shown in the graph below.



- (a) Find an equation for the graph in terms of M and N in the form $N = \frac{k}{M}$, where k is a constant. 1

$$5 = \frac{k}{50\,000} \quad N = \frac{250\,000}{M}$$

$$k = 50\,000 \times 5 \\ = 250\,000$$

- (b) The project needs to be carried out in one year or less. 1

What is the least amount of money that could be spent in order to achieve this timeline?

$$1 \leq \frac{250\,000}{M}$$

$$M \leq 250\,000$$

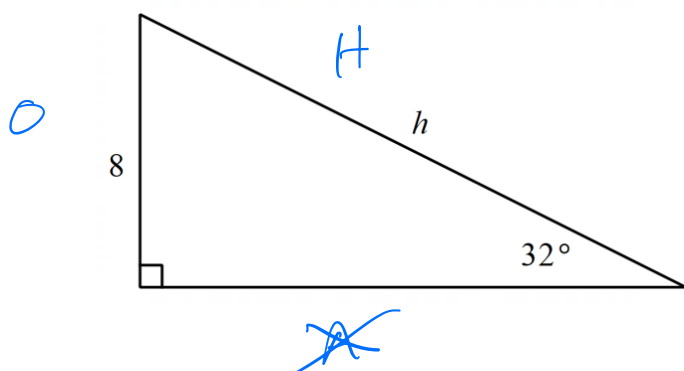
$\$250\,000$ is the least

Question 41 (2 marks)

SOH CAH TOA

Calculate the value of h correct to two decimal places.

2



$$\sin 32 = \frac{8}{h}$$

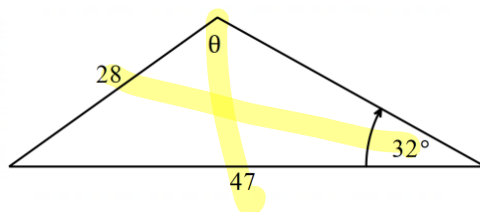
$$h = \frac{8}{\sin 32}$$

$$h = 15.096...$$

$$h = 15.10$$

Question 42 (3 marks)

The diagram shows a triangle with side lengths 25 cm and 47 cm and angle 30° and θ .



Find θ given it is an obtuse angle. Give your answer to the nearest minute.

3

$$\frac{47 \sin \theta}{47} = \frac{\sin 32}{28} \times 47$$

$$\theta = \sin^{-1}(0.8895)$$

$$\theta = 62.8...$$

But θ is obtuse

$$\theta = 180 - 62.8$$

$$\theta = 117.2...$$

Question 43 (2 marks)

Sanjay runs a hot yoga studio.

2

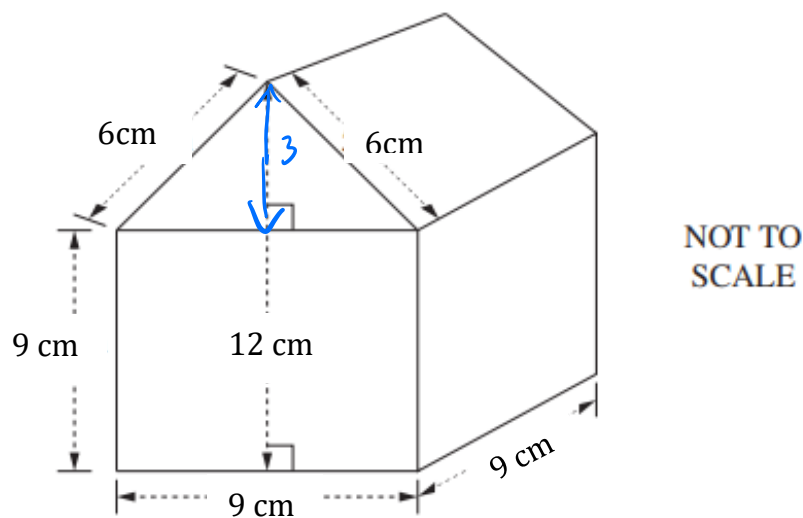
If it costs 42 cents for 1-kilowatt (1000 watts) for 1 hour, how much does it cost him to run three 3200-watt heaters from 10:00 am to 4:30 pm on a single day?

$$\begin{aligned}
 42 \text{ c / kWh} &= \$0.42 \text{ / kWh} \\
 3200 \div 1000 &= 3.2 \text{ kW} \times 0.42 = \$1.344/\text{h} \\
 \text{Time} &= 6.5 \text{ hrs} \\
 1.344 \times 6.5 &= \$8.736 \text{ per heater} \\
 3 \text{ heaters} &: \$8.736 \times 3 = \$26.21
 \end{aligned}$$

Question 44 (3 marks)

A composite solid consists of a triangular prism which fits exactly on top of a cube, as shown.

3



Find the surface area of the composite solid.

$$\begin{aligned}
 \text{cube surface (5 faces)} &: 9 \times 9 \times 5 = 405 \\
 \triangle \times 2 \times \frac{1}{2} \times 9 \times 3 &= 27 \\
 2 \text{ slant sides} &: 2 \times 6 \times 9 = 108 \\
 \text{total} &= 405 + 27 + 108 = 540 \text{ cm}^2
 \end{aligned}$$

M = marked
 N = population
 R = marked recaptured
 T = total recaptured.

Question 45 (3 marks)

The capture-recapture technique was used to estimate a population of seals in 2020.

3

- ^M70 seals were caught, tagged and released
- Later, ^T160 seals were caught at random.
- _R40 of these 160 seals had been tagged.

The estimated population of seals in 2020 was 12% less than the estimated population for 2018.

What was the estimated population for 2018?

$$M = 70 \quad T = 160 \quad R = 40$$

$$\frac{M}{N} = \frac{R}{T}$$

$$2020: \frac{70}{N} = \frac{40}{160}$$

$$\cancel{\frac{70}{70}} \frac{N}{70} = \frac{160}{40} \times 70$$

$$N_{2020} = 280$$

$$\begin{aligned}
 280 &= 100\% - 12\% \\
 280 &= 88\% \\
 3.18... &= 1\% \\
 318... &= 100\%
 \end{aligned}$$

population in 2018
= 318 seals

Question 46 (3 marks)

0.75 of an hour

Every day, a 1100-watt microwave oven is used for 45 minutes at 30% power. Electricity is charged at 22.5 cents per kWh.

3

What is the cost of running this microwave oven for 200 days?

$$\frac{1100 \times 0.75}{1000} = 0.825 \text{ kWh}$$

$$\text{cost/day} = 0.825 \times 0.225 = \$0.1856$$

$$\times 200 \text{ days} = \$37.13$$

but power runs at 30%

$$\text{cost} = 30\% \times 37.13$$

$$= \$11.14$$

Question 47 (2 marks)

In a small business, the seven employees earn the following wages per week:

\$310, \$485, \$525, \$590, \$675, \$690, \$995.

- (a) Is the wage of \$995 an outlier for this set of data? Justify your answer with calculations. 2

$$Q_1 = 485 \quad Q_3 = 690 \quad IQR = 205$$

$$690 + (1.5 \times 205) = 997.50 \text{ is max}$$

$\therefore$ No \$995 lies in the boundary

- (b) Each employee receives a \$25 pay increase. 1

What effect will this have on the standard deviation?

No effect.

Question 48 (2 marks)

The weights of 30 000 newborn babies in NSW are normally distributed. These weights have a mean of 2.9 kg and a standard deviation of 0.25 kg. 2

How many of these newborn babies have a weight between 2.65 kg and 3.65 kg?

$$\begin{array}{ccccccc}
 & 1 & 34\% & 34\% & 13.5\% & 2.35\% & \\
 2.65 & 2.9 & 3.15 & 3.4 & 3.65 & & \\
 34 + 34 + 13.5 + 2.35 = 83.85\% & & & & & & \\
 83.85\% \times 30,000 = 25155 \text{ babies} & & & & & &
 \end{array}$$

Question 49 (4 marks)

Shane's class sits two Biology tests. The results of his class on the first Biology test are shown.

53, 74, 67, 66, 73, 73, 72, 71, 62, 79

The mean was 69 for the first test.

- (a) Calculate the standard deviation for the first test. Give your answer correct to one decimal place. 1

$$6.985... = 7.0$$

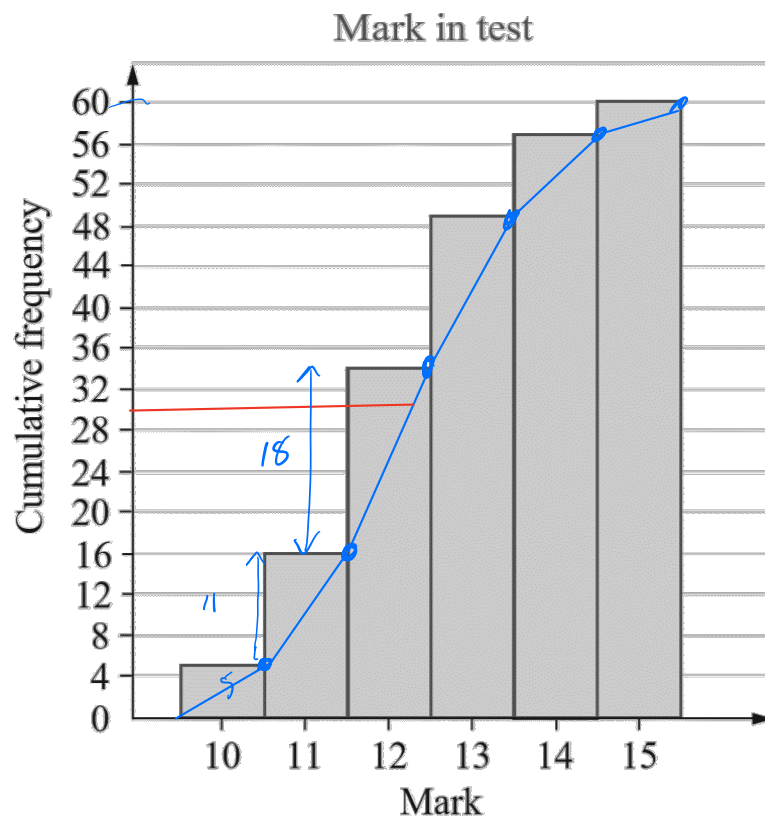
- (b) On the second Biology test, the mean for the class was 74.9 and the standard deviation was 13.1. 3

Shane scored 63 on the first test. Calculate the mark that he needed to obtain in the second test to ensure that his performance relative to the class was maintained.

$$\begin{aligned}
 z &= \frac{x - \bar{x}}{s} & \text{Test 1: } z &= \frac{63 - 69}{7.0} = -0.8571 \\
 \text{Test 2: } -0.8571 &= \frac{x - 74.9}{13.1} \\
 x - 74.9 &= -11.228 \\
 x &= 63.67 \\
 \therefore \text{needed to obtain } 64
 \end{aligned}$$

Question 50 (3 marks)

Sam's class results of a topic test are displayed in the cumulative frequency histogram below.



- (a) Draw the cumulative frequency ogive on the graph above to determine the median score. 1

median = 12

.....

.....

- (b) How many students scored a mark of 12? 1

$34 - 16 = 18$

.....

.....

- (c) How many students scored a mark of 11? 1

$16 - 5 = 11$

.....

.....

Question 51 (2 marks)

The probability that Bevan will score more than 120 points in a game of bowling is $\frac{43}{50}$.

- (a) A commentator states that the probability that Bevan will score less than 120 points in a game of bowling is $\frac{7}{50}$. **1**

Is the commentator correct? Give a reason for your answer.

No, does not include scoring exactly 120

- (b) Bevan plays two games of bowling. What is the probability that he scores more than 120 points in the first game and then again in the second game? **1**

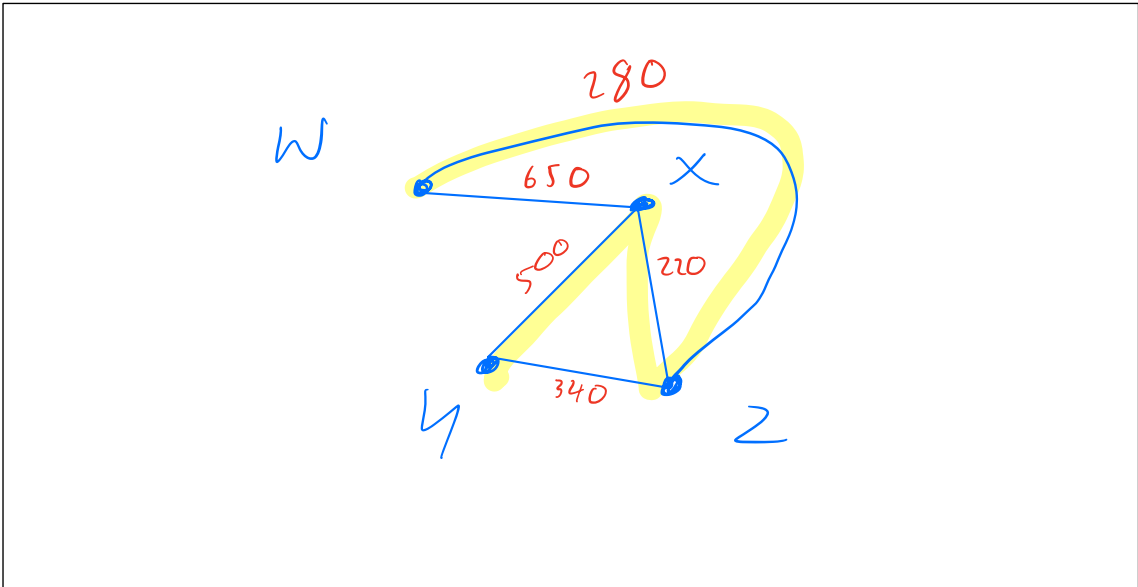
$$\frac{43}{50} \times \frac{43}{50} = \frac{1849}{2500}$$

Question 52 (4 marks)

In a town, there are four petrol stations W, X, Y and Z. The table shows the length, in metres, of roads connecting these petrol stations.

	W	X	Y	Z
W	–	650	–	280
X	650	–	500	220
Y	–	500	–	340
Z	280	220	340	–

- (a) Construct a network diagram to represent the information in the table.
- 2



- (b) A petrol tanker needs to refill each station. It starts at Station W and visits each station.
- 2

Calculate the shortest distance that can be travelled by the petrol tanker. In your answer, include the order that the petrol stations are refilled.

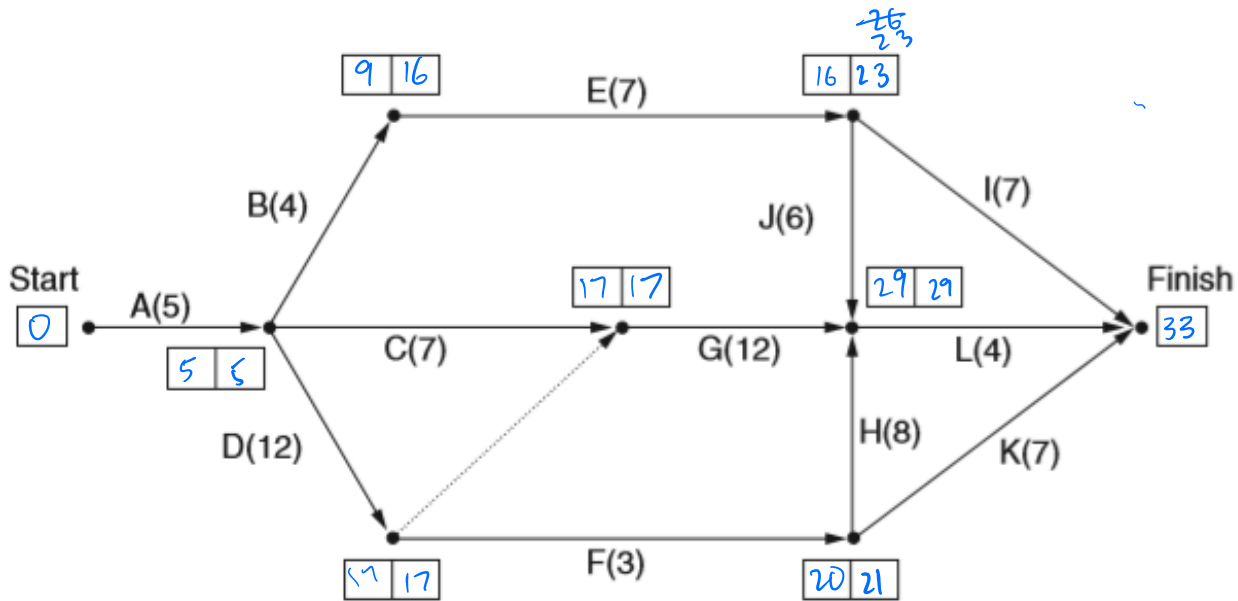
W – Z – X – Y = 1000 metres

Question 53 (4 marks)

EST $\rightarrow$ largest
LST $\rightarrow$ smallest

Steven and Mary are renovating a bathroom. The renovation involves activities A to L.

The network diagram shows these activities and their completion times in days.



(a) Which TWO activities immediately precede activity G?

1

C, D

(b) By completing the diagram shown, calculate the minimum time required to complete the renovation.

2

33 days

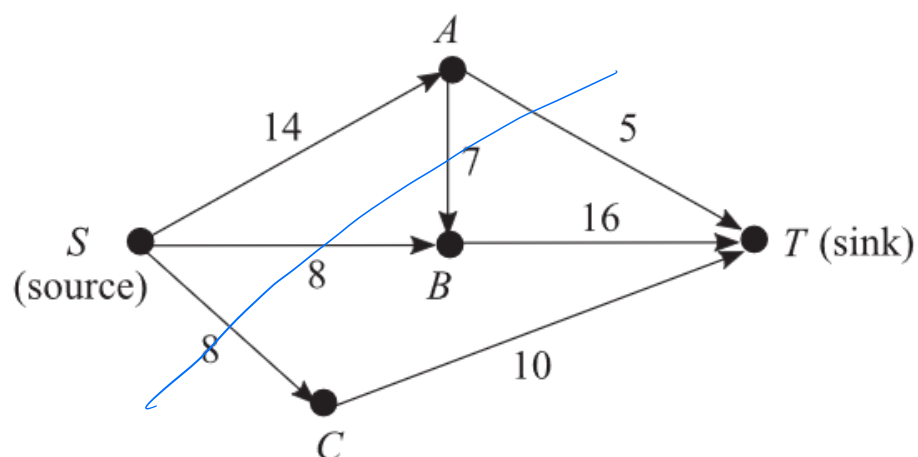
(c) Hence, what is the float time for activity E?

1

$23 - 16 = 7$ days

Question 54 (4 marks)

A network diagram is drawn below.



- (a) Calculate the ^{min cut} maximum flow through this network.

2

$$8 + 8 + 7 + 5 = 28$$

- (b) Illustrate the maximum flow capacity on the diagram.

2



InspirationED

These materials are the copyright property of InspirationED.

No part of this publication may be reproduced, copied, scanned, stored in a retrieval system, communicated, transmitted or disseminated in any form or by any means without the prior written consent of InspirationED. Reproduction of the whole or part of this document constitutes an infringement in copyright and can result in legal action.

