

2024

S3 ELEMENTARY MATH WA1 MATH (EXPRESS)

KRANJI SECONDARY SCHOOL

DETAILED SOLUTIONS

Detailed solutions are crafted following the methods taught at Thinker Education and are offered as a guiding reference. Any logically sound mathematical answers are accepted.

For Thinker parents, the respective levels' blank question papers and detailed solutions have been uploaded to Teams.

For others, please Whatsapp us at 9831 9770 to obtain the question papers for your child to practise.





WEIGHTED ASSESSMENT 1 2024

MATHEMATICS SYLLABUS 4052

Level : Secondary Three

Date : ____ Feb 2024

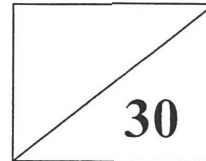
Stream : Express

Duration : 45 minutes

Name : DETAILED SOLUTIONS ()

Marks :

Class : Secondary 3_____



READ THESE INSTRUCTIONS FIRST:

Do not open this question paper until you are told to do so.

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

Write in dark blue or black pen.

You may use HB pencil for any diagrams or graphs.

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

Answer **all** questions.

Give non-exact numerical answers correct to three significant figures, or 1 decimal place in the case of angles in degrees, unless a different level of accuracy is specified in the question.

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

You are reminded of the need for clear presentation in your answers.

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 30.

Setter: Mdm Mah

This question paper consists of 9 printed pages, including the cover page.

[Turn over]

*Mathematical Formulae**Compound Interest*

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

Mensuration

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

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

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

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

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

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

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

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.

Factorisation (52)

- 1 (a) Factorise completely $2ap + 10p - aq - 5q$.

$$\begin{aligned} & 2ap + 10p - aq - 5q \\ &= 2p(a+5) - q(a+5) \\ &= (a+5)(2p-q) \end{aligned}$$

Answer $(a+5)(2p-q)$ [2]

Algebraic Fractions & Formulae (52)

- (b) It is given that $a = \frac{4b-3c}{6-b}$.

Express b in terms of a and c .

$$\begin{aligned} a(6-b) &= 4b-3c \\ 6a-ab &= 4b-3c \\ 4b+ab &= 6a+3c \\ b(4+a) &= 6a+3c \\ b &= \frac{6a+3c}{4+a} \end{aligned}$$

Answer $b = \frac{6a+3c}{4+a}$ [2]

Simultaneous Linear Inequalities

2 (a) Solve the inequalities $\frac{5-4x}{3} < 2x - 10 \leq 13$.

$$\frac{5-4x}{3} < 2x-10$$

$$2x-10 \leq 13$$

$$5-4x < 3(2x-10)$$

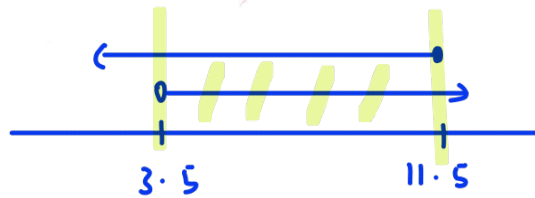
$$2x \leq 23$$

$$5-4x < 6x-30$$

$$x \leq 11.5$$

$$-10x < -35$$

$$x > 3.5$$



$$3.5 < x \leq 11.5$$

Answer $3.5 < x \leq 11.5$ [3]

(b) Hence, write down the smallest prime number(s) that satisfy

$$\frac{5-4x}{3} < 2x - 10 \leq 13.$$

Answer 5 [1]

Quadratic & Fractional Equations

- 3 (a) Express $x^2 - 4x + 8$ in the form $(x - p)^2 + q$, where p and q are constants.

$$\begin{aligned}
 &= x^2 - 4x + \left(\frac{4}{2}\right)^2 - \left(\frac{4}{2}\right)^2 + 8 \\
 &= (x-2)^2 - 4 + 8 \\
 &= (x-2)^2 + 4
 \end{aligned}$$

Answer $(x-2)^2 + 4$ [2]

- (b) Use your result in (a) to explain why $x^2 - 4x + 8 = 0$ has no real solution.

Answer

$$\begin{aligned}
 (x-2)^2 + 4 &= 0 \\
 (x-2)^2 &= -4 \\
 \text{Since } (x-2)^2 &\geq 0, (x-2)^2 \neq -4, \\
 \therefore x^2 - 4x + 8 &= 0 \text{ has no real solution.}
 \end{aligned}$$

[1]

- (c) State the minimum value of $x^2 - 4x + 8$.

$$\begin{aligned}
 \text{Since } (x-2)^2 &\geq 0 \\
 (x-2)^2 + 4 &\geq 4 \\
 \therefore \text{minimum value} &= 4
 \end{aligned}$$

Answer 4 [1]

- (d) Write down the equation of the line of symmetry of the graph $y = x^2 - 4x + 8$.

Answer $x = 2$ [1]

Quadratic & Fractional Equations

4 Express as a single fraction in its simplest form $\frac{2}{x+5} + \frac{5}{x^2-25}$.

$$\begin{aligned} & \frac{2}{x+5} + \frac{5}{(x+5)(x-5)} \\ = & \frac{2(x-5)+5}{x^2-25} \\ = & \frac{2x-10+5}{x^2-25} \\ = & \frac{2x-5}{x^2-25} \end{aligned}$$

Answer $\frac{2x-5}{x^2-25}$ [3]

Quadratic & Fractional Equations

- 5 Sketch the graph of $y = (5 - x)(x + 2)$ on the axes below.
Indicate clearly the values where the graph crosses the axes and the coordinates of the turning point.

Shape: 

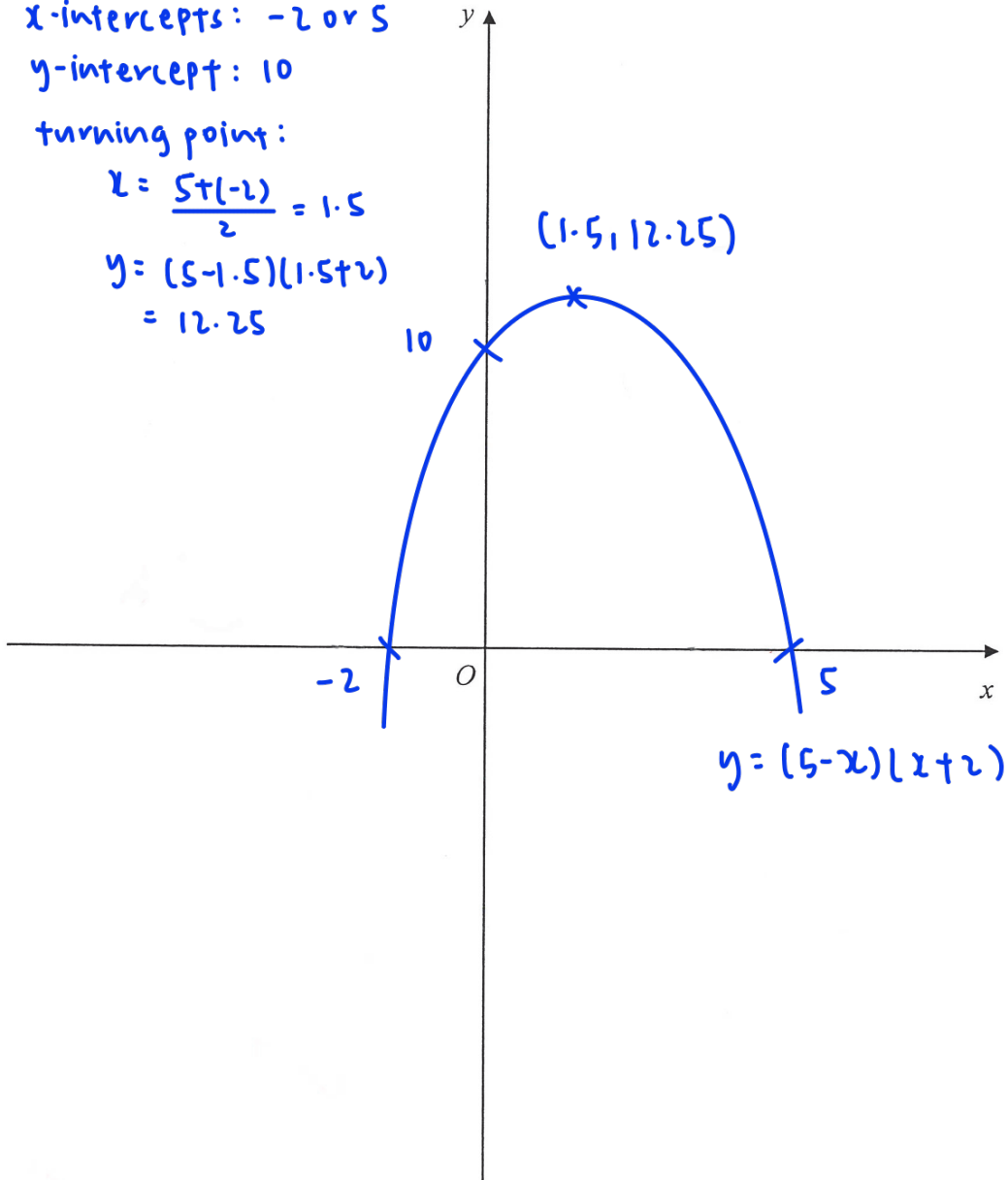
x-intercepts: -2 or 5

y-intercept: 10

turning point:

$$x = \frac{5 + (-2)}{2} = 1.5$$

$$y = (5 - 1.5)(1.5 + 2) = 12.25$$



Quadratic & Fractional Equations

6 Two train stations A and B are 300 km apart.

At 0800 hours, a train leaves A and travels to B at a constant speed of x km/h.

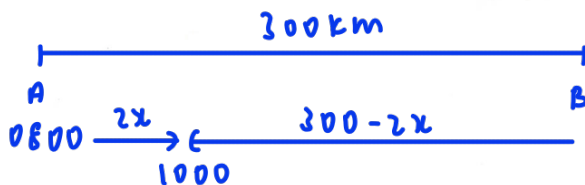
- (a) Write down, in terms of x , an expression for the number of hours it takes this first train to reach B .

Answer $\frac{300}{x}$ h [1]

- (b) At the same time, a second train leaves B to travel to A at constant speed.

The trains pass each other at 1000 hours.

Find, in terms of x , the speed of the second train in km/h.



$$\text{dist}(2h) = x(2) = 2x$$

Answer $150 - x$ km/h [2]

$$\text{speed} = \frac{300 - 2x}{2} = 150 - x$$

- (c) The first train takes 15 minutes less than the second train to complete the 300 km journey.

Write down an equation in x to represent this information and show that it reduces to

$$x^2 + 2250x - 180000 = 0.$$

Answer

$$\frac{300}{150 - x} - \frac{300}{x} = \frac{15}{60}$$

$$\frac{300(x) - 300(150 - x)}{x(150 - x)} = \frac{1}{4}$$

$$4(300x - 45000 + 300x) = x(150 - x)$$

$$2400x - 180000 = 150x - x^2$$

$$x^2 + 2250x - 180000 = 0 \quad (\text{shown})$$

[3]

- (d) Solve the equation $x^2 + 2250x - 180000 = 0$, giving both answers correct to 2 decimal places.

$$\begin{aligned}
 x &= \frac{-2250 \pm \sqrt{(2250)^2 - 4(-180000)}}{2(1)} \\
 &= \frac{-2250 \pm \sqrt{5782500}}{2} \\
 &= 77.341 \text{ or } -2327.3414 \\
 &\approx 77.34 \text{ (2dp)} \quad \approx -2327.34 \text{ (2dp)}
 \end{aligned}$$

Answer $x = \dots\dots 77.34 \dots\dots$ or $\dots\dots -2327.34 \dots\dots$ [3]

- (e) Find the time the first train takes to arrive at B.
Give your answers in hours and minutes, to the nearest minute.

$$\begin{aligned}
 \text{time taken} &= \frac{300}{77.341} \\
 &= 3.8789 \text{ h}
 \end{aligned}$$

\therefore 3h 53 min

Answer $\dots\dots 3 \dots\dots$ hours $\dots\dots 53 \dots\dots$ minutes [2]

END OF PAPER

