ZHONGHUA SECONDARY SCHOOL

PRELIMINARY EXAMINATION 2018
SECONDARY 4E/4N/5N

Candidate's Name	Class	Register Number

MATHEMATICS 4048/01

PAPER 1

27 Aug 2018
2 hours

READ THESE INSTRUCTIONS FIRST

Write your name, class and register 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 paper clips, 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 total of the marks for this paper is **80**.

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.

For Examiner's Use
80

This question paper consists of **17** printed pages (including this cover page)

Downloaded from SingaKids.com

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

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

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

Downloaded from SingaKids.com

Answer **all** the questions.

1 **(a)** Calculate $\frac{3+\sqrt{-4^2+2\times11}}{5}$.

Write down the first 6 digits on your calculator display.

Answer ..... [1]

(b) Write your answer to part **(a)** correct to 3 decimal places.

Answer ..... [1]

---

2 These are the first five terms of a sequence.

2018 2011 2004 1997 1990

(a) Write down the tenth term in the sequence

SGFREEPAPERS.COM

Answer ..... [1]

(b) Write down an expression, in terms of n, for the nth term in the sequence.

Answer ..... [1]

(c) Explain why the number 3 does not appear in the sequence.

Show your working clearly.

Answer .....

.....

..... [2]

Downloaded from SingaKids.com

3 **(a)** Factorise completely $48xy - 8y$.

Answer ..... [1]

(b) Factorise completely $x^4 + 3x^3 - 4x^2$.

Answer ..... [2]

---

4 Solve the equation $x(x-3) = 5(x^2 - 9)$.

Answer ..... [3]

---

5 Calculate the interior angle of a regular 10-sided polygon.
Show your working clearly.

Answer ..... ° [2]

Downloaded from SingaKids.com

6 **(a)** Given that $6^m \div 6^{-3} = 6^2$, find the value of m.

Answer $m =$ ..... [1]

(b) Arrange the following numbers in increasing value.
Show your working clearly.

0.0037×10^6 3.7×10^5 370×10^{-3} 37

Answer ....., ..., ..., ... [2]
smallest largest

(c) Simplify $\sqrt[3]{8x^6} \times \frac{1}{3y^{-5}}$. Leave your answer in positive index form.

SGFREEPAPERS.COM

Answer ..... [2]

---

7 Ken invested \$12 000 into a fund which pays compound interest of 4% per annum compounded half-yearly.
Calculate the total interest earned in 5 years.

Answer \$ ..... [3]

Downloaded from SingaKids.com

8 **(a)** Express $x^2 - 8x + 11$ in the form $(x - a)^2 + b$.

Answer ..... [2]

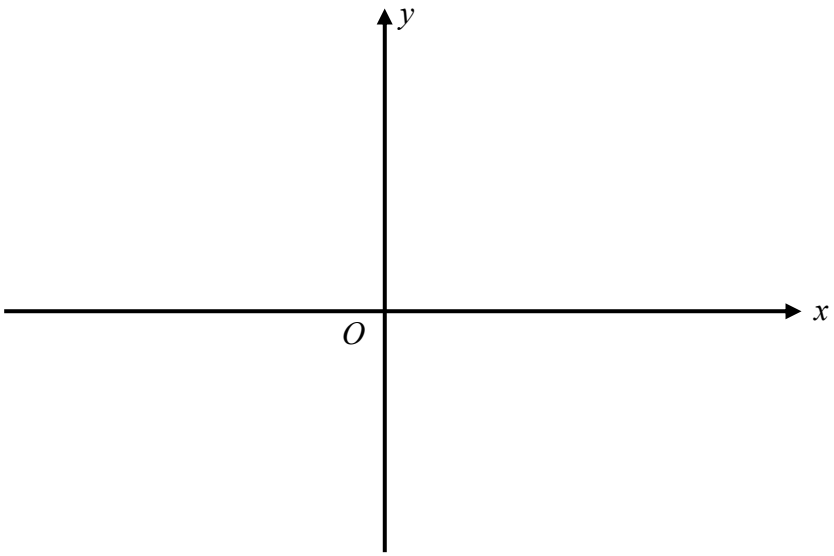
(b) **Hence** solve the equation $x^2 - 8x + 11 = 0$, giving your answers correct to two decimal places.

Answer $x =$ ..... or $x =$ ..... [2]

(c) Sketch the graph of $y = x^2 - 8x + 11$.

Indicate the y-intercept and the turning point of the graph clearly.

Answer



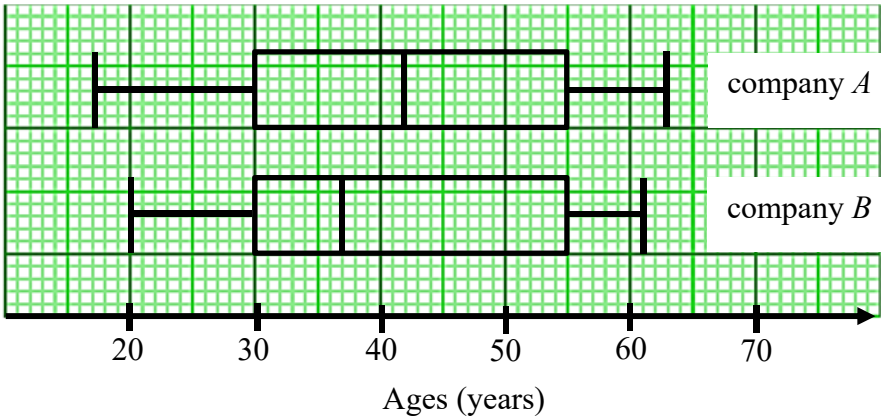
[2]

(d) Write down the equation of line of symmetry of the graph of $y = x^2 - 8x + 11$.

Answer ..... [1]

Downloaded from SingaKids.com

9 These box plots show the age distributions of the 200 employees in each of company *A* and company *B*.



(a) Find the range of the employee's age of company *A*.

Answer ..... [1]

(b) For each the following statements, write whether you agree or disagree.
Give a statistical reason which you use to support your decision.

(i) On average, company *A* has older employees than company *B*.

Answer ..... because .....
.....
..... [1]

(ii) There are more employees who are below 30 years old in company *A* than in company *B*.

Answer ..... because .....
.....
..... [1]

(c) An employee is randomly selected from company *B*.
Find the probability that the employee ages between 30 and 55 years old.

Answer ..... [1]

Downloaded from SingaKids.com

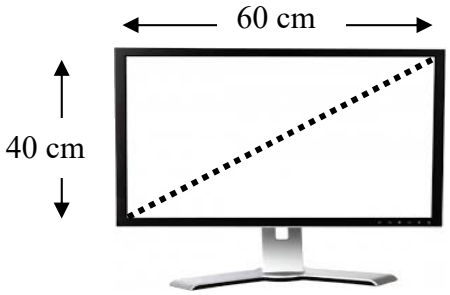
10 The size of television (TV) screens are measured diagonally in inches.

(1 inch = 2.54 cm)

(a) A TV screen has dimension 40 cm by 60 cm.

Find the size of the TV.

Give your answer correct to the nearest inch.



Answer .....inches [2]

(b) An electronic store offers 20% discount storewide.

Ali wishes to buy a new 45-inch TV which costs $2298.

All TV sets have an additional y % off after a storewide discount.

He received a receipt with poor print quality and some numbers missing.

45-inch TV		$ 2298
After 20% off		$ x
After y% off		$ 1562.64
Amount Paid		$

Find the value of x and y.

Answer x = ...

y = ... [2]

Downloaded from SingaKids.com

11 **(a)** ξ = {integers x : $2 \leq x \leq 10$}

F = {factors of 18}

G = {prime numbers}

(i) List the elements in F'.

Answer ..... [1]

(ii) State the number of elements in $F \cup G$.

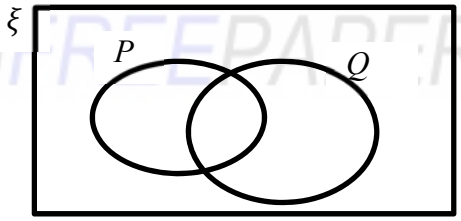
Answer ..... [1]

(iii) Explain why $2 \in (F \cap G)$.

Answer .....

..... [1]

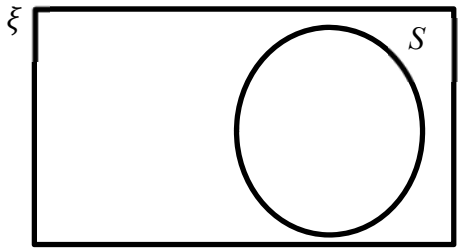
(b) On the Venn diagram shown below, shade the set $P \cap Q'$.



SGFREEPAPERS.COM

Answer On the diagram [1]

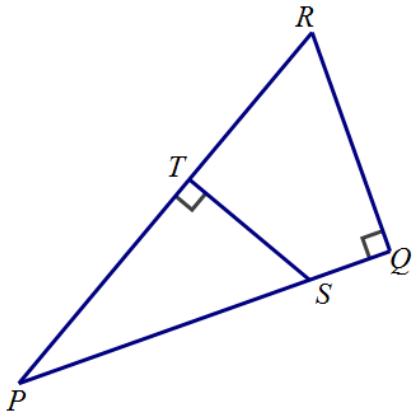
(c) On the diagram below, draw the set R such that $R \cap S = \emptyset$.



Answer On the diagram [1]

Downloaded from SingaKids.com

12 **(i)** PQR forms a right-angled triangle such that angle $PQR = 90°$.
ST is perpendicular to PR.



Name a triangle which is similar to triangle PQR.

Answer Triangle..... [1]

(ii) Given further that $PQ = 8$ cm , $QR = 6$ cm and $PR = 10$ cm, find the length of ST where T is the midpoint of PR.

Answer $ST =$ ..... cm [2]

---

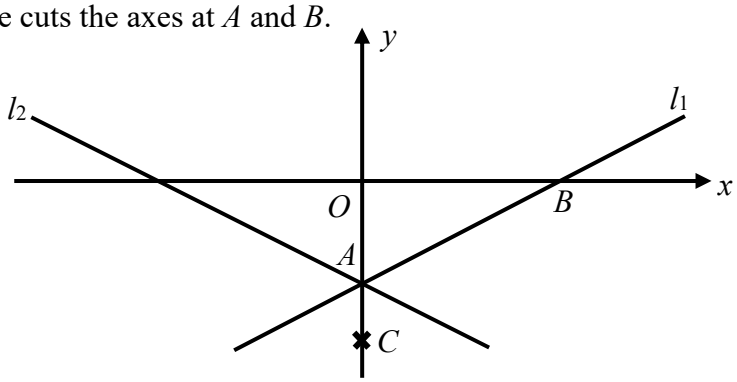
13 The radius of a cylinder is increased by 25% and its height is decreased by 50%.
Calculate the percentage decrease in the volume of the cylinder.
Give your answer correct to 1 decimal place.

Answer .....% [2]

Downloaded from SingaKids.com

14 The following diagram shows a sketch of the line $l_1 : y = \frac{3}{4}x - 3$.

The line cuts the axes at A and B.



(a) Find the coordinates of A and B.

Answer A (……, ……)

B (……, ……) [2]

(b) The line l_2 is a reflection of the line l_1 along the y-axis.

Write down the equation of the line l_2.

SGFREEPAPERS.COM

Answer ..... [1]

(c) C is a point on y-axis, as shown on the diagram.

Calculate the exact value of $\cos \angle BAC$.

Answer ..... [1]

(d) Another line $l_3 : y = \frac{3}{4}x + 2$ can be drawn on the same axes.

Explain why the lines l_1 and l_3 do not meet.

Answer .....

.....

.....

.....

..... [2]

Downloaded from SingaKids.com

15 Two geometrically similar containers have the following specifications.

	Container *A*	**Container *B***
Height (m)	p	50
Cost of painting the base ($)	120	480
Time taken to completely fill the container with water (to the nearest minute)	123 minutes	q hours r minutes

Find the values of p, q and r.

Answer $p =$ .....

$q =$ .....

$r =$ ..... [5]

---

16 Given that y varies as x^n, write down the value of n in each of the following cases:

(a) y is the volume of a sphere of radius x,

Answer $n =$ ..... [1]

(b) y and x are the sides of a rectangle of given area.

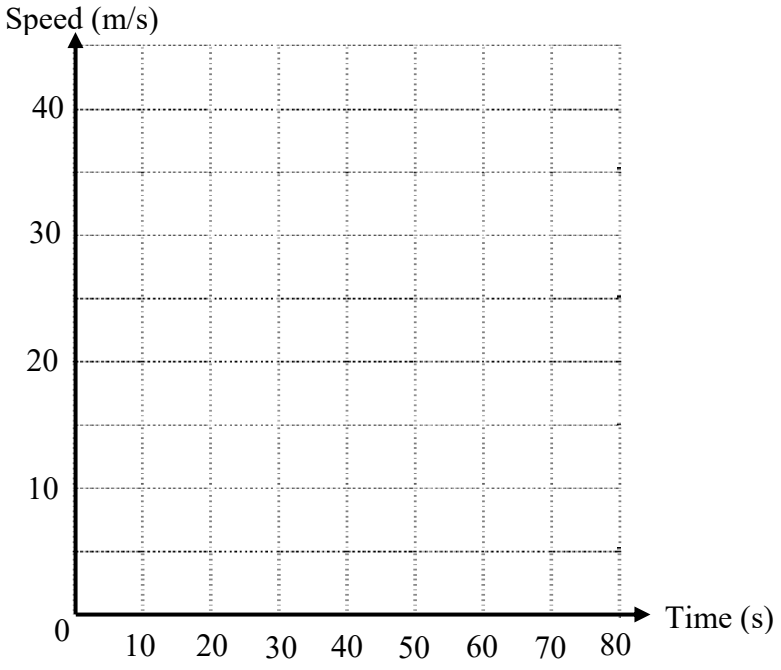
Answer $n =$ ..... [1]

Downloaded from SingaKids.com

17 A train travels at a constant speed of 40 m/s for 50 seconds.

It then slows down at a constant rate until it comes at rest in 20 seconds.

(a) On the axes, draw the speed-time graph for the journey.



Answer On the diagram [1]

SGFREEPAPERS.COM

(b) Calculate the distance travelled by the train during the first 60 seconds.

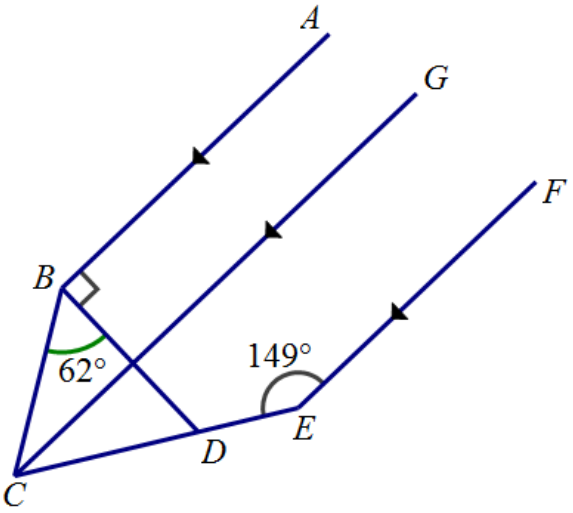
Answer .....m [2]

Downloaded from SingaKids.com

18 In the figure, AB is parallel to GC and FE.

Angle $CEF = 149°$ and angle $CBD = 62°$.

D is a point on CE such that angle $ABD = 90°$.



Find, stating the reasons clearly,

(a) angle BCD,

Answer ..... ° [3]

(b) angle BDE.

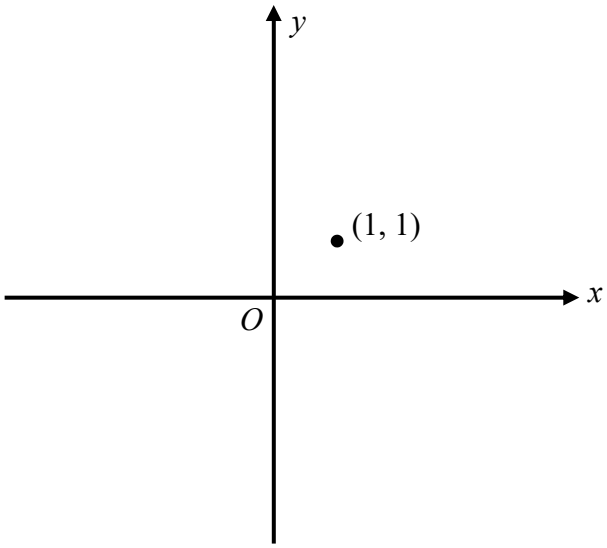
Answer ..... ° [2]

Downloaded from SingaKids.com

19 Sketch the graph of each of the following equations.

The point (1, 1) is plotted on each diagram.

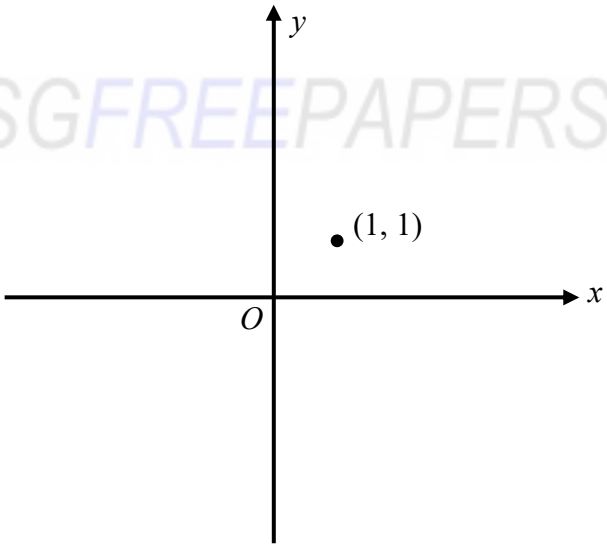
(a) $y = 2^x$



Answer On the diagram [1]

(b) $y = \frac{1}{x^2}$

SGFREEPAPERS.COM



Answer On the diagram [1]

Downloaded from SingaKids.com

20 The line AB is drawn below.



(a) Construct triangle ABC where angle $ABC = 60°$ and $BC = 8$ cm. [2]

(b) Construct the perpendicular bisector of BC. [1]

(c) From C, construct a line that is equidistant from the lines CA and CB. [1]

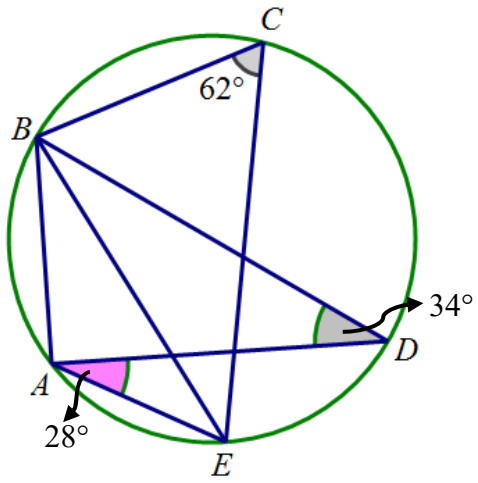
(d) Find the reflex angle ACB.

Answer ..... ° [1]

Downloaded from SingaKids.com

21 A circle passes through A, B, C, D and E.

It is given that angle $ADB = 34°$, angle $DAE = 28°$ and angle $BCE = 62°$.



By stating the reasons clearly,

(a) show that BD is a diameter of the circle,

Answer

SGFREEPAPERS.COM

[3]

(b) show that BE bisects angle ABD.

Answer

[2]

~~~ End of Paper ~~~

Downloaded from SingaKids.com

Answers

1a) 1.08989
1b) 1.090

2a) 1955
2b) $2025 - 7n$

3a) $8y(6x - 1)$
3b) $x^2(x + 4)(x - 1)$

4) x = 3 or $x = \frac{15}{4}$

5) 144°

6a) $m = -1$
6b) 370×10^{-3}, 37, 0.0037×10^6, 3.7×10^5
6c) $\frac{2}{5}x^2y^3$

7) $2627.93

8a) $(x - 4)^2 - 5$
8b) $x = 6.24$ or $x = 1.76$
8d) $x = 4$

9a) 46 years
9b) agree, due to Company A has higher median age than Company B
9c) disagree, both companies have equal lower quartile and therefore they have equal number of employees whose age is below 30.

10a) 28
10b) x = 1838.40, y = 15

11ai) {4, 5, 7, 8, 10}
11aii) 6
11aiii) Because 2 is a factor of 18 AND it is also a prime number

12i) triangle PTS
12ii) 3.75 cm

13 21.9%

14a) A (0, –3), B (4, 0)
14b) $y = -\frac{3}{4}x - 3$
14c) $-\frac{3}{5}$
14d) Both lines have equal gradient, therefore they are parallel. As both lines are parallel and have different y-intercept, both lines do not meet.

15 p = 25, q = 16, r = 24

16a) n = 3
16b) n = –1

17b) 2300

18a) 59°
18b) 121°

Downloaded from SingaKids.com

ZHONGHUA SECONDARY SCHOOL
PRELIMINARY EXAMINATION 2018
SECONDARY 4E/4N/5N

Candidate's Name	Class	Register Number
MARKING SCHEME		

MATHEMATICS 4048/01

PAPER 1

27 Aug 2018
2 hours

READ THESE INSTRUCTIONS FIRST

Write your name, class and register 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 paper clips, 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 total of the marks for this paper is **80**.

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.

For Examiner's Use
80

This question paper consists of **17** printed pages (including this cover page)

Downloaded from SingaKids.com

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

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

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

Downloaded from SingaKids.com

Answer **all** the questions.

1 **(a)** Calculate $\frac{3+\sqrt{-4^2+2\times11}}{5}$.

Write down the first 6 digits on your calculator display.

Answer 1.08989 [B1] [1]

(b) Write your answer to part **(a)** correct to 3 decimal places.

Answer 1.090 [B1] [1]

---

2 These are the first five terms of a sequence.

2018 2011 2004 1997 1990

(a) Write down the tenth term in the sequence.

SGFREEPAPERS.COM

Answer 1955 [B1] [1]

(b) Write down an expression, in terms of n, for the nth term in the sequence.

Answer $2025 - 7n$ or [1]

$2018 - 7(n - 1)$ [B1]

(c) Explain why the number 3 does not appear in the sequence.

Show your working clearly.

$2025 - 7n = 3$

$2022 = 7n$

$n = \frac{2022}{7}$ [B1]

Answer Since $n = \frac{2022}{7}$ is not a positive integer or whole number [A1], the number 3 does not appear in the sequence.[2]

Downloaded from SingaKids.com

3 **(a)** Factorise completely $48xy - 8y$.

Answer $8y(6x - 1)$ [B1] [1]

(b) Factorise completely $x^4 + 3x^3 - 4x^2$.

$x^4 + 3x^3 - 4x^2 = x^2(x^2 + 3x - 4)$[M1 - factorise x^2]

$= x^2(x + 4)(x - 1)$

Answer $x^2(x + 4)(x - 1)$ [A1] [2]

---

4 Solve the equation $x(x-3) = 5(x^2 - 9)$.

Method 1:

$x(x - 3) = 5(x - 3)(x + 3)$[M1]

$(x - 3)(x - 5(x + 3)) = 0$[M1]

$(x - 3)(-4x - 15) = 0$

Method 2:

$x^2 - 3x = 5x^2 - 45$[M1]

$-4x^2 - 3x + 45 = 0$

$(-4x - 15)(x - 3) = 0$[M1]

Answer $x = 3$ or $x = -\frac{15}{4}$ [A1] [3]

---

5 Calculate the interior angle of a regular 10-sided polygon.

Show your working clearly.

$\text{int. angle} = \frac{10 - 2}{10} \times 180°$[M1]

$= 144°$

Answer 144° [A1] [2]

Downloaded from SingaKids.com

6 **(a)** Given that $6^m \div 6^{-3} = 6^2$, find the value of m.

Answer $m = -1$ [B1] [1]

(b) Arrange the following numbers in increasing value.

Show your working clearly.

0.0037×10^6 3.7×10^5 370×10^{-3} 37

$= 3.7 \times 10^3$ $= 3.7 \times 10^{-1}$ $= 3.7 \times 10^1$

[M1 – conversion to multiplication of 3.7]

[A1 – correct order]

Answer 370×10^{-3}, 37, 0.0037×10^6, 3.7×10^5 [2]

smallest largest

(c) Simplify $\sqrt[3]{8x^6} \times \frac{1}{3y^{-5}}$. Leave your answer in positive index form.

$\sqrt[3]{8x^6} \times \frac{1}{3}y^5 = 2x^2 \times \frac{1}{3}y^5$ [B1 – $2x^2$ seen]

$= \frac{2}{3}x^2y^5$

SGFREEPAPERS.COM

Answer $\frac{2}{3}x^2y^5$ [A1] [2]

---

7 Ken invested \$12 000 into a fund which pays compound interest of 4% per annum compounded half-yearly.

Calculate the total interest earned in 5 years.

$\text{Total interest} = 12000\left(1 + \frac{4\%}{2}\right)^{10} - 12000$ [B1 – $\frac{4\%}{2}$ or 2% seen]

[B1 – to the power of 10]

$= 2627.93$

Answer \$ 2627.93 [A1] [3]

Downloaded from SingaKids.com

8 **(a)** Express $x^2 - 8x + 11$ in the form $(x-a)^2 + b$.

[B1 – for value of a] [B1 – for value of b]

Answer $(x-4)^2 - 5$ [2]

(b) **Hence** solve the equation $x^2 - 8x + 11 = 0$, giving your answers correct to two decimal places.

$x^2 - 8x + 11 = 0$

$(x-4)^2 - 5 = 0$

$x - 4 = \pm\sqrt{5}$[M1]

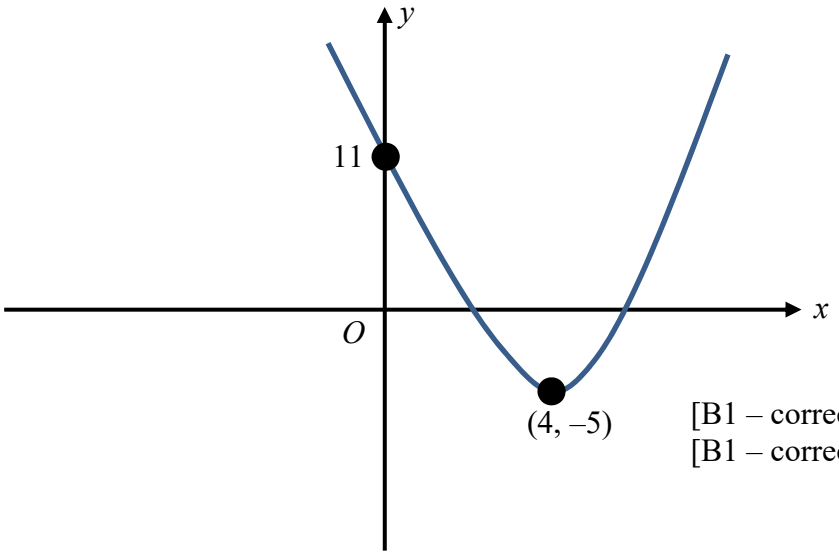
[A1 – for both values of x]

Answer $x = 6.24$ or $x = 1.76$ [2]

(c) Sketch the graph of $y = x^2 - 8x + 11$.

Indicate the y-intercept and the turning point of the graph clearly.

Answer



[B1 – correct y-intercept]
[B1 – correct turning pt]

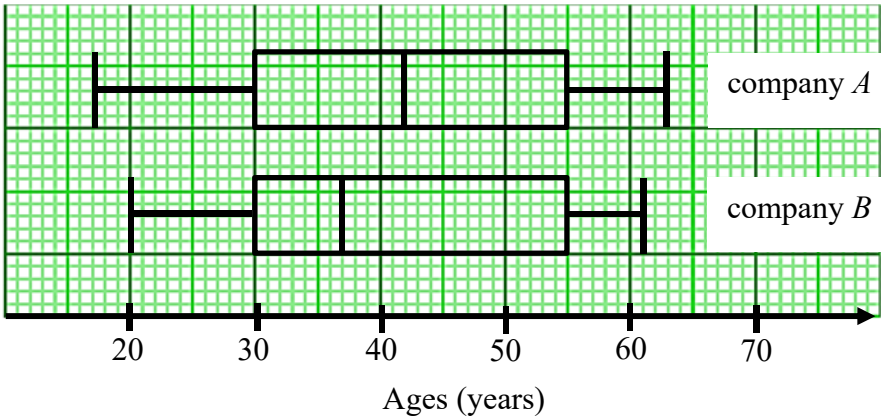
[2]

(d) Write down the equation of line of symmetry of the graph of $y = x^2 - 8x + 11$.

Answer $x = 4$ [B1] [1]

Downloaded from SingaKids.com

9 These box plots show the age distributions of the 200 employees in each of company *A* and company *B*.



(a) Find the range of the employee's age of company *A*.

Answer 46 years [B1] [1]

(b) For each the following statements, write whether you agree or disagree.
Give a statistical reason which you use to support your decision.

(i) On average, company *A* has older employees than company *B*.

Answer Agree because the median age of employees in company *A* is higher than the median age of employees in company *B*. [1]

(ii) There are more employees who are below 30 years old in company *A* than in company *B*.

Answer Disagree because employees in both companies have equal lower quartile, therefore there are equal number of employees who are below 30 years old in both companies. [1]

(c) An employee is randomly selected from company *B*.
Find the probability that the employee ages between 30 and 55 years old.

Answer 0.5 [B1] [1]

Downloaded from SingaKids.com

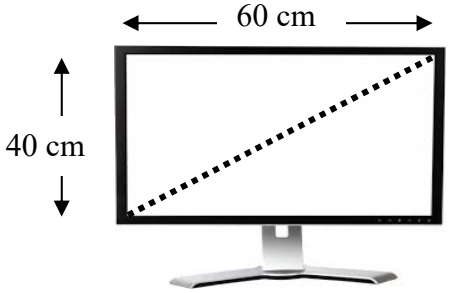
10 The size of television (TV) screens are measured diagonally in inches.

(1 inch = 2.54 cm)

(a) A TV screen has dimension 40 cm by 60 cm.

Find the size of the TV.

Give your answer correct to the nearest inch.



$$\text{size} = \sqrt{\left(\frac{40}{2.54}\right)^2 + \left(\frac{60}{2.54}\right)^2} \text{ [M1]}$$

$$= 28.390$$

Answer 28 [A1] inches [2]

(b) An electronic store offers 20% discount storewide.

Ali wishes to buy a new 45-inch TV which costs $2298.

All TV sets have an additional y% off after a storewide discount.

He received a receipt with poor print quality and some numbers missing.

45-inch TV		$ 2298
After 20% off		$ x
After y% off		$ 1562.64
Amount Paid		$

Find the value of x and y.

Answer $x = 1838.40$ [B1]

$y = 15$ [B1] [2]

Downloaded from SingaKids.com

11 **(a)** $\xi = \{\text{integers } x : 2 \leq x \leq 10\}$

$F = \{\text{factors of } 18\}$

$G = \{\text{prime numbers}\}$

(i) List the elements in F'.

Answer $\{4, 5, 7, 8, 10\}$ [B1] [1]

(ii) State the number of elements in $F \cup G$.

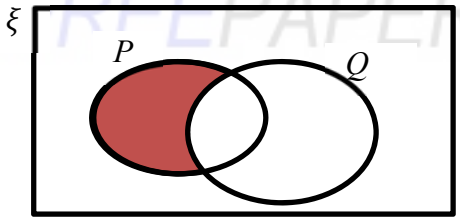
Answer 6 [B1] [1]

(iii) Explain why $2 \in (F \cap G)$.

Answer Because 2 is a factor of 18 **AND** also a prime number. [B1]

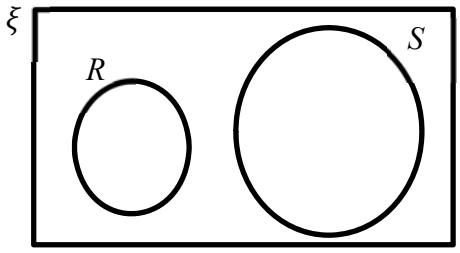
(b) On the Venn diagram shown below, shade the set $P \cap Q'$.

SCHREEPAPERS.COM



Answer On the diagram [1]

(c) On the diagram below, draw the set R such that $R \cap S = \emptyset$.

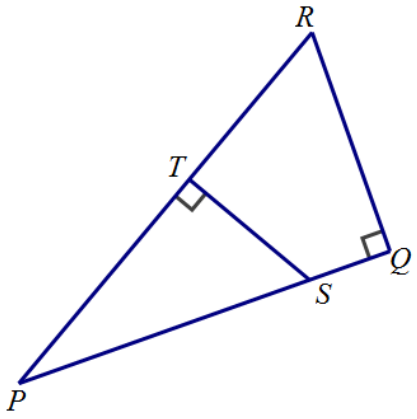


Answer On the diagram [1]

Downloaded from SingaKids.com

12 **(i)** *PQR* forms a right-angled triangle such that angle *PQR* = 90°.

ST is perpendicular to *PR*.



Name a triangle which is similar to triangle *PQR*.

Answer Triangle *PTS* [B1] [1]

(ii) Given further that *PQ* = 8 cm , *QR* = 6 cm and *PR* = 10 cm, find the length of *ST* where *T* is the midpoint of *PR*.

$\frac{PQ}{PT} = \frac{QR}{TS}$ [M1]

$\frac{8}{5} = \frac{6}{TS}$

$TS = 3.75$

Answer *ST* = 3.75 [A1] cm [2]

---

13 The radius of a cylinder is increased by 25% and its height is decreased by 50%.

Calculate the percentage decrease in the volume of the cylinder.

Give your answer correct to 1 decimal place.

Let the radius and the height of the cylinder be *r* and *h* respectively.

$\%\text{ change in volume} = \frac{\pi(1.25r)^2(0.5h) - \pi r^2 h}{\pi r^2 h} \times 100\%$[B1 - $1.25r$ or $0.5h$ seen]

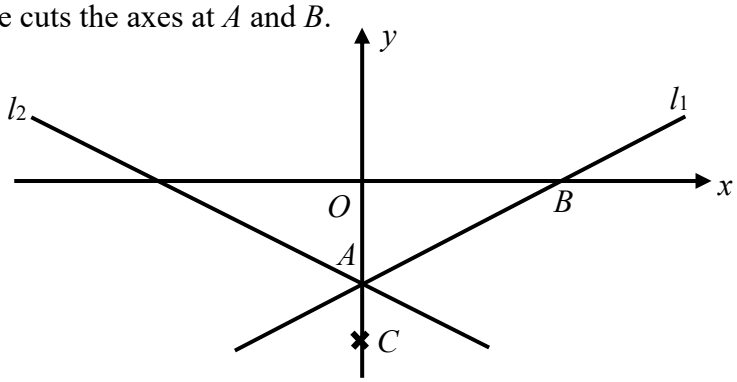
$= -21.875\%$

Answer 21.9 [A1] % [2]

Downloaded from SingaKids.com

14 The following diagram shows a sketch of the line $l_1 : y = \frac{3}{4}x - 3$.

The line cuts the axes at A and B.



(a) Find the coordinates of A and B.

Answer $A\ (0, -3)$ [B1]

$B\ (4, 0)$ [B1] [2]

(b) The line l_2 is a reflection of the line l_1 along the y-axis.

Write down the equation of the line l_2.

Answer $y = -\frac{3}{4}x - 3$ [B1] [1]

SGFREEPAPERS.COM

(c) C is a point on y-axis, as shown on the diagram.

Calculate the exact value of $\cos \angle BAC$.

Answer $-\frac{3}{5}$ [B1] [1]

(d) Another line $l_3 : y = \frac{3}{4}x + 2$ can be drawn on the same axes.

Explain why the lines l_1 and l_3 do not meet.

Answer The line l_1 and l_3 have **equal gradient**. Therefore, they are **parallel**. [B1]

As both lines are parallel and have **different *y*-intercepts**, both lines do not meet. [B1]

..... [2]

Downloaded from SingaKids.com

15 Two geometrically similar containers have the following specifications.

	Container *A*	**Container *B***
Height (m)	p	50
Cost of painting the base ($)	120	480
Time taken to completely fill the container with water (to the nearest minute)	123 minutes	q hours r minutes

Find the values of p, q and r.

$\left(\frac{p}{50}\right)^2 = \frac{120}{480}$ [M1]

$p = 25$

Let the time taken to completely fill container B be T minutes.

$\left(\frac{25}{50}\right)^3 = \frac{123}{T}$ [M1]

$T = 984$

$T = 16 \text{ hours } 24 \text{ minutes}$

Answer $p = 25$ [A1]

$q = 16$ [A1]

$r = 24$ [A1] [5]

---

16 Given that y varies as x^n, write down the value of n in each of the following cases:

(a) y is the volume of a sphere of radius x,

Answer $n = 3$ [B1] [1]

(b) y and x are the sides of a rectangle of given area.

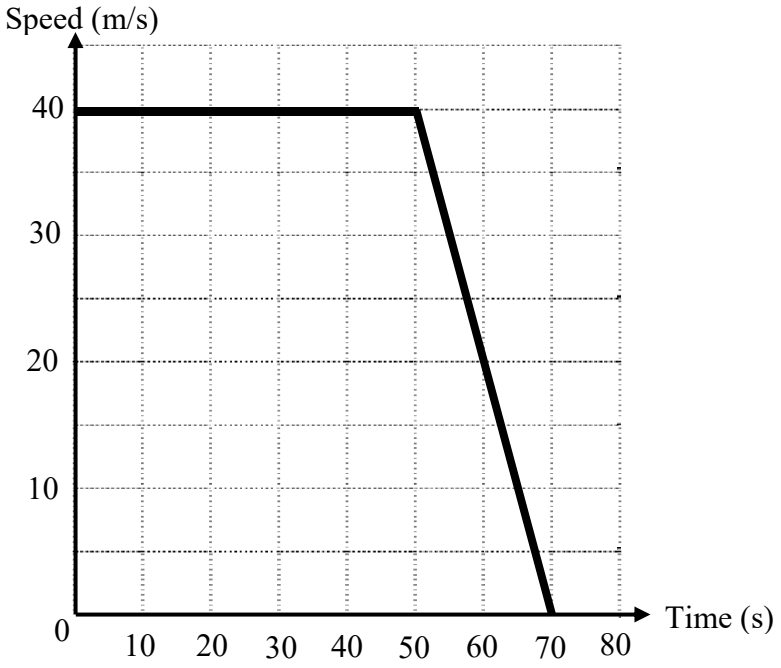
Answer $n = -1$ [B1] [1]

Downloaded from SingaKids.com

17 A train travels at a constant speed of 40 m/s for 50 seconds.

It then slows down at a constant rate until it comes at rest in 20 seconds.

(a) On the axes, draw the speed-time graph for the journey.



Answer On the diagram [1]

SGFREEPAPERS.COM

(b) Calculate the distance travelled by the train during the first 60 seconds.

distance travelled = area under graph

$$= (60 \times 40) - \frac{1}{2} \times 10 \times 20 \text{[M1]}$$

$$= 2300 \text{ m}$$

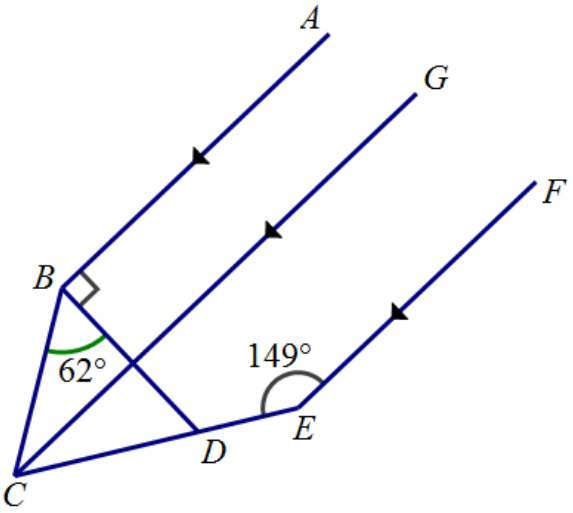
Answer 2300 [A1] m [2]

Downloaded from SingaKids.com

18 In the figure, AB is parallel to GC and FE.

Angle $CEF = 149°$ and angle $CBD = 62°$.

D is a point on CE such that angle $ABD = 90°$.



Find, stating the reasons clearly,

(a) angle BCD,

$\angle GCE + \angle CEF = 180°$ (sum of int. $\angle$s $= 180°, GC \parallel FE$)[B1 − reason]

$\angle GCE + 149° = 180°$

$\angle GCE = 31°$

Let T be the intersection of GC and BD.

$\angle BTC = \angle ABT = 90°$(alt. $\angle s, GC \parallel AB$)

$\angle BCG + \angle TBC = 90$ (complementary angles)[M1]

$\angle BCG + 62° = 90°$

$\angle BCG = 28°$

Therefore, $\angle BCD = 59°$

Answer 59 [A1] ° [3]

(b) angle BDE.

$\angle BDE = \angle CBD + \angle BCD$(sum of 2 int. $\angle$s = exterior $\angle$ of a triangle) [B1]

$= 62° + 59°$

$= 121°$

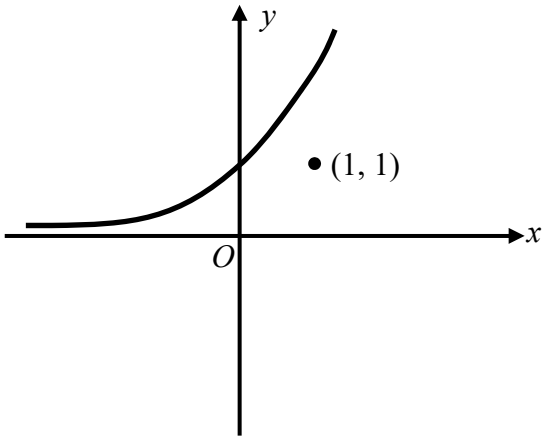
Answer 121 [A1] ° [2]

Downloaded from SingaKids.com

19 Sketch the graph of each of the following equations.

The point (1, 1) is plotted on each diagram.

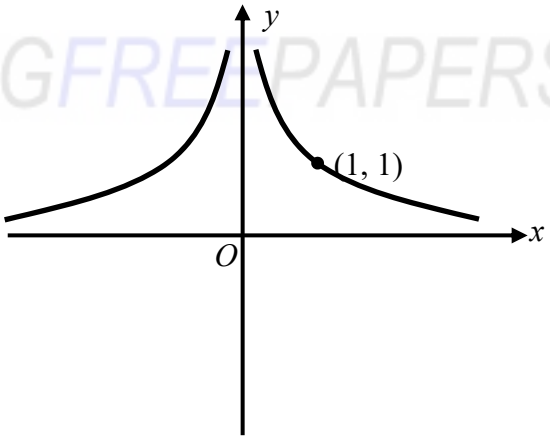
(a) $y = 2^x$



Answer On the diagram [1]

(b) $y = \frac{1}{x^2}$

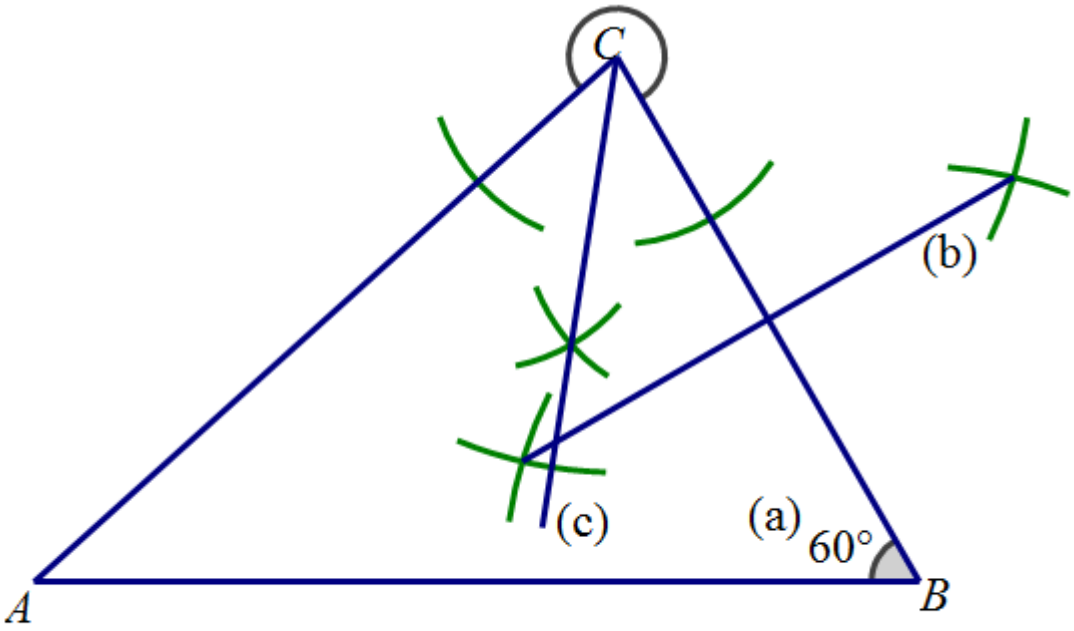
SGFREEPAPERS.COM



Answer On the diagram [1]

Downloaded from SingaKids.com

20 The line AB is drawn below.



reflex $\angle ACB = 281.98° \pm 2$

(a) Construct triangle ABC where angle $ABC = 60°$ and $BC = 8$ cm. [2]

(b) Construct the perpendicular bisector of BC. [1]

(c) From C, construct a line that is equidistant from the lines CA and CB. [1]

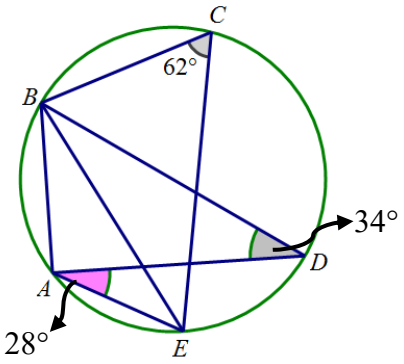
(d) Find the reflex angle ACB.

Answer ..... ° [1]

Downloaded from SingaKids.com

21 A circle passes through A, B, C, D and E.

It is given that angle $ADB = 34°$, angle $DAE = 28°$ and angle $BCE = 62°$.



By stating the reasons clearly,

(a) show that BD is a diameter of the circle,

Answer

$\angle BCE + \angle BAE = 180°$(∠s in opp. segments are supplementary) [B1]

$62° + \angle BAD + 28° = 180°$

$\angle BAD = 90°$[A1]

Since BD is a chord and $\angle BAD = 90°$, BD is a diameter of a circle. [AG]

(angle in a semicircle) [B1]

SGFREEPAPERS.COM

[3]

(b) show that BE bisects angle ABD.

Answer

$\angle DBE = \angle DAE$(∠s in the same segment are equal)[B1- reason]

$= 28°$

$\angle BEA = \angle BDA$(∠s in the same segment are equal)

$= 34°$

$\angle ABE = 180° - \angle BAE - \angle BEA$(∠ sum of a triangle $= 180°$)

$= 180° - (90° + 28°) - 34°$

$= 28°$[A1]

Since $\angle ABE = \angle DBE = 28°$, BE bisects angle ABD. [AG]

[2]

~~~ End of Paper ~~~

Downloaded from SingaKids.com

ZHONGHUA SECONDARY SCHOOL

PRELIMINARY EXAMINATION 2018

SECONDARY 4E/4N/5N

Candidate's Name	Class	Register Number

MATHEMATICS 4048/02

PAPER 2

29 Aug 2018

2 hours and 30 minutes

Additional Materials: Writing paper, Graph paper (1 sheet)

READ THESE INSTRUCTIONS FIRST

Write your name, class and register number on all the work you hand in.
Write in dark blue or black pen on both sides of the paper.
You may use an HB pencil for any diagrams or graphs.
Do not use paper clips, 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 total of the marks for this paper is **100**.

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.

For Examiner's Use
100

This question paper consists of **11** printed pages (including this cover page)

Downloaded from SingaKids.com

Mathematical Formulae

Compound Interest

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

Mensuration

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

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

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

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

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

SGFREEPAPERS.COM

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

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

Trigonometry

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

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

Statistics

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

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

Downloaded from SingaKids.com

Answer **all** the questions.

1 **(a)** Simplify $\frac{5x^3}{7y^3} \div \frac{25x}{49y^4}$ [2]

(b) Simplify $\frac{9x^2-1}{6x^2+x-1}$ [3]

(c) Solve the inequality $2x - 1 < 3x \leq \frac{2+3x}{3}$ [3]

(d) **(i)** Express as a single fraction in its simplest form

$$\frac{5}{x-7} - \frac{1}{x+1}.$$ [2]

(ii) Solve the equation

$$\frac{5}{x-7} - \frac{1}{x+1} = \frac{4}{5}.$$ [4]

---

2 **(a)** Carol and Pei are at a flower shop.
Carol buys three pots of mint and two pots of rosemary for \$17.85.

Pei buys five pots of mint and four pots of rosemary.
She pays with a \$50 note and receives change of \$17.25.

(i) Write down a pair of simultaneous equations to represent this information.
Use m to represent the cost, in dollars, of a pot of mint
and r to represent the cost, in dollars, of a pot of rosemary. [2]

(ii) Solve your simultaneous equations to find m and r. [2]

(iii) Work out the cost of two pots of mint and three pots of rosemary. [1]

(b) Factorise $4x^2 + 4xy - x - y$. [2]

(c) **(i)** Express 3850 as the product of its prime factors. [1]

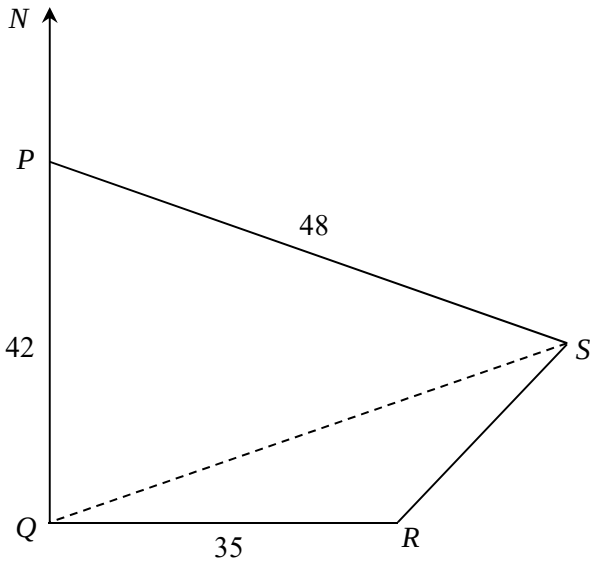
(ii) Given that $\frac{3850}{k}$ is a perfect square, find the smallest possible integer value of k. [1]

(iii) The product of two 2-digit numbers is 3850.
The highest common factor of these two numbers is 5.

Find the two numbers. [2]

Downloaded from SingaKids.com

3



The diagram shows a field, *PQRS*.
P, *Q*, *R* and *S* are on level ground such that *R* is due east of *Q*.
The bearing of *S* from *P* is 105°.
QS is a straight path across the field.
PQ = 42 m, *PS* = 48 m, *QR* = 35 m.

(a) Calculate *QS*. [3]

(b) Find the bearing of *S* from *Q*. [3]

(c) Calculate the area of the field *PQRS*. [3]

(d) A drone flies in a straight line from *Q* to *S* at a height of 20 m above ground.

A man standing at *R* looks up at the drone.
Calculate the largest angle of elevation of the drone from the man. [3]

SGFREEPAPERS.COM

Downloaded from SingaKids.com

4 **(a)** The daily dietary requirements differ slightly for school-going children and adolescents, based on their age-range.
The table summarises their respective daily dietary requirements of fruit and vegetables by number of servings.

Age	Fruit	Vegetables
3-6 years old	1	1
7-12 years old	2	2
13-18 years old	2	2

(i) Represent the above information in a 3 × 2 matrix **M**. [1]

(ii) One serving of fruit weighs 145g and one serving of vegetables weighs 150g.
Represent the weight for one serving in a 2 × 1 column matrix **N**. [1]

(iii) Evaluate the matrix **T** = **MN**. [1]

(iv) State what the elements of **T** represent. [1]

(b) The recommended period of time spent on physical activities for adolescents is one hour daily. 17-year-old Janet plots a route for her daily walk.

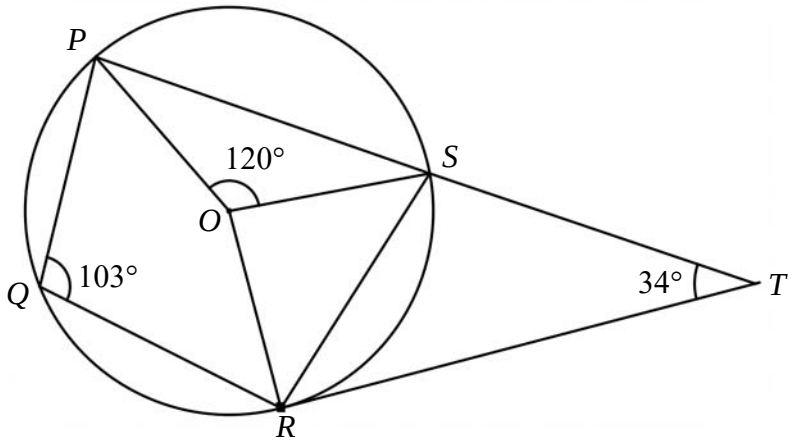
(i) The length of her route on a map is 8.2 cm.
The scale of the map is 1 : 50 000.

Work out the number of kilometres Janet walks each day. [1]

(ii) If Janet walks at a speed of 1.2 metres per second, will she be able to complete her route in an hour? Justify your answer with figures. [2]

Downloaded from SingaKids.com

5 (a)



O is the centre of the circle *PQRS*.
RT is a tangent to the circle, and when produced, the line *PS* meets the tangent at *T*.
Angle *PQR* = 103°, angle *SOP* = 120° and angle *STR* = 34°.

(i) Stating your reasons clearly, find

(a) angle *POR*, [2]

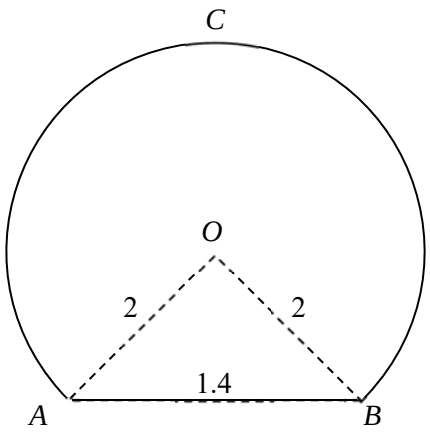
(b) angle *OST*, [2]

(ii) Show that angle *OPQ* + angle *ORQ* = 103°. [2]

(iii) Determine if quadrilateral *OSTR* is a trapezium.
Justify your answer with appropriate reason(s). [1]

SGFREEPAPERS.COM

(b)



The diagram shows a major segment, *ACB*, of radius 2 m with *AB* = 1.4 m.

(i) Calculate angle *AOB* in radians. [2]

(ii) Calculate the perimeter of the major segment *ACB*. [2]

Downloaded from SingaKids.com

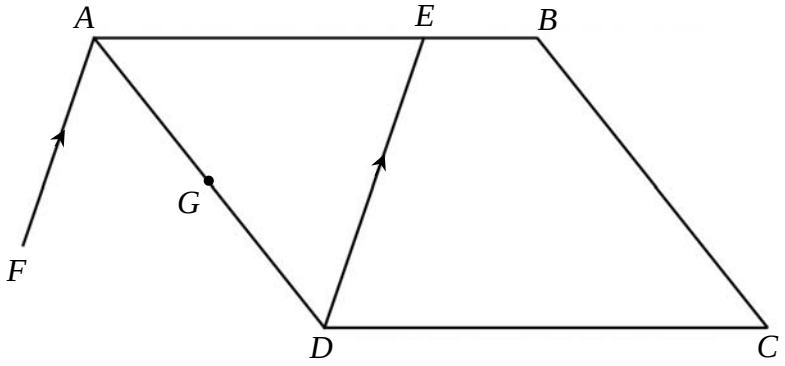
6 **(a)** P is the point (5, 12). Q is the point (–5, 0).

(i) Write down the column vector $\overrightarrow{PQ}$. [1]

(ii) Find $\left|\overrightarrow{PQ}\right|$. [2]

(iii) R is the point such that $\overrightarrow{PQ} = 2\overrightarrow{QR}$.
Find the coordinates of R. [2]

(b)



$ABCD$ is a parallelogram.
$\overrightarrow{AB} = \mathbf{a}$ and $\overrightarrow{BC} = \mathbf{b}$.
E is a point on AB such that $AE = 3EB$.
G is the midpoint of AD.
FA is parallel to DE such that $FA : DE = 4 : 5$.

(i) Express each of the following, as simply as possible, in terms of **a** and/or **b**.

(a) $\overrightarrow{AE}$, [1]

(b) $\overrightarrow{DE}$, [1]

(c) $\overrightarrow{FA}$. [1]

(ii) Write down the value of $\frac{\text{area of } \Delta AFD}{\text{area of } \Delta ADE}$. [1]

(iii) Determine if points F, G, and B lie on a straight line.
Justify your answer using vectors. [3]

Downloaded from SingaKids.com

7 **(a)** The number of goals scored by France in the 2018 World Cup is shown in the table below.

Number of goals	0	1	2	3	4
Frequency	1	2	2	0	2

(i) Is mode an appropriate measure of average for this set of data? Justify your answer. [1]

(ii) Calculate

(a) the mean number of goals scored per game, [1]

(b) the standard deviation. [1]

(iii) France played 7 games at the 2006 World Cup.
The results are summarised below.

Mean	1.29 goals per game
Standard Deviation	0.88 goals per game

Make two comparisons between the number of goals scored per game by France in the two World Cups. [2]

SGFREEPAPERS.COM

(b) A packet of mixed nuts contains three different kinds of nuts: macadamia, almond, peanut.
There are a total of 10 macadamia nuts, 12 almond nuts, and 21 peanuts.
Mary picks two nuts at random without replacement.

(i) Draw a tree diagram to show the probabilities of the possible outcomes. [2]

(ii) Find, as a fraction in its simplest form, the probability that

(a) the first nut taken is a macadamia nut, [1]

(b) both nuts are peanuts, [1]

(c) one almond nut and one macadamia nut was picked, [2]

(d) both nuts are different. [2]

Downloaded from SingaKids.com

8 Answer the whole of this question on a sheet of graph paper.

The variables x and y are connected by the equation

$$y = 4x + \frac{25}{x^2}.$$

Some corresponding values of x and y are given in the table below.

x	1	1.25	1.5	2.0	2.5	3.0	3.5	4.0
y	p	21.0	17.1	14.3	14.0	14.8	16.0	17.6

(a) Calculate the value of p, to 1 decimal place. [1]

(b) Using a scale of 2 cm to represent 0.5 unit, draw a horizontal x-axis for $0 \leq x \leq 4$.
Using a scale of 2 cm to represent 5 units, draw a vertical y-axis for $0 \leq y \leq 30$.

On your axes, plot the points given in the table and join them with a smooth curve. [3]

(c) Use your graph to find the solution(s) of the equation $4x + \frac{25}{x^2} = 25$ for $0 \leq x \leq 4$ [2]

(d) By drawing a tangent, find the gradient of the curve at $x = 1.5$. [2]

(e) By drawing a suitable straight line graph, solve $3x^3 + 10x^2 - 25 = 0$. [3]

Downloaded from SingaKids.com

9 Ivy runs an online business delivering goods by post.
The local postage rates are shown below.

Weight-Step Up to	Standard Regular (C5, C6 & DL size envelope)	Standard Large (Up to C4 size envelope)	Non-Standard
20g	\$0.30	\$0.60	\$0.60
40g	\$0.37		
100g			\$0.90
250g		\$0.90	\$1.15
500g		\$1.15	\$1.70
1kg		\$2.55	
2kg		\$3.55	

[Extracted from https://www.singpost.com/sites/default/files/PostageRates-MailingGuidelines.pdf]

(a) **(i)** For a particular delivery, Ivy used a C4 size envelope for her paper-based goods which weighed 150g. Write down the cost of posting this package. [1]

(ii) However, when Ivy attempted to deliver the package, she was informed that her package is considered a non-standard mail as it contained merchandise.

Calculate the additional amount she has to pay to deliver the package. [2]

SGFREEPAPERS.COM

Ivy would like to expand her business to delivering to overseas customers.
The airmail rates for packages are shown below.

Destination	**Small Packages***	
	Weight-Step Up To (max weight: 2kg)	**Postage Rate**
Zone 1 Malaysia and Brunei	100g	\$2.50
	250g	\$3.90
	500g	\$5.20
	per additional 100g	\$1.10
Zone 2 Countries in the Asia & The Pacific (except Australia, Japan & New Zealand)	100g	\$3.20
	250g	\$6.80
	500g	\$12.00
	per additional 100g	\$2.50
Zone 3 Countries in the rest of the world, including Australia, Japan, New Zealand, Africa, The Americas, Europe & The Middle East	100g	\$4.70
	250g	\$9.85
	500g	\$17.00
	per additional 100g	\$3.50

*Small Packages are mail containing goods or merchandise that are up to 2kg in weight. The largest dimensions should not exceed 60 cm, with length, width and height combined not exceeding 90 cm.
[Extracted from https://www.singpost.com/sites/default/files/PostageRates-MailingGuidelines.pdf]

Downloaded from SingaKids.com

(b) **(i)** Calculate the cost of sending a package weighing 562g to Australia. [1]

(ii) Write down a possible set of dimensions of a small package, giving your answer in cm. [1]

(iii) Ivy observed that the packages usually weigh from 210g to 270g. For ease of charging, Ivy would like to implement a fixed delivery charge, regardless of destination.

Assume that an equal amount of packages is delivered to each zone, and considering the range of weights of packages, determine a reasonable fixed delivery charge that Ivy should implement. Justify your answer with appropriate working.

[4]

Downloaded from SingaKids.com

ZHONGHUA SECONDARY SCHOOL
PRELIMINARY EXAMINATIONS
MATHEMATICS PAPER 2 (4048/2)
ANSWER KEY

1a	$\frac{7}{5}x^2y$	5aiii	Since $\angle ROS + \angle TRO = 86° + 90° \neq 180°$, OR is not parallel to RT. Therefore, $OSTR$ is not a trapezium as it does not have a pair of parallel sides.
1b	$\frac{(3x+1)}{(2x+1)}$		
1c	$-1 < x \leq \frac{1}{3}$	5bi	0.715 radians
1di	$\frac{4x+12}{(x-7)(x+1)}$	5bii	12.5m
1dii	$x = 12.7 \quad or \quad -1.73$ (3 sig fig)	6ai	$\begin{pmatrix}-10\\-12\end{pmatrix}$
2ai	$3m + 2r = 17.85$ $5m + 4r = 32.75$	6aii	15.6 units
		6aiii	(–10, –6)
2aii	$m = 2.95$, $r = 4.5$	6bia	$\overrightarrow{AE} = \frac{3}{4}\mathbf{a}$
2aiii	\$19.40		
2b	$(4x-1)(x+y)$	6bib	$\overrightarrow{DE} = -\mathbf{b} + \frac{3}{4}\mathbf{a}$
2ci	$2 \times 5^2 \times 7 \times 11$		
2cii	154	6bic	$\overrightarrow{FA} = -\frac{4}{5}\mathbf{b} + \frac{3}{5}\mathbf{a}$
2ciii	55 *and* 70		
3a	55.0 m	6bii	$\frac{4}{5}$
3b	057.5°		
3c	1490m^2	7ai	No, because the highest frequency occurs 3 times.
3d	46.7°		
4ai	$\begin{pmatrix}1&1\\2&2\\2&2\end{pmatrix}$	7aiia	2 goals
		7aiib	1.41 goals (3 sig. fig.)
4aii	$\begin{pmatrix}145\\150\end{pmatrix}$	7aiii	As the mean number of goals was smaller in 2006 than in 2018, France scored better at the 2018 World Cup. As the standard deviation of goals was smaller in 2006 than in 2018, France scored more consistently at the 2006 World Cup.
4aiii	$\begin{pmatrix}295\\590\\590\end{pmatrix}$		
4aiv	The elements of **T** represent the total weight of fruits and vegetables consumed by school-going children and adolescents, based on their age-range.	7bi	1st selection: $\frac{10}{43}, \frac{12}{43}, \frac{21}{43}$ 2nd selection: $\frac{9}{42}, \frac{12}{42}, \frac{21}{42}, \frac{10}{42}, \frac{11}{42}, \frac{21}{42}, \frac{10}{42}, \frac{12}{42}, \frac{20}{42}$
		7biia	$\frac{10}{43}$
4bi	4.1 km	7biib	$\frac{10}{43}$
4bii	Yes.		
5aia	154°	7biic	$\frac{40}{301}$
5aib	150°		
5aii	$\angle POR = 154°$ (from (a)(i)(a)) $\angle OPQ + \angle ORQ + 154° + 103° = 360°$ (angle sum of quadrilateral) $\angle OPQ + \angle ORQ = 103°$ (shown)	7biid	$\frac{194}{301}$

Downloaded from SingaKids.com

8a	29.0
8b	Graph
8c	$x = 1.1$
8d	Gradient = –10.814 (exact)
8e	$x = 1.325$
9ai	\$0.90
9aii	\$0.25
9bi	\$20.50
9bii	e.g. 20cm by 30cm by 40cm
9biii	\$9.20

Downloaded from SingaKids.com

ZHONGHUA SECONDARY SCHOOL
4E/4N/5N
PRELIMINARY EXAMINATIONS (2018)

Marking Scheme

Qn [14m]		Answer	Mark Allocated
1	(a)	$\frac{5x^3}{7y^3} \div \frac{25x}{49y^4}$ $= \frac{5x^3}{7y^3} \times \frac{49y^4}{25x}$ $= \frac{7}{5}x^2y$	M1 A1
	(b)	$\frac{9x^2-1}{6x^2+x-1}$ $= \frac{(3x-1)(3x+1)}{(3x-1)(2x+1)}$ $= \frac{(3x+1)}{(2x+1)}$	B1 – factorisation of $9x^2-1$ B1 – factorisation of $6x^2+x-1$ A1
	(c)	$2x-1 < 3x \leq \frac{2+3x}{3}$ $2x-1 < 3x$ and $3x \leq \frac{2+3x}{3}$ $2x-1 < 3x$ and $9x \leq 2+3x$ $x > -1$ and $x \leq \frac{1}{3}$ $\therefore -1 < x \leq \frac{1}{3}$	B1, B1 – each correct inequality B1
	(d)(i)	$\frac{5}{x-7} - \frac{1}{x+1}$ $= \frac{5(x+1)-(x-7)}{(x-7)(x+1)}$ $= \frac{5x+5-x+7}{(x-7)(x+1)}$ $= \frac{4x+12}{(x-7)(x+1)}$	M1 – taking common denominator A1
	(d)(ii)	$\frac{5}{x-7} - \frac{1}{x+1} = \frac{4}{5}$ $\frac{4x+12}{(x-7)(x+1)} = \frac{4}{5}$ $\frac{x+3}{(x-7)(x+1)} = \frac{1}{5}$ $5x+15 = x^2-6x-7$	M1 – ft from their (d)(i)

SGFREEPAPERS.COM

Downloaded from SingaKids.com

		$x^2 - 11x - 22 = 0$ $x = \frac{-(-11) \pm \sqrt{(-11)^2 - 4(1)(-22)}}{2(1)}$ $x = 12.7 \quad or \quad -1.73$ (3 sig fig)	M1 – reduce to quadratic M1 – substitution of values seen A1 – both roots

Qn [11m]		Answer	Mark Allocated
2	**(a)(i)**	$3m + 2r = 17.85$ $5m + 4r = 32.75$	B1 B1
	(a)(ii)	$3m + 2r = 17.85$ ---① $5m + 4r = 32.75$ ---② ① × 2: $6m + 4r = 35.7$ ---③ ③ – ②: $m = 2.95$ $r = 4.5$	 B1 B1
	(a)(iii)	\$19.40	B1 – B0 if not written to 2 d.p.
	(b)	$4x^2 + 4xy - x - y$ $= 4x(x + y) - (x + y)$ $= (4x - 1)(x + y)$	 M1 A1
	(c)(i)	$2 \times 5^2 \times 7 \times 11$	B1
	(c)(ii)	154	B1
	(c)(iii)	55 *and* 70	B1, B1

Qn [12m]		Answer	Mark Allocated
3	(a)	$\angle QPS = 180° - 105° = 75°$ (adj. ∠s on a st. line) By cosine rule, $QS^2 = 42^2 + 48^2 - 2(42)(48)\cos 75°$ $QS^2 = 3024.44161$ $QS = 54.9949 = 55.0$ m (3 sig. fig.)	M1 – seen or implied M1 – applying Cosine rule A1
	(b)	By sine rule, $\frac{sin\angle PQS}{48} = \frac{sin75°}{54.9949}$ $sin\angle PQS = 0.84306$ $\angle PQS = 57.4655$ Bearing of *S* from *Q* $= 057.5°$ (1 dec.pl.)	M1 – applying Sine rule A1 – finding $\angle PQS$ A1 – answer statement must be seen
	(c)	Area of $\Delta PQS = \frac{1}{2} \times 42 \times 48 \times \sin 75° = 973.653 m^2$ Area of ΔQRS $= \frac{1}{2} \times 54.9949 \times 35 \times \sin(90 - 57.4655)°$ $= 517.591 m^2$ Area of field *PQRS* = 1491.24 = 1490m² (3 sig. fig.)	M1 M1 – for $(90 - their\ \angle PQS)$ A1

Downloaded from SingaKids.com

(d)	Let h be the shortest distance from R to QS. $\frac{1}{2} \times QS \times h = 517.59$ or $\sin \angle SQR = \frac{h}{35}$ $h = 18.823 = 18.8\,\text{m}$ (3 sig. fig.) Let angle of elevation be θ. $\tan\theta = \frac{20}{18.823}$ $\theta = 46.736 = 46.7°$ (1 dec. pl.) Largest angle of elevation = 46.7° (1 dec. pl.)	M1 (or trigo ratio) M1 – calculating angle of elevation A1 – answer statement

Qn [7 m]		Answer	Mark Allocated
4	(a)(i)	$\begin{pmatrix} 1 & 1 \\ 2 & 2 \\ 2 & 2 \end{pmatrix}$	B1
	(a)(ii)	$\begin{pmatrix} 145 \\ 150 \end{pmatrix}$	B1
	(a)(iii)	$\mathbf{T} = \begin{pmatrix} 1 & 1 \\ 2 & 2 \\ 2 & 2 \end{pmatrix}\begin{pmatrix} 145 \\ 150 \end{pmatrix}$ $= \begin{pmatrix} 295 \\ 590 \\ 590 \end{pmatrix}$	B1
	(a)(iv)	The elements of **T** represent the total weight of fruits and vegetables consumed by school-going children and adolescents, based on their age-range.	B1
	(b)(i)	No. of kilometers Janet walks $= 8.2 \times 0.5km$ $= 4.1km$	B1
	(b)(ii)	Janet's walking speed in km/h = $1.2 \times \frac{3600}{1000} = 4.32km/h$ Since Janet walks at a speed of 4.32km in 1 hour, and 4.32km > 4.1km, she will be able to complete her route in 1 hour. OR Speed = 1.2 m/s Distance = 4.1 km = 4100 m Time taken = $\frac{4100}{1.2}$ seconds $= \frac{4100}{1.2} \div 60$ minutes = 56.94 min Since Janet took 56.94min which is < 60 min (1 hr), she will be able to complete her route in 1 hour.	M1 – conversion to km/h A1 – concluding statement seen M1 – conversion to min A1 – concluding statement seen

SGFREEPAPERS.COM

Downloaded from SingaKids.com

Qn [11m]		Answer	Mark Allocated
5	(a)(i)(a)	Reflex $\angle POR = 103° \times 2 = 206°$ (angle at centre = twice of angle at circumference) $\angle POR = 360° - 206° = 154°$ (angles at a point)	M1 A1
	(a)(i)(b)	$\angle ORT = 90°$ (tangent perpendicular to radius) $\angle ROS = 206° - 120° = 86°$ $\angle OST = 360° - 86° - 90° - 34° = 150°$ **OR** $\angle OSP = (180° - 120°) \div 2 = 30°$ ($\angle$ sum of triangle, base angles of isosceles triangle) $\angle OST = 180° - 30° = 150°$	M1 – reason stated A1 M1 – reason stated A1
	(a)(ii)	$\angle OPS = (180° - 120°) \div 2 = 30°$ $\angle ORS = (180° - 86°) \div 2 = 47°$ $\angle QPS + \angle QRS = 180°$ (angles in opposite segment) $\angle OPQ + \angle OPS + \angle ORQ + \angle ORS = 180°$ $\angle OPQ + 30° + \angle ORQ + 47° = 180°$ $\angle OPQ + \angle ORQ = 103°$ (shown) **OR** $\angle POR = 154°$ (from (a)(i)(a)) $\angle OPQ + \angle ORQ + 154° + 103° = 360°$ (angle sum of quadrilateral) $\angle OPQ + \angle ORQ = 103°$ (shown)	B1 – for both angles B1 – reason stated, leading to conclusion B1 – reason stated B1
	(a)(iii)	Since $\angle ROS + \angle TRO = 86° + 90° \neq 180°$, OR is not parallel to RT. Therefore, $OSTR$ is not a trapezium as it does not have a pair of parallel sides.	B1
	(b)(i)	By cosine rule, $\cos \angle AOB = \frac{2^2 + 2^2 - 1.4^2}{2(2)(2)} = \frac{151}{200}$ $\angle AOB = 0.71514 = 0.715$ radians (3 sig. fig.)	M1 – correct application of cosine rule A1
	(b)(ii)	Reflex $\angle POQ = 2\pi - 0.71514 = 5.5680$ Perimeter of major segment = 2(5.5680) + 1.4 = 12.5m (3 sig. fig.)	M1 – seen or implied, their (bi) A1

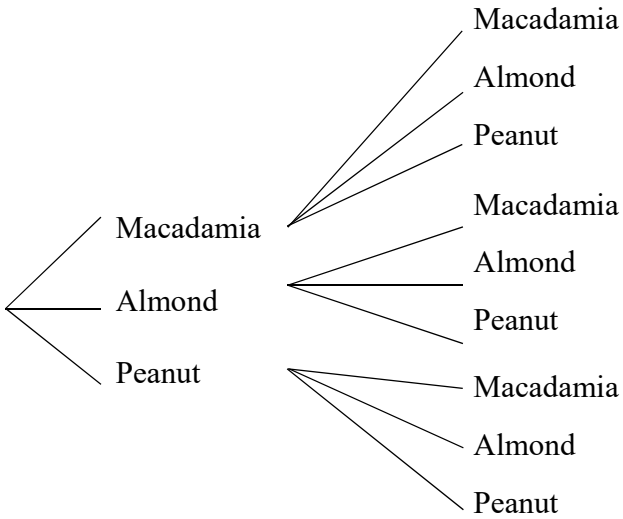
Downloaded from SingaKids.com

Qn [12m]		Answer	Mark Allocated
6	(a)(i)	$\overrightarrow{PQ} = \begin{pmatrix}-10\\-12\end{pmatrix}$	B1
	(a)(ii)	$\left\|\overrightarrow{PQ}\right\| = \sqrt{(-12)^2 + (-10)^2}$ = 15.6 units (3 sig. fig.)	M1 – ft from their (i) A1 – correct answer only
	(a)(iii)	$\overrightarrow{QR} = \frac{1}{2}\overrightarrow{PQ} = \begin{pmatrix}-5\\-6\end{pmatrix}$ $\overrightarrow{OR} = \overrightarrow{OQ} + \overrightarrow{QR}$ $\overrightarrow{OR} = \begin{pmatrix}-5\\0\end{pmatrix} + \begin{pmatrix}-5\\-6\end{pmatrix} = \begin{pmatrix}-10\\-6\end{pmatrix}$ Coordinates of R = (–10, –6)	M1 – ft from their (i) A1 – coordinates must be stated
	(b)(i)(a)	$\overrightarrow{AE} = \frac{3}{4}\mathbf{a}$	B1
	(b)(i)(b)	$\overrightarrow{DE} = \overrightarrow{DA} + \overrightarrow{AE} = -\mathbf{b} + \frac{3}{4}\mathbf{a}$	B1
	(b)(i)(c)	$\overrightarrow{FA} = \frac{4}{5}\left(-\mathbf{b} + \frac{3}{4}\mathbf{a}\right) = -\frac{4}{5}\mathbf{b} + \frac{3}{5}\mathbf{a}$	B1
	(b)(ii)	$\frac{\text{area of } \Delta AFD}{\text{area of } \Delta ADE} = \frac{4}{5}$	B1
	(b)(iii)	$\overrightarrow{FB} = \overrightarrow{FA} + \overrightarrow{AB} = -\frac{4}{5}\mathbf{b} + \frac{3}{5}\mathbf{a} + \mathbf{a}$ $= \frac{8}{5}\mathbf{a} - \frac{4}{5}\mathbf{b}$ $= \frac{8}{5}\left(\mathbf{a} - \frac{1}{2}\mathbf{b}\right)$ $\overrightarrow{GB} = \overrightarrow{GA} + \overrightarrow{AB} = -\frac{1}{2}\mathbf{b} + \mathbf{a}$ $\overrightarrow{FG} = -\frac{3}{10}\mathbf{b} + \frac{3}{5}\mathbf{a}$ Since $\overrightarrow{FB} = \frac{8}{5}\overrightarrow{GB}$, $\overrightarrow{FB}$ is parallel to $\overrightarrow{GB}$, B is a common point, therefore F, G, and B lie on a straight line.	M2 – find any two vectors A1 – concluding statement

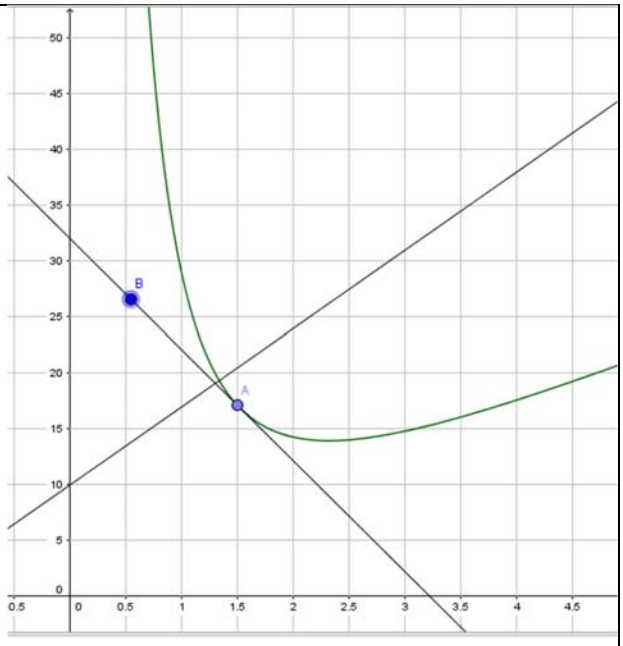
Qn [13m]		Answer	Mark Allocated
7	(a)(i)	No, because the highest frequency occurs 3 times.	B1
	(a)(ii)(a)	2 goals	B1
	(a)(ii)(b)	1.41 goals (3 sig. fig.)	B1
	(a)(iii)	As the mean number of goals was smaller in 2006 than in 2018, France scored better at the 2018 World Cup. As the standard deviation of goals was smaller in 2006 than in 2018, France scored more consistently at the 2006 World Cup.	B1 B1

SGFREEPAPERS.COM

Downloaded from SingaKids.com

	(b)(i)	 –1 mark if legend/key is missing	B2 – Correct tree diagram with all probabilities correct B1 – for branches for first selection correct 1st selection: $\frac{10}{43}, \frac{12}{43}, \frac{21}{43}$ 2nd selection: $\frac{9}{42}, \frac{12}{42}, \frac{21}{42}, \frac{10}{42}, \frac{11}{42}, \frac{21}{42}, \frac{10}{42}, \frac{12}{42}, \frac{20}{42}$
	(b)(ii)(a)	$\frac{10}{43}$	B1
	(b)(ii)(b)	$\frac{21}{43} \times \frac{20}{42} = \frac{10}{43}$	B1
	(b)(ii)(c)	$\frac{12}{43} \times \frac{10}{42} \times 2$ $= \frac{40}{301}$	M1 – ft from tree diagram A1
	(b)(ii)(d)	$1 - \left(\frac{10}{43} \times \frac{19}{42}\right) - \left(\frac{12}{43} \times \frac{11}{42}\right) - \left(\frac{21}{43} \times \frac{20}{42}\right)$ $= \frac{194}{301}$	M1 A1

Qn [11m]		Answer
8	(a)	$p = 29.0$
	(b)	P2 – All 8 points plotted (P1 – at least 6 points plotted correctly) C1 – Smooth curve drawn through plotted points, dependent on P1 Minus 1 mark if scale is not adhered to
	(c)	$x = 1.1$
	(d)	Gradient = –10.814 (exact) M1 – tangent line drawn at $x = 1.5$ A1 – gradient estimated and calculated between –9 to –11
	(e)	$3x^3 + 10x^2 - 25 = 0$ $7x + 10 = 4x + \frac{25}{x^2}$ Draw $y = 7x + 10$ M2 for straight line $y = 7x + 10$ drawn. (M1 if only $y = 7x + 10$ is seen) $x = 1.325$ [A1]



Downloaded from SingaKids.com

Qn [9m]		Answer	Mark Allocated
9	(a)(i)	\$0.90	B1
	(a)(ii)	Cost of mailing non-standard mail = \$1.15 Additional amount = \$1.15 – \$0.90 = \$0.25	M1 A1
	(b)(i)	\$17.00 + \$3.50 = \$20.50	B1
	(b)(ii)	Any set of 3 **reasonable** measurements, each not exceeding 60cm, total not exceeding 90cm e.g. 20cm by 30cm by 40cm [B1] e.g. 1cm by 1 cm by 1cm [B0]	B1
	(b)(iii)	Mean cost of packages from 210g up to 250g = (\$3.90 + \$6.80 + \$9.85) ÷ 3 = \$6.85 OR Median cost of packages from 210g up to 250g = \$6.80 Mean cost of packages heavier than 250g up to 270g = (\$5.20 + \$12.00 + \$17.00) ÷ 3 = \$11.40 OR Median cost of packages heavier than 250g up to 270g = \$12.00 Mean cost across weight categories = (\$6.85 + \$11.40) ÷ 2 = \$9.125 OR Median cost across weight categories = (\$6.80 + \$12.00) ÷ 2 = \$9.40 Ivy could charge \$9.20 as it is an average of the cost of airmailing an average package across two weight categories.	M1 – select costs across all 3 zones M1 – select costs across weight categories M1 – using mean or median A1 – conclusion, justified by calculations, answer correct to 2 d.p.

SGFREEPAPERS.COM

Downloaded from SingaKids.com