68. Prelims Paper 1 (MS)

Thursday, August 8, 2024 1:21 PM

Answer **all** the questions.

1 $-4.4 \quad -(2.1)^2 \quad \pi \quad \frac{22}{7} \quad \sqrt[3]{27}$

-4.41 3.1415 3.1429 3

Write these numbers in order of size, starting with the smallest.

B1 – Any 2 correct
B1 – All correct

Answer $-(2.1)^2$, -4.4, $\sqrt[3]{27}$, π, $\frac{22}{7}$ [2]

smallest

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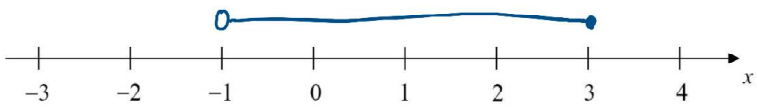
2 **(a)** Represent $-1 < x \leq 3$ on the number line below.

Answer

B1



[1]

(b) Solve the inequality $-3x \leq 7$

$-3x \leq 7$

$x \geq -\frac{7}{3}$

$x \geq -2\frac{1}{3}$

Answer $x \geq -2\frac{1}{3}$ [1] B1

(c) State the smallest integer that satisfy $-3x \leq 7$

Answer -2 [1] B1 ECF

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3 2940 expressed as a product of its prime factors is $2^2 \times 3 \times 5 \times 7^2$.

(a) Express 504 as a product of its prime factors.

2 | 504
2 | 252
2 | 126
3 | 63
3 | 21
7

$504 = 2^3 \times 3^2 \times 7$

Answer $2^3 \times 3^2 \times 7$ B1 [1]

(b) Find the lowest common factor of 2940 and 504.

$2940 = 2^2 \times 3 \times 5 \times 7^2$
$504 = 2^3 \times 3^2 \times 7$

LCM $= 2^3 \times 3^2 \times 5 \times 7^2$
$= 17640$ //

Answer 17640 B1 [1]

(c) Find the smallest integer k such that 2940k is a perfect square.

$3 \times 5 = 15$ //

15 B1 [1]

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4 Which of these ratio(s) are equivalent to the ratio $a : b$?

$a^b : b^a$ $\quad a^2 : b^2$ $\quad 4a : 4b$ $\quad \frac{1}{b} : \frac{1}{a}$ $\quad a+2 : b+2$

Answer $4a : 4b$ B1 , $\frac{1}{b} : \frac{1}{a}$ B1 [2]

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5 Gracia has a map drawn to a scale 1 : 25 000.

(a) Rewrite the scale in the form 1 cm to x km.

1 cm : 25 000 cm

1 cm : 250 m

1 cm : 0.25 km

B1

Answer 1 : 0.25 ..... [1]

(b) A road on the map is 13 cm long.
Find the actual length of the road in kilometres.

map	:	Actual
1	:	0.25
13	:	3.25

B1

Answer 3.25 ..... km [1]

(c) A plot of land has an area of 120 km^2.
Find the area of the plot of land on the map in square centimetres.

map	:	Actual
1 cm	:	0.25 km
4 cm	:	1 km
16 cm^2	:	1 km^2
1920 cm^2	:	120 km^2

− m1

Alt

map	:	Actual
1 cm	:	0.25km
1 cm^2	:	0.0625 km^2
1920 cm^2	:	120 km^2

− m1

Answer 1920 ..... cm^2 [2] A1

6 $x^2 + 6x - 2 = (x + a)^2 + b$

(a) Find the value of a and b.

$x^2 + 6x - 2 = (x+3)^2 - 3^2 - 2$

$= (x+3)^2 - 11$

B1 B1

Answer $a =$ 3, $b =$ −11 [2]

(b) Hence, solve $x^2 + 6x - 2 = 0$.
Give your answers correct to 2 decimal places.

$x^2 + 6x - 2 = 0$

$(x+3)^2 - 11 = 0$

$(x+3)^2 = 11$

$x + 3 = \sqrt{11}$ or $x + 3 = -\sqrt{11}$ −m1

$x = \sqrt{11} - 3$ or $x = -3 - \sqrt{11}$

$x = 0.32$ or $x = -6.32$

* do not accept other methods

A1

Answer $x =$ 0.32, −6.32 [2]

7 $v = 3w + 8u^2$.

(a) Find v when $w = 4$ and $u = -2$.

$v = 3(4) + 8(-2)^2$

$= 44$

B1

Answer $v =$ 44 [1]

(b) Rearrange the formula to make u the subject.

$v = 3w + 8u^2$

$v - 3w = 8u^2$

$u^2 = \frac{v-3w}{8}$ -M1

$u = \pm\sqrt{\frac{v-3w}{8}}$ A1

reject if missing "$u =$"

Answer $u = \pm\sqrt{\frac{v-3w}{8}}$ [2]

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8 Solve $\frac{x}{2} - \frac{3+x}{3} = 1$.

(M1)

$3x - 2(3+x) = 6$ -M1

$3x - 6 - 2x = 6$

$x = 12$ // A1

(M2)

$\frac{3x}{6} - \frac{2(3+x)}{6} = 1$ — M1 (same base)

$\frac{3x-2(3+x)}{6} = 1$

$3x - 2(3+x) = 6$

$3x - 6 - 2x = 6$

$x = 12$ // - A1

Answer $x = 12$ [2]

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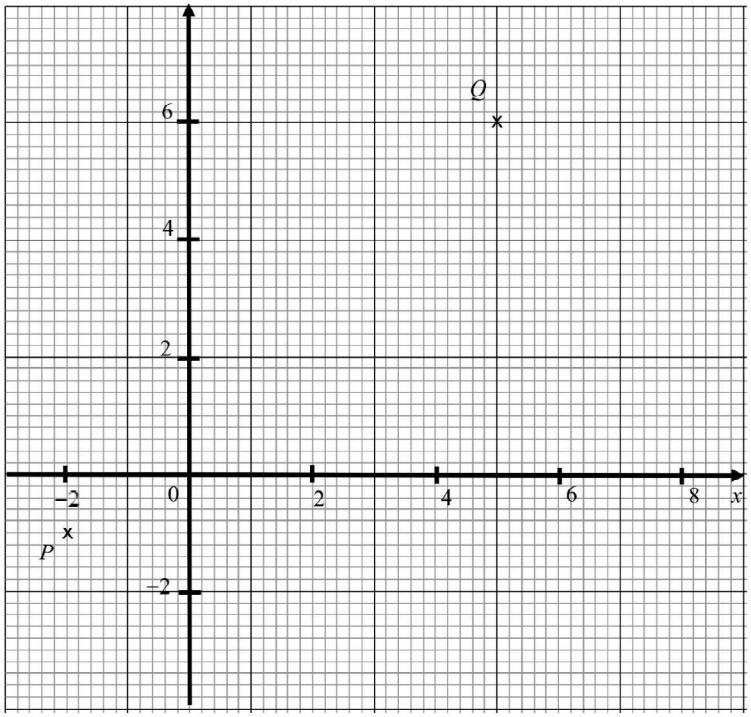
9 P is the point $(-2, -1)$ and Q is the point $(5, 6)$.



(a) Find the length of PQ.

$PQ = \sqrt{(-2-5)^2 + (-1-6)^2}$

$= 9.90$ (3sf)

B1

Answer 9.90 [1]

(b) R is the point $(8, k)$.
Given that the gradient of QR is -3, find the value of k.

$\text{grad}_{QR} = \frac{6-k}{5-8}$ -m1

$\frac{6-k}{5-8} = -3$

$\frac{6-k}{-3} = -3$

$6-k = 9$

$k = -3$ A1

Alt using Q: (5,6), grad QR = −3,
$6 = -3(5) + c$
$c = 21$ -m1
Eqn line QR: $y = -3x + 21$
when $x = 8$,
$y = -3(8) + 21$
$y = -3$
$\therefore k = -3$ -A1

Answer −3 [2]

(c) Find the equation of line QR.

$y = mx + c$

$y = -3x + c$

when $x = 5$, $y = 6$

$6 = -3(5) + c$

$c = 21$ M1 → A1 ow FCF from (b)

Answer $y = -3x + 21$ A1 [2]

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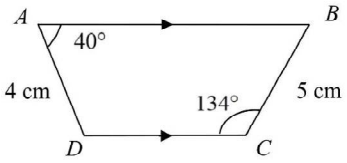
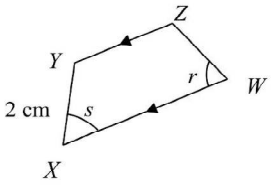
10 In the diagram below, $ABCD$ is similar to $WXYZ$.
AB is parallel to CD.





(a) Find the value of r.

Answer $r =$ 40 B1 [1]

(b) Find the value of s.

$\angle s = \angle B$.

$\angle B = 180^\circ - 134^\circ$

$= 46^\circ$

Answer $s =$ 46 B1 [1]

(c) Find the length of ZW.

M1

Scale factor : $\frac{YX}{BC} = \frac{2}{5}$ – M1

$ZW = 4 \times \frac{2}{5}$

$= 1.6$ – A1

M2 $\frac{YX}{BC} = \frac{ZW}{DA}$

$\frac{2}{5} = \frac{ZW}{4}$ – M1

$ZW = \frac{2}{5} \times 4$

$= 1.6$ – A1

Answer 1.6 or $1\frac{3}{5}$ cm [2]

M3

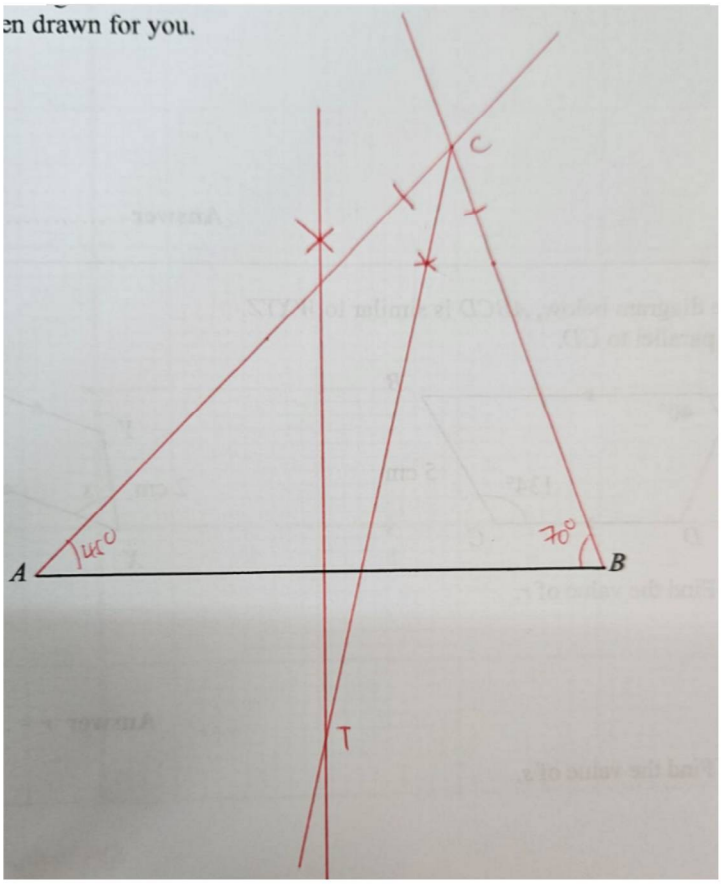
Scale factor (enlargement) $= \frac{5}{2}$ – M1

$ZW = 4 \div \frac{5}{2}$

$= 1.6$ – A1

11 ABC is a triangle with $AB = 9$ cm, angle $BAC = 45°$ and angle $ABC = 70°$.

(a) Construct triangle ABC
AB has been drawn for you



B2

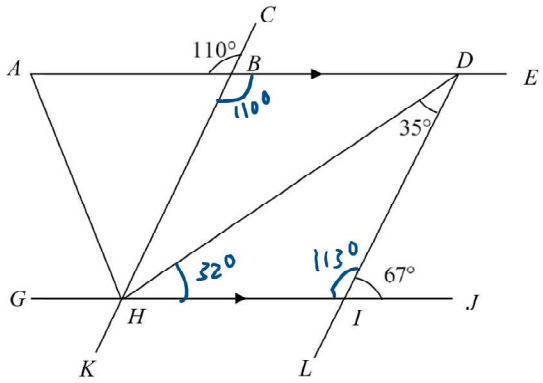
[2]

(b) The perpendicular bisector of AB and the angle bisector of ACB meet at point T.
Label point T. [2]

B1 - ⊥ bisect
B1 - ∠ bisect

17 H

AE, *GJ*, *CK* and *DL* are straight lines.
AE and *GJ* are parallel to each other.
Angle $DIJ = 67°$, angle $HDI = 35°$, angle $ABC = 110°$.



* -1m for entire question if no reason.

By stating your reason clearly, find

(a) **(i)** angle *HBD*,

∠HBD = 110° (vert. opp ∠s) B1

Answer 110 ° [1]

(ii) angle *DHI*.

∠DIH = 180° − 67° (adj. ∠s on a str. line) −M1
= 113°

∠DHI = 180° − 113° − 35° (∠ sum of Δ)
= 32°

(AH) ∠DHI = 67° − 35°
= 32° (ext ∠ of Δ)

Answer 32 A1 ° [2]

(b) Is *BDIH* a parallelogram?
Explain and show your working clearly.

Answer

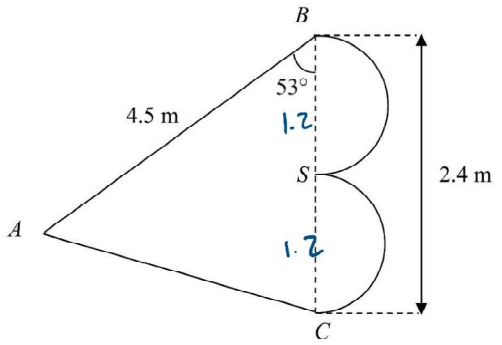
M1 NO, ∠DIH = 113°, not 110°. ∴ ∠DIH & ∠HBE not opp ∠ of ||gram, ∴ BDIH not a ||gram

M2 NO. ∠BDH = 32° (alt ∠s) B1

But ∠HBD + ∠BDI
= 110° + 32° + 35°
= 177°
≠ 180°

13

12 A playground is made up of triangle ABC and two congruent semicircles with diameter BS and SC respectively.
Angle $ABC = 53°$, $AB = 4.5$ m and $BC = 2.4$ m.



(a) Calculate the perimeter of the playground.

$AC^2 = 4.5^2 + 2.4^2 - 2(4.5)(2.4)\cos 53°$ – M1

$AC = 3.6070$

$BS + SC = 1.2\pi$ – M1

$= 3.76991$

Perimeter $= 3.6070 + 1.2\pi + 4.5$

$= 11.9$ m A1

Answer 11.9 m [3]

(b) (i) Calculate the area of the playground.

Area $ABC = \frac{1}{2}(4.5)(2.4)\sin 53°$ – M1

$= 4.3126\ m^2$

Area circle $= \pi(0.6)^2$ – M1

$= 1.1310\ m^2$

Total area $= 4.3126 + 1.1310$

$= 5.44\ m^2$ A1

Answer 5.44 m² [3]

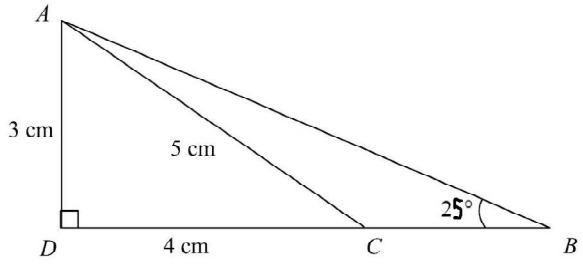
(ii) Convert your answer in **(bi)** to cm^2.

B1

Answer 54 400 cm^2 [1]

14

~~13~~ In the diagram below, Angle $ADB = 90°$, $AC = 5$ cm, $AD = 3$ cm, $DC = 4$ cm.



(a) Find the exact value of $\cos ACB$.

$\cos ACD = \frac{4}{5}$

$\cos ACB = -\cos(180° - \angle ACB)$

$= -\cos ACD$

$= -\frac{4}{5}$ 11

B1

Answer $-\frac{4}{5}$ cm [2]

(b) Calculate CB

$\tan 25° = \frac{3}{DB}$

$DB = \frac{3}{\tan 25°}$ -M1

$CB = \frac{3}{\tan 25°} - 4$

$= 2.43$ cm 11 -A1

Answer 2.43 cm [2]

AH

$\angle ACB = \cos^{-1}\left(-\frac{4}{5}\right)$

$= 143.13°$

$\angle CAB = 180° - 143.13° - 25°$

$= 11.87°$

$\frac{BC}{\sin 11.87°} = \frac{5}{\sin 25°}$ -M1

$\frac{5}{\sin 25°} \times \sin 11.87°$

1 $\frac{}{\sin 11.87^\circ} = \frac{}{\sin 25^\circ}$

$BC = \frac{5}{\sin 25^\circ} \times \sin 11.87^\circ$

$= 2.43$,, – A1

15

14 Mrs Leow wish to invest \$5000 in the bank for **6** years.
He has researched and found two options.

Bank ABC	Bank XYZ
Simple interest at 2.5% per annum.	Compound interest at 2.4% per annum, compounded yearly.

Which bank should Mrs Leow invest in to earn the greatest profit? Show workings to support your answer.

Answer

Bank ABC

$I = \frac{PRT}{100}$

$= \frac{5000(2.5)(6)}{100}$

$= 750$ – M1

Bank XYZ

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

$= 5000\left(1+\frac{2.4}{100}\right)^6$ – M1

$= 5764.61$

$I = 5764.61 - 5000$

$= 764.61$ – M1

Alt M1 : Bank ABC
$(750 + 5000 = \$5750)$

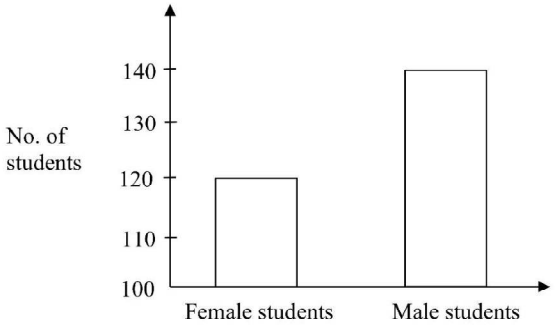
(m1) Mrs Leow should invest in bank ~~XYZ~~ B because it offers a higher interest (\$764.61) than bank ~~ABC~~ (\$750) A1 √ A [4]

(m2) Bank ~~XYZ~~ B as it offers more money at the end of 6 years (\$5764.61) than bank ~~ABC~~ A (\$5750)

(m3) Bank B as she can earn \$14.61 more.

16

~~15~~ The following bar graph shows the number of male and female students who spends more than five hours on their phones per day.



Ayden claims that there are twice as many male students than female students who spends more than five hours on their phones per day.
State one feature of the bar graph that is misleading and explain why.

Answer The vertical axis does not start from 0.
Hence, while male bar appears to be twice as tall, the number of male students (140) is not twice of female (120) [1] B1

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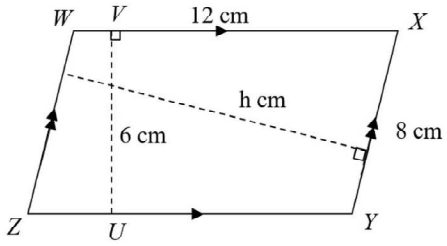
17 The diagram shows parallelogram $WXYZ$.
$WX = 12$ cm, $XY = 8$ cm and $VU = 6$ cm.
Find the length of h.



Area = 12 x 6 - M1
= 72 cm²

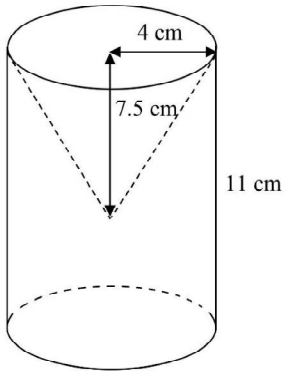
72 = 8h

h = 9 cm A1

Answer 9 cm [2]

18

~~17~~ The diagram shows a solid formed by removing a cone from a cylinder.



The cylinder and the cone have a common radius of 4 cm.
The height of the cone is 7.5 cm, and the height of the cylinder is 11cm.
Calculate the volume of the solid.

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

$= \frac{1}{3} \pi (4)^2 (7.5)$ – m1

$= 125.66 \text{ cm}^2$

Volume cylinder $= \pi r^2 h$

$= \pi (4)^2 (11)$ – m1

$= 552.92 \text{ cm}^2$

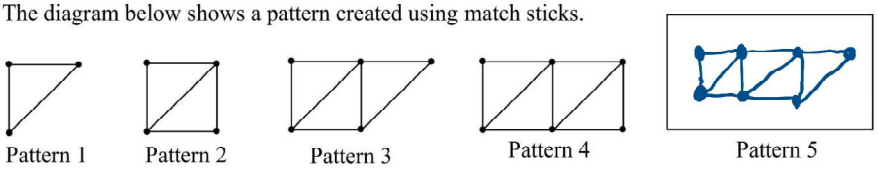
Volume solid $= 552.92 - 125.66$

$= 427 \text{ cm}^2$ A1

Answer 427 cm [4] ~~3~~

19

~~18~~ The diagram below shows a pattern created using match sticks.



B1

(a) Draw pattern 5 in the space above. [1]

(b) Write down an expression, in terms of n, for the number of sticks in Pattern n.

$T_1 = 3$

$T_2 = 5$

$T_3 = 7$

$T_4 = 9$

$T_n = 3 + 2(n-1)$

$= 3 + 2n - 2$

$= 2n + 1$

B1

Answer $2n+1$ ..... m^2 [1]

(c) Will there be a Pattern number with 100 match sticks?
If yes, find the pattern number.
Otherwise, explain why no such pattern number exists.

Answer

$100 = 2n + 1$

$99 = 2n$

$n = 49.5$

M1 No. To have 100 matchsticks $n = 49.5$. But n must be an integer/whole number.

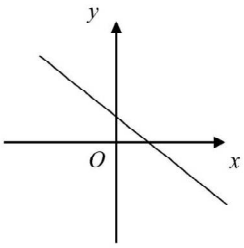
B1

M2 No, every pattern has an odd number of matchsticks [1]

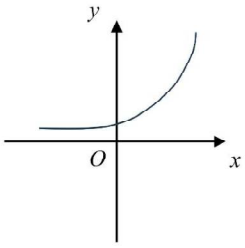
20
~~19~~ Match the following functions to their graphs.

Graph A: $y = -\frac{3}{x}$

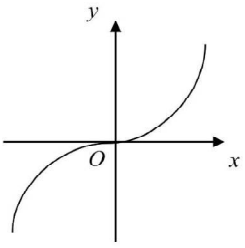
Graph B: $y = 2^x$



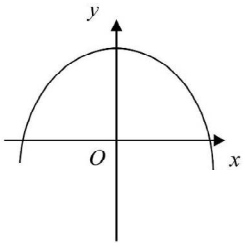
Graph 1



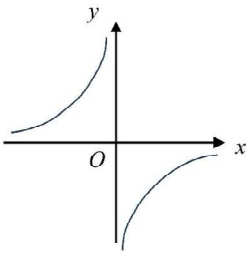
Graph 2



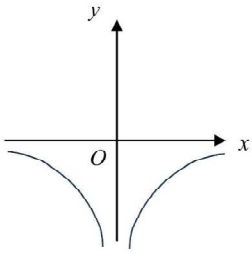
Graph 3



Graph 4



Graph 5



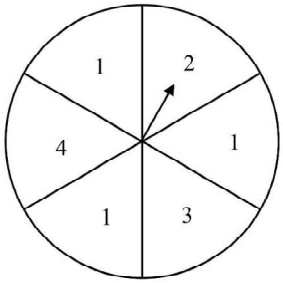
Graph 6

Answer **Graph A** 5 ..... [1] B1

Graph B 2 ..... [1] B1

21

A stall runs a spinner game at a fair.



Each player will spin the wheel twice.
Find the probability that

(a) The spinner will land on odd numbers on both spins.

$P(\text{odd, odd}) = \frac{4}{6} \times \frac{4}{6}$

$= \frac{4}{9}$

B1

Answer $\frac{4}{9}$ [1]

(b) The total score of both spins is greater than 6.

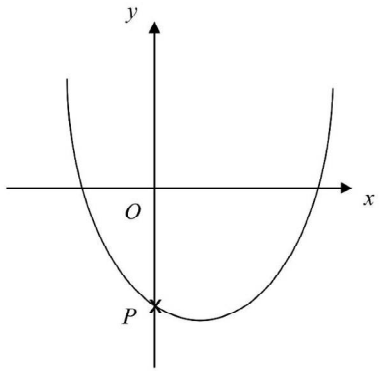
$P(4,3) + P(3,4) + P(4,4)$

$= \left(\frac{1}{6} \times \frac{1}{6}\right) + \left(\frac{1}{6} \times \frac{1}{6}\right) + \left(\frac{1}{6} \times \frac{1}{6}\right)$ -M1 (Any one bracket)

$= \frac{1}{18}$ -A1

Answer $\frac{1}{18}$ [2]

22 The diagram shows a sketch of the graph $y = (x+3)(x-5)$.



(a) Find the coordinates of point P.

when $x = 0$,

$y = (0+3)(0-5)$

$= -15$

Answer P (0, −15) B1 [1]

(b) State the equation of the line of symmetry of the graph.

$\frac{5+(-3)}{2} = 1$

Answer $x = 1$ B1 [1]

----- **END OF PAPER** -----

Efforts Today, Rewards Tomorrow