Write your name here

| Surname | Other names |
|---|---|
| | |

Pearson Edexcel
Level 1/Level 2 GCSE (9 - 1)

Centre Number

Candidate Number

# Mathematics

## Paper 1 (Non-Calculator)

**Higher Tier**

Specimen Papers Set 2

**Time: 1 hour 30 minutes**

Paper Reference

**1MA1/1H**

**You must have:** Ruler graduated in centimetres and millimetres, protractor, pair of compasses, pen, HB pencil, eraser.

Total Marks

## Instructions

- Use **black** ink or ball-point pen.
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer **all** questions.
- Answer the questions in the spaces provided – *there may be more space than you need.*
- **Calculators may not be used.**
- Diagrams are **NOT** accurately drawn, unless otherwise indicated.
- You must **show all your working out**.

## Information

- The total mark for this paper is 80
- The marks for **each** question are shown in brackets – *use this as a guide as to how much time to spend on each question.*

## Advice

- Read each question carefully before you start to answer it.
- Keep an eye on the time.
- Try to answer every question.
- Check your answers if you have time at the end.

*Turn over* ►

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PEARSON

**Answer ALL questions.**

**Write your answers in the spaces provided.**

**You must write down all the stages in your working.**

1 (a) Factorise $y^2 + 27y$

$= y(y+27)$

take out a common factor of y

$y(y+27)$

**(1)**

(b) Simplify $(t^3)^2$

$(t^3)^2 = t^6$

multiply powers when in brackets $(3 \times 2 = 6)$

$t^6$

**(1)**

(c) Simplify $\frac{w^9}{w^4}$

$= w^{9-4} = w^5$

indices rule: $\frac{x^a}{x^b} = x^{a-b}$

$w^5$

**(1)**

**(Total for Question 1 is 3 marks)**

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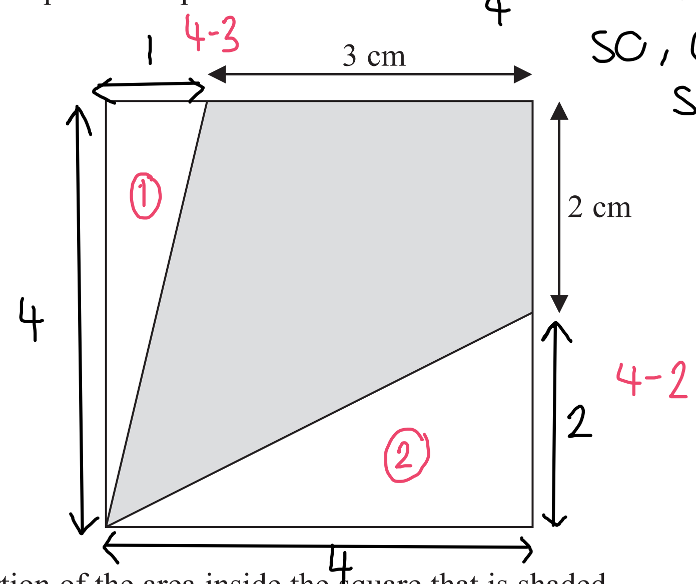
**2** The diagram shows a square with perimeter 16 cm.

$\frac{16}{4} = 4cm$

so, each side of square is 4cm in length.




Work out the proportion of the area inside the square that is shaded.

total area of square $= 4 \times 4 = 16cm^2$

area of $\Delta$ ① $\frac{1 \times 4}{2} = 2cm^2$

area of $\Delta$ ② $\frac{2 \times 4}{2} = 4cm^2$

Shaded area total area − ① − ②

$= 16 - 2 - 4 = 10cm^2$

proportion shaded $= \frac{\text{shaded area}}{\text{total area}} = \frac{10}{16} = \frac{5}{8}$

÷2

÷2

$\frac{5}{8}$ ..............................

**(Total for Question 2 is 5 marks)**

**3** David has designed a game.
He uses a fair 6-sided dice and a fair 5-sided spinner.
The dice is numbered 1 to 6
The spinner is numbered 1 to 5

Each player rolls the dice once and spins the spinner once.
A player can win £5 or win £2

| **Win £5** | **Win £2** |
| --- | --- |
| roll a 5 **and** spin a 5 | roll a 1 **or** spin a 1 **or** both |

David expects 30 people will play his game.
Each person will pay David £1 to play the game.

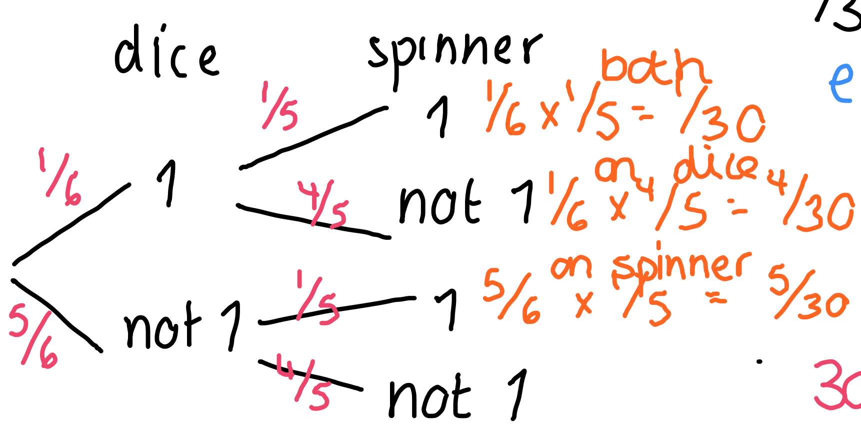
(a) Work out how much profit David can expect to make.

total money in:
30 x £1 = £30

Win £5
P(rolling 5) = 1/6
6 numbers on dice
P(spinning 5) = 1/5
5 numbers on spinner

so, P(winning £5) = 1/6 x 1/5 = 1/30
expecting 1 person to win £5.

Win £2




1/30 + 4/30 + 5/30 = 10/30
expect 10 people to win £2

money in = 5 + 10(2)
= 25

30 - 25 = £5 difference

£ 5

(4)

(b) Give a reason why David's actual profit may be different to the profit he expects to make.

the expected profit is calculated using probability, but the actual number of winners is down to chance.

(1)

**(Total for Question 3 is 5 marks)**



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**4** Triangle $ABC$ has perimeter 20 cm.

$AB = 7$ cm.
$BC = 4$ cm.

By calculation, deduce whether triangle $ABC$ is a right-angled triangle.

Side CA = 20 − 7 − 4 = 9 cm.
So, CA is the longest side.
If the triangle is right-angled, CA is the hypotenuse.
Pythagoras' theorem: $a^2+b^2=c^2$
c being the hypotenuse
$a^2+b^2 = 7^2+4^2 = 49+16 = 65$
$c^2 = 9^2 = 81$
$65 \neq 81$, so $\Delta ABC$ is not right-angled.

**(Total for Question 4 is 4 marks)**

**5** One sheet of A3 card has area $\frac{1}{8}$ $m^2$.
The card has a mass of 160 g per $m^2$.

Work out the total mass of 25 sheets of A3 card.

$1m^2 = 160g$ ÷8 ÷8
$\frac{1}{8}m^2 = 20g$ So, 1 sheet is 20g

25 sheets = 25 × 20g = 500g

500 g

**(Total for Question 5 is 4 marks)**

**6** (a) Work out $2\frac{1}{4} \times 3\frac{1}{3}$

Give your answer as a mixed number in its simplest form.

$2\frac{1}{4} = \frac{8}{4} + \frac{1}{4} = \frac{9}{4}$ $3\frac{1}{3} = \frac{9}{3} + \frac{1}{3} = \frac{10}{3}$

$$\frac{9}{4} \times \frac{10}{3} = \frac{90}{12} \overset{\div 2}{=} \frac{45}{6} \overset{\div 3}{=} \frac{15}{2} = 7\frac{1}{2}$$

turn into a mixed fraction

$7\frac{1}{2}$

**(3)**

(b) Write the numbers 3, 4, 5 and 6 in the boxes to give the greatest possible total.
You may write each number only once.

$$\boxed{6}\frac{1}{\boxed{4}} + \boxed{5}\frac{2}{\boxed{3}}$$

make the fractions 1/4 and 2/3 for maximum value

use the largest numbers as whole numbers to give the largest value

**(1)**

**(Total for Question 6 is 4 marks)**

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**7** A shop has a sale.

| Microwave ovens | Combination ovens |
|---|---|
| $\frac{1}{3}$ off normal price | 40% off normal price |

A microwave oven has a sale price of £90
A combination oven has a sale price of £84

Which of these ovens has the greater normal price?
You must show all your working.

Microwave [1/3 off, so 2/3 remaining]

$\div 2$ £90 is 2/3 of normal price
£45 is 1/3 $\div 2$
$\times 3$ £135 is 3/3 $\times 3$

£140 > £135, so the combination oven has the greater normal price.

Combination oven [40% off, so 60% left]

$\div 6$ 60% = £84 $\div 6$
$\times 10$ 10% = £14 $\times 10$
100% = £140

**(Total for Question 7 is 4 marks)**

**8** Work out an estimate for $\sqrt{4.98 + 2.16 \times 7.35}$

4.98 ≃ 5
2.16 ≃ 2
7.35 ≃ 7
round to 1 sig. fig

BIDMAS

$\sqrt{5 + (2 \times 7)} = \sqrt{19}$

4 x 4 = 16 < 19

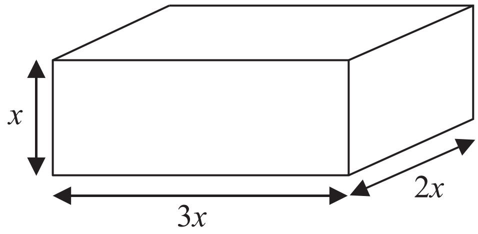
4.5 x 4.5 = 20.25 > 19

so answer lies between 4 and 4.5.

4.5
x 4.5
0.25
2.00
2.00
16.00
20.25

**(Total for Question 8 is 3 marks)**

**9** Here is a cuboid.




All measurements are in centimetres.
$x$ is an integer.
The total volume of the cuboid is less than 900 cm$^3$

Show that $x \leqslant 5$

volume = $x \times 3x \times 2x = 6x^3$

$6x^3 < 900$ $\div 6$
$x^3 < 150$ $\div 6$

$5^3 = 5 \times 5 \times 5 = 125 < 150$ $x$ is an integer, so
$6^3 = 6 \times 6 \times 6 = 216 > 150$ it must be equal to or less than 5 $\therefore x \leq 5$

**(Total for Question 9 is 3 marks)**

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**10** $y$ is inversely proportional to $x$
When $x = 1.5$, $y = 36$

Find the value of $y$ when $x = 6$

$y \propto \frac{1}{x}$ so $y = \frac{k}{x}$

$x = 1.5, y = 36 \xRightarrow{\text{sub in}} 36 = \frac{k}{1.5}$ $\times 1.5$

$k = 54$

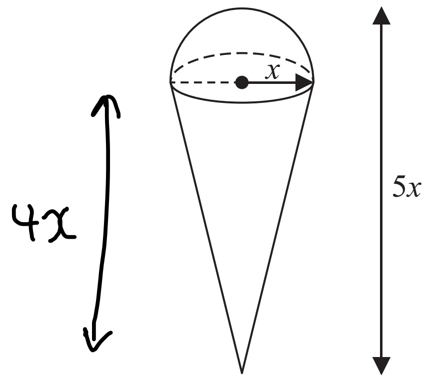
$y = \frac{54}{x}$ sub $x = 6$

$y = \frac{54}{6} = 9$

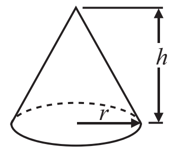
9

**(Total for Question 10 is 3 marks)**

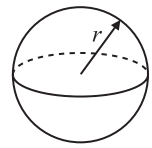
**11** A solid is made by putting a hemisphere on top of a cone.



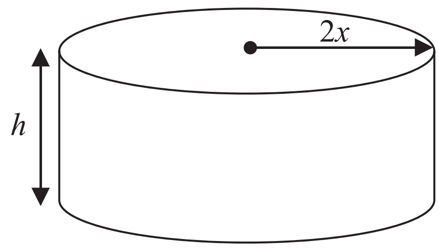

**Volume of cone** $= \frac{1}{3}\pi r^2 h$




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




The total height of the solid is $5x$
The radius of the base of the cone is $x$
The radius of the hemisphere is $x$




A cylinder has the same volume as the solid.
The cylinder has radius $2x$ and height $h$
All measurements are in centimetres.

Find a formula for $h$ in terms of $x$
Give your answer in its simplest form.

volume of hemisphere:
$\frac{1}{2} \times \frac{4}{3} \times \pi \times x^3 = \frac{2}{3}\pi x^3$
(half as it is a hemisphere)

volume of cone:
$\frac{1}{3} \times \pi \times x^2 \times 4x = \frac{4}{3}\pi x^3$

total volume of solid:
$\frac{2}{3}\pi x^3 + \frac{4}{3}\pi x^3 = 2\pi x^3$

volume of cylinder:
area of base x height
$= \pi \times (2x)^2 \times h = 4\pi x^2 h$

$4\cancel{\pi} x^2 h = 2\cancel{\pi} x^3$

$\div 2$ $\quad 2x^2 h = x^3 \quad \div 2$

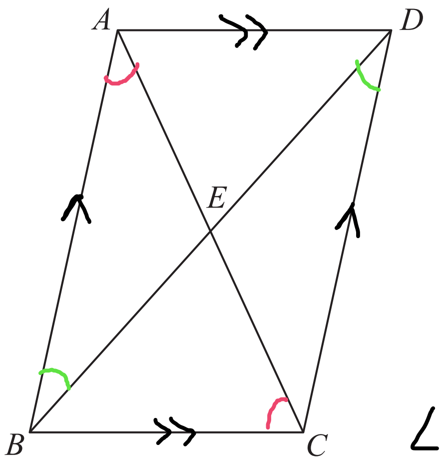
$\div x^2$ $\quad 2h = x \quad \div x^2$

$\div 2$ $\quad h = \frac{x}{2} \quad \div 2$

$h = \frac{x}{2}$

**(Total for Question 11 is 5 marks)**

**12** *ABCD* is a parallelogram.




$\angle BAE = \angle DCE$

and $\angle ABE = \angle CDE$

as alternate angles are equal

*E* is the point where the diagonals *AC* and *BD* meet.

Prove that triangle *ABE* is congruent to triangle *CDE*.

$AB = CD$, because opposite sides of a parallelogram are equal in length

hence $\triangle ABE$ is congruent to $\triangle CDE$, as they have 2 angles the same and one side the same $\rightarrow$ ASA condition met

**(Total for Question 12 is 3 marks)**

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**13** Mr Brown gives his class a test.
The 10 girls in the class get a mean mark of 70%
The 15 boys in the class get a mean mark of 80%

Nick says that because the mean of 70 and 80 is 75 then the mean mark for the whole class in the test is 75%

Nick is not correct.
Is the correct mean mark less than or greater than 75%?
You must justify your answer.

total mark for girls : $10 \times 70\% = 700\%$

total mark for boys : $15 \times 80\% = 1200\%$

total mark for all students : $1900\%$

$10 + 15 = 25$, total students

mean for class $= \dfrac{1900\%}{25}$

$= 76\%$

$76\% > 75\%$

, so the mean mark is greater

**(Total for Question 13 is 2 marks)**

**14** Show that $\dfrac{(4-\sqrt{3})(4+\sqrt{3})}{\sqrt{13}}$ simplifies to $\sqrt{13}$

expand brackets

$(4-\sqrt{3})(4+\sqrt{3}) = 16 + 4\sqrt{3} - 4\sqrt{3} - 3$
$= 16 - 3 = 13$

$\dfrac{(4-\sqrt{3})(4+\sqrt{3})}{\sqrt{13}} = \dfrac{13}{\sqrt{13}} \times \dfrac{\sqrt{13}}{\sqrt{13}} = \dfrac{\cancel{13}\sqrt{13}}{\cancel{13}} = \sqrt{13}$

rationalise the denominator!

**(Total for Question 14 is 2 marks)**

$\sqrt[3]{a} = a^{1/3}$

**15** (a) Find the value of $\sqrt[3]{8 \times 10^6}$

$= \sqrt[3]{8} \times \sqrt[3]{10^6}$

$= 2 \times 10^2$ $\quad (10^6)^{1/3} = 10^2$

$= 200$

2

**(1)**

(b) Find the value of $144^{\frac{1}{2}} \times 64^{-\frac{1}{3}}$

$= \sqrt{144} \times \dfrac{1}{\sqrt[3]{64}}$ $\quad 4 \times 4 \times 4 = 64$

$= 12 \times \dfrac{1}{4}$

$= \dfrac{12}{4} = 3$

3

**(2)**

(c) Solve $3^{2x} = \dfrac{1}{81}$

$\dfrac{1}{81} = \dfrac{1}{9 \times 9} = \dfrac{1}{3^2 \times 3^2} = \dfrac{1}{3^4}$

so $\dfrac{1}{81} = 3^{-4} = 3^{2x}$ $\quad -4 = 2x$

$\div 2 \quad x = \dfrac{-4}{2} \quad \div 2$

$x = -2$

$x =$ −2

**(2)**

**(Total for Question 15 is 5 marks)**

**16** The probability that Sanay is late for school tomorrow is 0.05
The probability that Jaden is late for school tomorrow is 0.15

Alfie says that the probability that Sanay and Jaden will both be late for school tomorrow is 0.0075 because $0.05 \times 0.15 = 0.0075$

What assumption has Alfie made?

the events are independent

when events A and B are independent:

$P(A \cap B) = P(A) \times P(B)$

**(Total for Question 16 is 1 mark)**

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**17** Solve $x^2 - 6x - 8 = 0$

Write your answer in the form $a \pm \sqrt{b}$ where $a$ and $b$ are integers.

quadratic formula → $x = \frac{-b \pm \sqrt{b^2-4ac}}{2a}$

$$x = \frac{6 \pm \sqrt{(-6)^2 - 4(1\times -8)}}{2\times 1} = \frac{6 \pm \sqrt{36+32}}{2} = \frac{6 \pm \sqrt{68}}{2}$$

$$\sqrt{68} = \sqrt{4\times 17} = \sqrt{4}\times\sqrt{17} = 2\sqrt{17}$$

$$x = \frac{6 \pm 2\sqrt{17}}{2} = 3 \pm \sqrt{17}$$

$3 \pm \sqrt{17}$

**(Total for Question 17 is 3 marks)**

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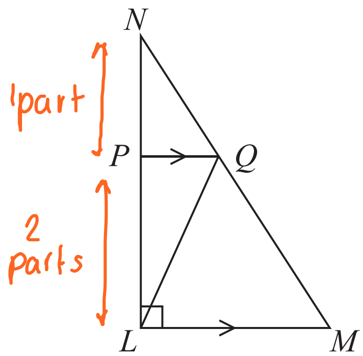
**18** LMN is a right-angled triangle.




Angle $NLM = 90°$
$PQ$ is parallel to $LM$.

The area of triangle $PNQ$ is 8 cm²
The area of triangle $LPQ$ is 16 cm²

Work out the area of triangle $LQM$.

$\frac{16}{8} = 2$

as the base, PQ, of the triangles PNQ and LPQ is the same, the height of ΔPQ is 2x that of PNQ.

PL = 2PN

so, LN = 3PN

length scale factor = 3

area scale factor = $3^2 = 9$

area of LMN is 9x area of PNQ.

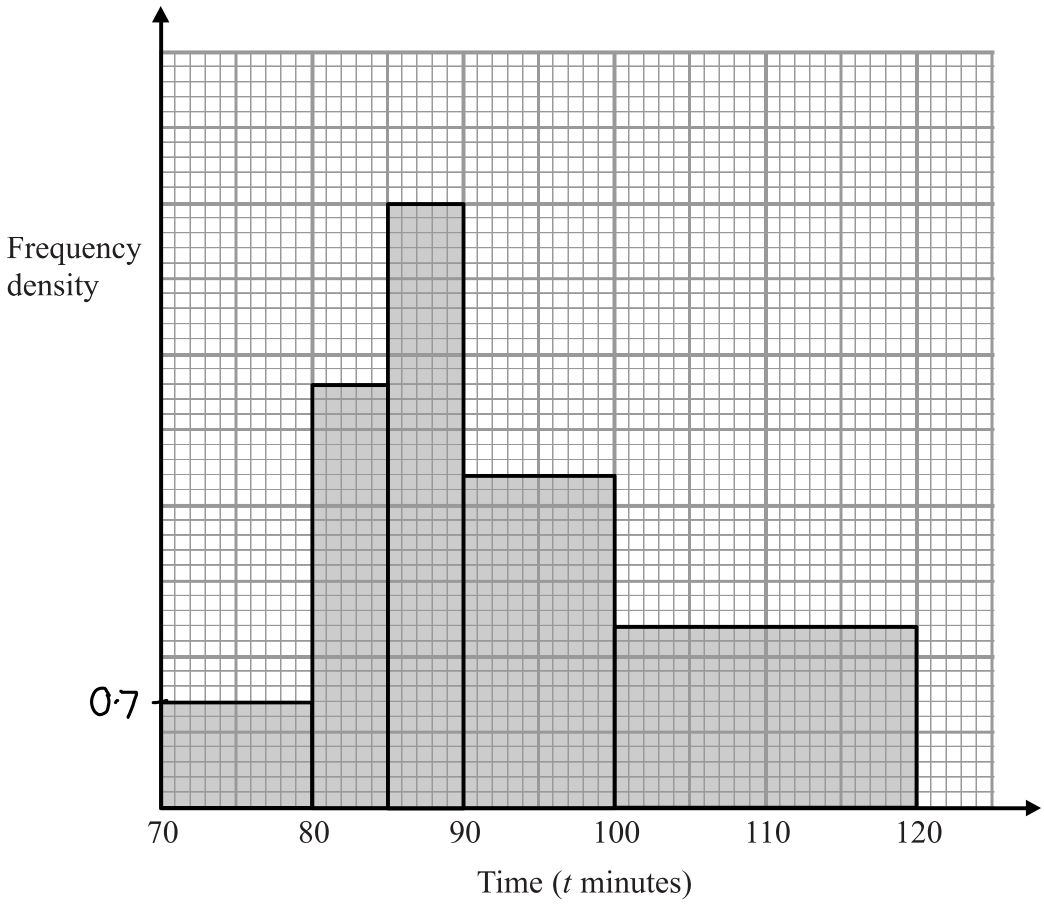
$8 \times 9 = 72\text{cm}^2$

area of LQM: $72 - 16 - 8 = 48\text{cm}^2$

48 cm²

**(Total for Question 18 is 4 marks)**

**19** The histogram shows information about the time taken by cyclists to finish a cycle race.




7 cyclists took 80 minutes or less to finish the race.

$f \cdot d = \frac{f}{c \cdot w}$

(i) Work out an estimate for the number of cyclists who took more than 105 minutes to finish the race.

first bar: frequency density $= \frac{7}{10} = 0.7$ so, height of 1 small square $= 0.1$

100-120 bar: height $= 1.2$

frequency $= 1.2 \times 20 = 24$

24

(ii) Explain why your answer to part (i) is only an estimate.

the data is in groups, so the individual data points are unknown.

**(Total for Question 19 is 4 marks)**

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**20** Show that $\dfrac{3x+6}{x^2-3x-10} \div \dfrac{x+5}{x^3-25x}$ simplifies to $ax$ where a is an integer.

factorise each expression if possible:

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

$x^2-3x-10 = (x+2)(x-5)$

difference of two squares

$x^3-25x = x(x^2-25) = x(x+5)(x-5)$

$$\frac{3(x+2)}{(x+2)(x-5)} \div \frac{x+5}{x(x+5)(x-5)} = \frac{3(x+2)}{(x+2)(x-5)} \times \frac{x(x+5)(x-5)}{x+5}$$

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

cancel terms on top and bottom

$$= 3x$$

**(Total for Question 20 is 4 marks)**

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**21** Solve the inequality $x^2 > 3(x+6)$

expand

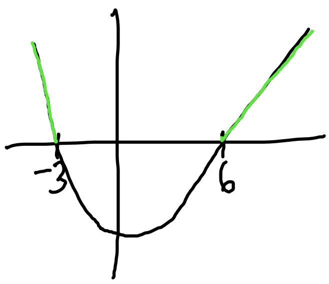
$x^2 > 3x+18$

$-3x-18$ $\qquad$ $-3x-18$

$x^2-3x-18 > 0$

factorise

$(x+3)(x-6)\ \boxed{>0}$




for graph to be greater than 0 (above x axis)

$x < -3\ ,\ x > 6$

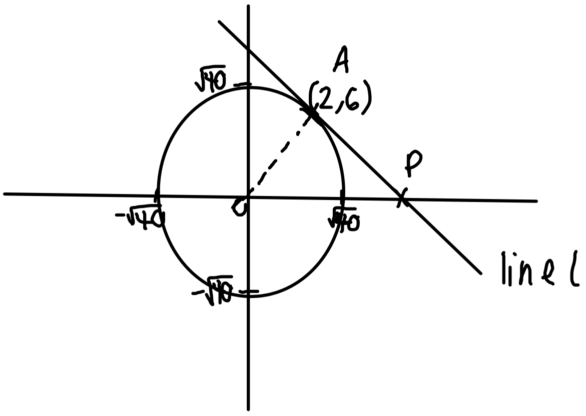
$x < -3\ ,\ x > 6$ ....................................

**(Total for Question 21 is 4 marks)**

**22** The line $l$ is a tangent to the circle $x^2 + y^2 = 40$ at the point $A$.
$A$ is the point (2, 6).

The line $l$ crosses the $x$-axis at the point $P$.

Work out the area of triangle $OAP$.




gradient OA : $\frac{6-0}{2-0} = 3$ OA and AP are perpendicular, so gradients are -ve reciprocals

gradient of AP $= -\frac{1}{3}$

equation of tangent : $y = mx + c$

$y = 6$ $\quad m = -\frac{1}{3}$ $\quad x = 2$

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

$6 = -\frac{2}{3} + c$ ) $+\frac{2}{3}$

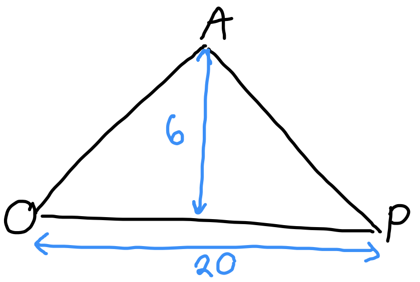
$\frac{20}{3} = c$

$y = -\frac{1}{3}x + \frac{20}{3}$

at P, $y = 0 \Rightarrow 0 = -\frac{1}{3}x + \frac{20}{3}$

$\frac{1}{3}x = \frac{20}{3}$

$x = 20$ P is (20, 0)




area of triangle = ½ x base x perpendicular height

area = ½ x 6 x 20

= 60

60

**(Total for Question 22 is 5 marks)**

**TOTAL FOR PAPER IS 80 MARKS**

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