

Please check the examination details below before entering your candidate information

Candidate surname		Other names	
Centre Number		Candidate Number	
<div>Pearson Edexcel</div> <div>Level 1/Level 2 GCSE (9–1)</div>		<div> <div></div><div></div><div></div><div></div><div></div> </div> <div> <div></div><div></div><div></div><div></div><div></div> </div>	
<div>Tuesday 6 November 2018</div>			
Morning (Time: 1 hour 30 minutes)		Paper Reference 1MA1/1H	
<div> <div>Mathematics</div> <div>Paper 1 (Non-Calculator)</div> <div>Higher Tier</div> </div> <div>Solutions</div>			
You must have: Ruler graduated in centimetres and millimetres, protractor, pair of compasses, pen, HB pencil, eraser. Tracing paper may be used.			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.*
- You must **show all your working**.
- Diagrams are **NOT** accurately drawn, unless otherwise indicated.
- **Calculators may not be used.**



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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Answer ALL questions.

Write your answers in the spaces provided.

You must write down all the stages in your working.

1 Work out the value of $\frac{3^7 \times 3^{-2}}{3^3} = \frac{3^5}{3^3} = 3^2 = 9$

9

(Total for Question 1 is 2 marks)

2 $v^2 = u^2 + 2as$

$u = 12 \quad a = -3 \quad s = 18$

(a) Work out a value of v .

$$v^2 = 12^2 + 2(-3) \times 18$$

$$v^2 = 144 - 108$$

$$v^2 = 36$$

$$v = \pm\sqrt{36}$$

$$v = \pm 6$$

± 6

(2)

(b) Make s the subject of $v^2 = u^2 + 2as$

$$v^2 - u^2 = 2as$$

$$\frac{v^2 - u^2}{2a} = s$$

$$s = \frac{v^2 - u^2}{2a}$$

(2)

(Total for Question 2 is 4 marks)



- 3 A bonus of £2100 is shared by 10 people who work for a company.
40% of the bonus is shared equally between 3 managers.
The rest of the bonus is shared equally between 7 salesmen.

One of the salesmen says,

“If the bonus is shared equally between all 10 people I will get 25% more money.”

Is the salesman correct?

You must show how you get your answer.

Salesmen share 60% of £2100

$$10\% \text{ of } £2100 = £210$$

$$60\% \text{ of } £2100 = £1260$$

$$\text{Each salesman receives } \frac{1260}{7} = £180$$

If bonus shared equally

each salesman would receive 10% of £2100 = £210

$$£180 \text{ increased by } 25\% = £180 + £45 \\ = £225$$

Salesman is not correct

$$£225 \neq £210$$

(Total for Question 3 is 5 marks)



4 It would take 120 minutes to fill a swimming pool using water from 5 taps.

(a) How many minutes will it take to fill the pool if only 3 of the taps are used?

$$\begin{array}{lcl} 1 \text{ Tap} & 120 \times 5 & = 600 \text{ min} \\ 3 \text{ Taps} & 600 \div 3 & = 200 \text{ min} \end{array}$$

200 minutes
(2)

(b) State one assumption you made in working out your answer to part (a).

All taps deliver water at same rate

(1)

(Total for Question 4 is 3 marks)

5 A plane travels at a speed of 213 miles per hour.

(a) Work out an estimate for the number of seconds the plane takes to travel 1 mile.

$$60 \times 60 = 3600 \text{ seconds for 213 miles}$$

$$\frac{3600}{213} \text{ seconds for 1 mile}$$

$$\approx \frac{3600}{200} = 18 \text{ seconds}$$

18 seconds
(3)

(b) Is your answer to part (a) an underestimate or an overestimate?
Give a reason for your answer.

Overestimate as I made denominator smaller

(1)

(Total for Question 5 is 4 marks)



6 Solve the simultaneous equations

$$\begin{aligned} 5x + y &= 21 & \textcircled{1} \\ x - 3y &= 9 & \textcircled{2} \end{aligned}$$

$$\textcircled{1} \times 3$$

$$15x + 3y = 63 \quad \textcircled{3}$$

$$\textcircled{2} + \textcircled{3}$$

$$16x = 72$$

$$x = \frac{72}{16} = \frac{9}{2} = 4.5$$

Sub in $\textcircled{1}$

$$5(4.5) + y = 21$$

$$22.5 + y = 21$$

$$y = 21 - 22.5$$

$$y = -1.5$$

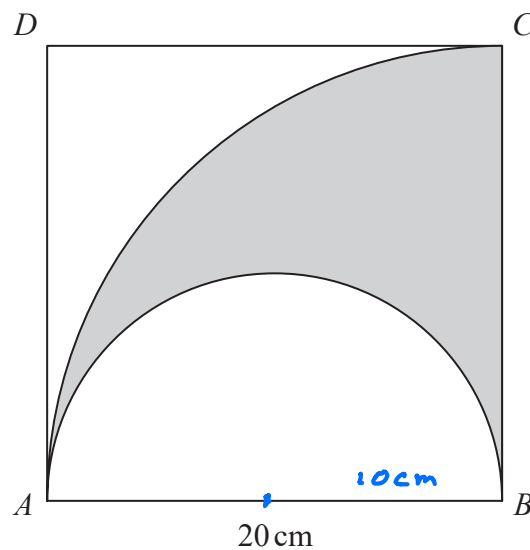
$$x = 4.5$$

$$y = -1.5$$

(Total for Question 6 is 3 marks)



- 7 The diagram shows a square $ABCD$ with sides of length 20 cm. It also shows a semicircle and an arc of a circle.



AB is the diameter of the semicircle.
 AC is an arc of a circle with centre B .

Show that $\frac{\text{area of shaded region}}{\text{area of square}} = \frac{\pi}{8}$

$$\begin{aligned}
 \text{Shaded Region} &= \frac{\pi \times 20^2}{4} - \frac{\pi \times 10^2}{2} \\
 &= \frac{400\pi}{4} - \frac{100\pi}{2} \\
 &= 100\pi - 50\pi \\
 &= 50\pi
 \end{aligned}$$

$$\text{Area of Square} = 20 \times 20 = 400$$

$$\frac{\text{area of shaded region}}{\text{area of square}} = \frac{50\pi}{400} = \frac{\pi}{8}$$

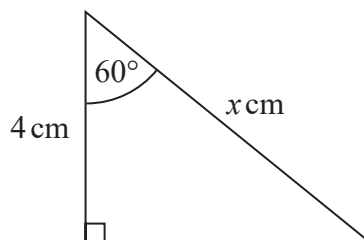
(Total for Question 7 is 4 marks)



- 8 (a) Write down the exact value of $\tan 45^\circ$

1
.....
(1)

Here is a right-angled triangle.



$$\cos 60^\circ = 0.5$$

- (b) Work out the value of x .

$$\cos 60^\circ = \frac{4}{x}$$

$$x \cos 60^\circ = 4$$

$$x = \frac{4}{\cos 60^\circ} = \frac{4}{\frac{1}{2}} = 8 \text{ cm}$$

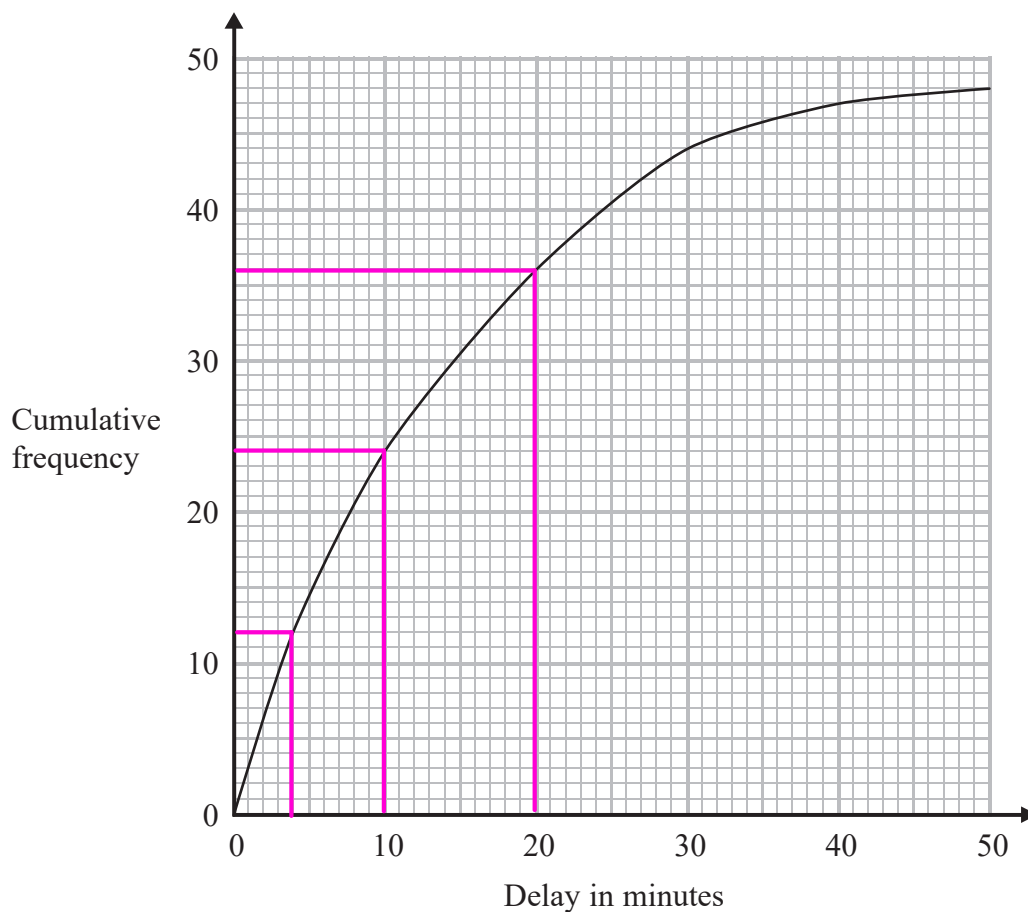
8 cm
.....
(2)

(Total for Question 8 is 3 marks)



- 9 The times that 48 trains left a station on Monday were recorded.

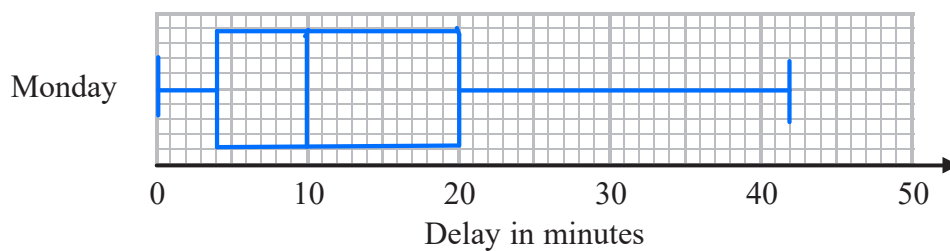
The cumulative frequency graph gives information about the numbers of minutes the trains were delayed, correct to the nearest minute.



The shortest delay was 0 minutes.

The longest delay was 42 minutes.

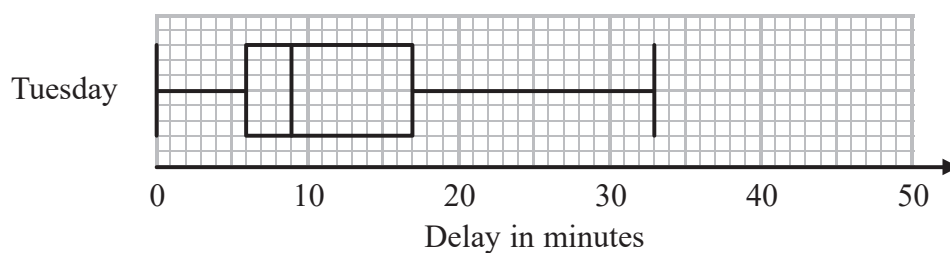
- (a) On the grid below, draw a box plot for the information about the delays on Monday.



(3)

48 trains left the station on Tuesday.

The box plot below gives information about the delays on Tuesday.



- (b) Compare the distribution of the delays on Monday with the distribution of the delays on Tuesday.

On average delays on Monday were slightly longer than on Tuesday
- a median value of 10 minutes compared with 9 minutes late
Delays were more varied on Monday than on Tuesday
~ IQR of 16 mins compared with 11 minutes

(2)

Mary says,

"The longest delay on Tuesday was 33 minutes.

This means that there must be some delays of between 25 minutes and 30 minutes."

- (c) Is Mary right?

You must give a reason for your answer.

No, the rest of the delays in the upper quartile
could possibly be all between 17 and 25 minutes
or 30 and 33 minutes

(1)

(Total for Question 9 is 6 marks)

10 (a) Simplify $\frac{x-1}{5(x-1)^2} = \frac{(x-1)}{5(x-1)^2} = \frac{1}{5(x-1)}$

$$\frac{1}{5(x-1)}$$

(1)

- (b) Factorise fully $50 - 2y^2$

$$= 2(25 - y^2)$$
$$= 2(5+y)(5-y)$$

$$2(5+y)(5-y)$$

(2)

(Total for Question 10 is 3 marks)



- 11 Jack and Sadia work for a company that sells boxes of breakfast cereal.

The company wants to have a special offer.

Here is Jack's idea for the special offer.

Put 25% more cereal into each box and do **not** change the price.

Here is Sadia's idea.

Reduce the price and do **not** change the amount of cereal in each box.

Sadia wants her idea to give the same value for money as Jack's idea.

By what percentage does she need to reduce the price?

Suppose original price = x pence per 100g

Jack's idea gives x pence per 125g

$$= \frac{x}{125} \text{ pence per 1g}$$

$$= \frac{100x}{125} \text{ pence per 100g}$$

$$= \frac{4x}{5} \text{ pence per 100g}$$

Sadia needs to cut price to $\frac{4x}{5}$ per 100g

$$= 0.8x \text{ per 100g}$$

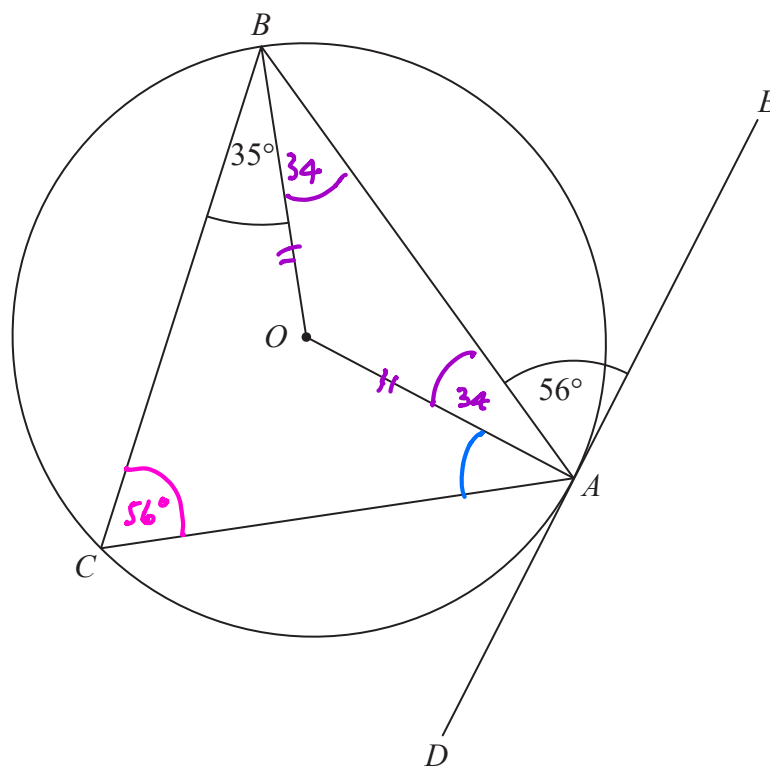
so reduce by 20%

20

%

(Total for Question 11 is 3 marks)





A , B and C are points on the circumference of a circle, centre O .

DAE is the tangent to the circle at A .

Angle $BAE = 56^\circ$

Angle $CBO = 35^\circ$

Work out the size of angle CAO .

You must show all your working.

$$\angle ACB = 56^\circ \text{ (alt seg theorem)}$$

$$\angle OAB = 34^\circ \text{ (tangent-radius } 90^\circ)$$

$$\angle OBA = 34^\circ \text{ (base } \angle \text{s isos } \triangle)$$

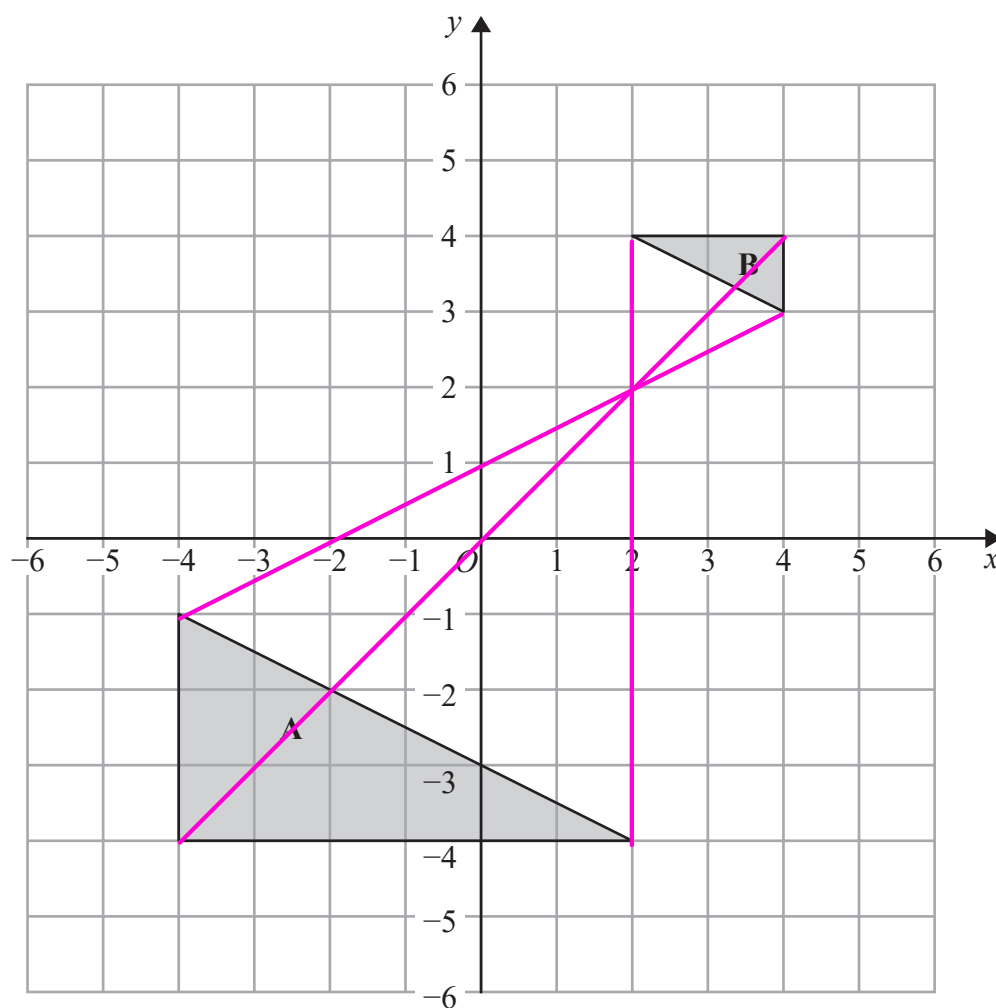
$$\begin{aligned} \angle CAO &= 180 - (56 + 35 + 34 + 34) \text{ (}\angle \text{ sum of } \triangle ABC) \\ &= 180 - 159 \end{aligned}$$

$$\angle CAO = 21^\circ$$

21

(Total for Question 12 is 3 marks)





Describe fully the single transformation that maps triangle A onto triangle B.

Enlargement by scale factor $-\frac{1}{3}$ about $(2, 2)$

(Total for Question 13 is 2 marks)



14 (a) Work out the value of $\left(\frac{16}{81}\right)^{\frac{3}{4}} = \left(\sqrt[4]{\frac{16}{81}}\right)^3 = \left(\frac{2}{3}\right)^3 = \frac{8}{27}$

$$\frac{8}{27}$$

(2)

$$3^a = \frac{1}{9} \quad 3^b = 9\sqrt{3} \quad 3^c = \frac{1}{\sqrt{3}}$$

(b) Work out the value of $a + b + c$

$$3^{-2} = \frac{1}{9}$$

$$\begin{aligned} 3^b &= 9\sqrt{3} \\ &= 3^2 \times 3^{\frac{1}{2}} \\ &= 3^{5/2} \end{aligned}$$

$$\begin{aligned} 3^c &= \frac{1}{\sqrt{3}} \\ 3^c &= 3^{-\frac{1}{2}} \end{aligned}$$

$$\begin{aligned} a + b + c &= -2 + \frac{5}{2} + \left(-\frac{1}{2}\right) \\ &= 0 \end{aligned}$$

$$0$$

(2)

(Total for Question 14 is 4 marks)



15 Three solid shapes A, B and C are similar.

The surface area of shape A is 4 cm^2

The surface area of shape B is 25 cm^2

The ratio of the volume of shape B to the volume of shape C is 27:64

Work out the ratio of the height of shape A to the height of shape C.

Give your answer in its simplest form.

$$\begin{array}{l|l}
 \text{Height A : Height B} & \text{Height A : Height B : Height C} \\
 = \sqrt{4} : \sqrt{25} & = 2 : 5 : 4 \\
 = 2 : 5 & \\
 \\
 \text{Height B : Height C} & 6 : 15 : 20 \\
 = \sqrt[3]{27} : \sqrt[3]{64} & \text{Height A : Height B} \\
 = 3 : 4 & = 6 : 20 \\
 & = 3 : 10
 \end{array}$$

(Total for Question 15 is 4 marks)

16 Prove algebraically that $0.2\dot{5}\dot{6}$ can be written as $\frac{127}{495}$

$$\text{Let } x = 0.2565656\dots$$

$$\textcircled{1} \quad 10x = 2.565656\dots$$

$$\textcircled{2} \quad 1000x = 256.565656\dots$$

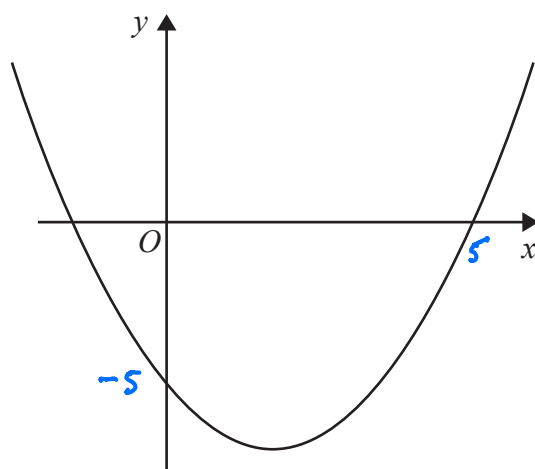
$$\textcircled{2} - \textcircled{1} \quad 990x = 254$$

$$x = \frac{254}{990} = \frac{127}{495}$$

(Total for Question 16 is 3 marks)



17 Here is a sketch of a curve.



The equation of the curve is $y = x^2 + ax + b$ where a and b are integers.

The points $(0, -5)$ and $(5, 0)$ lie on the curve.

Find the coordinates of the turning point of the curve.

$$y = x^2 + ax + b$$

$$\begin{cases} x=0 \\ y=-5 \end{cases} \quad -5 = 0 + 0 + b$$

$$\underline{b = -5}$$

$$\begin{cases} x=5 \\ y=0 \end{cases} \quad \begin{aligned} 0 &= 5^2 + 5a - 5 \\ 0 &= 25 + 5a - 5 \\ 0 &= 20 + 5a \\ -20 &= 5a \\ \frac{-20}{5} &= a \\ \underline{a} &= \underline{-4} \end{aligned}$$

$$y = x^2 - 4x - 5$$

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

$$y = (x-2)^2 - 9$$

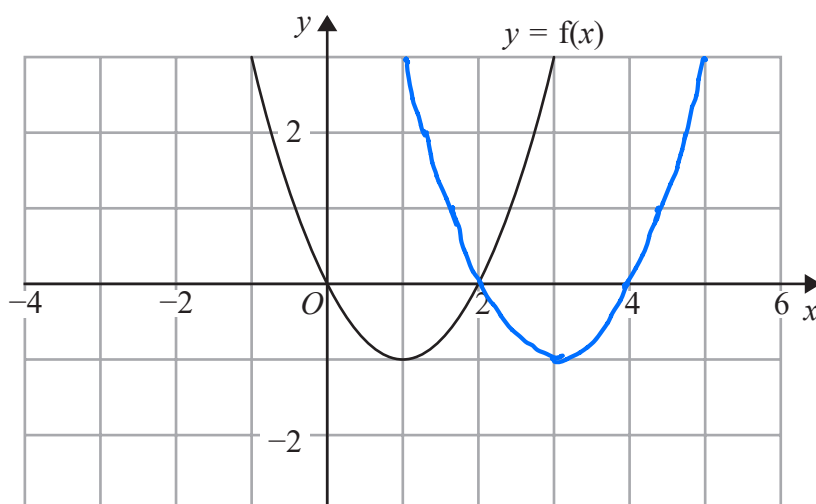
minimum point = $(2, -9)$
(turning point)

(2 , -9)

(Total for Question 17 is 4 marks)

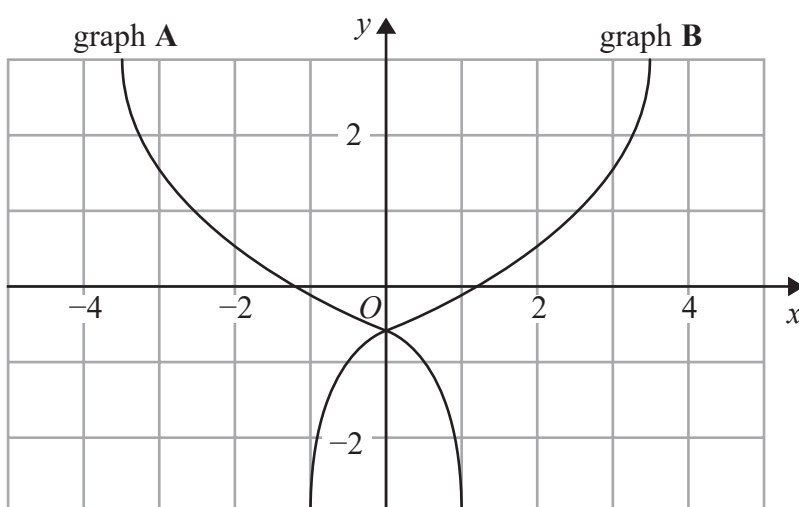


18 The graph of $y = f(x)$ is shown on the grid below.



(a) On the grid above, sketch the graph of $y = f(x - 2)$

(1)



On the grid, graph A has been reflected to give graph B.

The equation of graph A is $y = g(x)$

(b) Write down the equation of graph B.

$$y = g(-x)$$

(1)

(Total for Question 18 is 2 marks)



19 For all values of x

$$f(x) = (x + 1)^2 \quad \text{and} \quad g(x) = 2(x - 1)$$

(a) Show that $gf(x) = 2x(x + 2)$

$$\begin{aligned} gf(x) &= g(x+1)^2 \\ &= 2((x+1)^2 - 1) \\ &= 2(x^2 + 2x + 1 - 1) \\ &= 2(x^2 + 2x) \\ &= 2x(x + 2) \end{aligned}$$

(b) Find $g^{-1}(7)$

$$g(x) = 7$$

$$2(x - 1) = 7$$

$$(x - 1) = \frac{7}{2}$$

$$x = \frac{7}{2} + 1$$

$$x = \frac{9}{2}$$

$$g^{-1}(7) = \frac{9}{2}$$

(2)

$$y = 2(x - 1)$$

$$x = \frac{y + 1}{2}$$

swap

$$\frac{x}{2} = y - 1$$

$$\frac{x}{2} + 1 = y$$

$$g^{-1}(x) = \frac{x}{2} + 1$$

$$g^{-1}(7) = \frac{7}{2} + 1$$

$$= \frac{9}{2}$$

$$\frac{9}{2}$$

(2)

(Total for Question 19 is 4 marks)



20 Show that $\frac{(\sqrt{18} + \sqrt{2})^2}{\sqrt{8} - 2}$ can be written in the form $a(b + \sqrt{2})$ where a and b are integers.

$$= \frac{\sqrt{18}^2 + 2\sqrt{18}\sqrt{2} + \sqrt{2}^2}{\sqrt{8} - 2}$$

$$= \frac{18 + 2\sqrt{36} + 2}{\sqrt{8} - 2}$$

$$= \frac{20 + 12}{\sqrt{8} - 2}$$

$$= \frac{32}{\sqrt{8} - 2} \times \frac{(\sqrt{8} + 2)}{(\sqrt{8} + 2)}$$

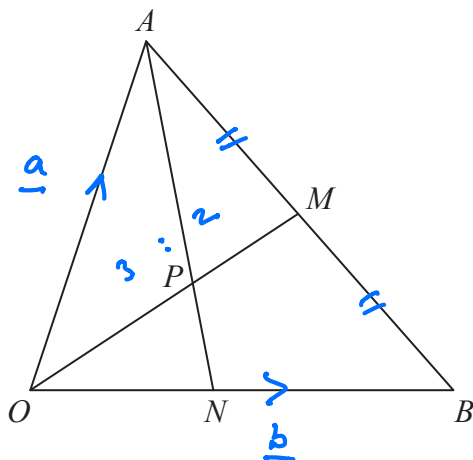
$$= \frac{32\sqrt{8} + 64}{\sqrt{8}^2 - 2^2}$$

$$= \frac{32 \times 2\sqrt{2} + 64}{8 - 4}$$

$$= \frac{64\sqrt{2} + 64}{4} = \frac{64(\sqrt{2} + 1)}{4} = 16(\sqrt{2} + 1)$$

(Total for Question 20 is 3 marks)





OAB is a triangle.
 OPM and APN are straight lines.
 M is the midpoint of AB .

$$\vec{OA} = \underline{a} \quad \vec{OB} = \underline{b}$$

$$OP:PM = 3:2$$

Work out the ratio $ON:NB$

$$\vec{AB} = \vec{AO} + \vec{OB}$$

$$\vec{AB} = -\underline{a} + \underline{b}$$

$$\vec{AM} = -\frac{1}{2}\underline{a} + \frac{1}{2}\underline{b}$$

$$\vec{OM} = \vec{OA} + \vec{AM}$$

$$= \underline{a} - \frac{1}{2}\underline{a} + \frac{1}{2}\underline{b}$$

$$= \frac{1}{2}\underline{a} + \frac{1}{2}\underline{b}$$

$$\vec{OP} = \frac{3}{5}\vec{OM}$$

$$\vec{OP} = \frac{3}{10}\underline{a} + \frac{3}{10}\underline{b}$$

$$\vec{AP} = \vec{AO} + \vec{OP}$$

$$= -\underline{a} + \frac{3}{10}\underline{a} + \frac{3}{10}\underline{b}$$

$$\vec{AP} = -\frac{7}{10}\underline{a} + \frac{3}{10}\underline{b}$$

$$\vec{ON} = \vec{OA} + \vec{AN}$$

$$= \underline{a} + k_1\vec{AP} \text{ for some value } k_1$$

$$\text{But } \vec{ON} = k_2\vec{OB} = k_2\underline{b} \text{ for some value } k_2$$

$$\Rightarrow \underline{a} + k_1\left(-\frac{7}{10}\underline{a} + \frac{3}{10}\underline{b}\right) = k_2\underline{b}$$

$$\Rightarrow \underline{a} - k_1\frac{7}{10}\underline{a} + \frac{3}{10}k_1\underline{b} = k_2\underline{b}$$

$$\Rightarrow k_1 = \frac{10}{7} \text{ since we require } 0\underline{a}$$

$$\therefore \vec{ON} = \underline{a} + \frac{10}{7}\left(-\frac{7}{10}\underline{a} + \frac{3}{10}\underline{b}\right)$$

$$= \frac{10}{7} \times \frac{3}{10} \underline{b}$$

$$= \frac{3}{7}\underline{b}$$

$$\therefore ON:NB = 3:4$$

$$\frac{3}{7}\underline{b} : \frac{4}{7}\underline{b}$$

(Total for Question 21 is 5 marks)



22 There are only green pens and blue pens in a box.

There are three more blue pens than green pens in the box.

There are more than 12 pens in the box.

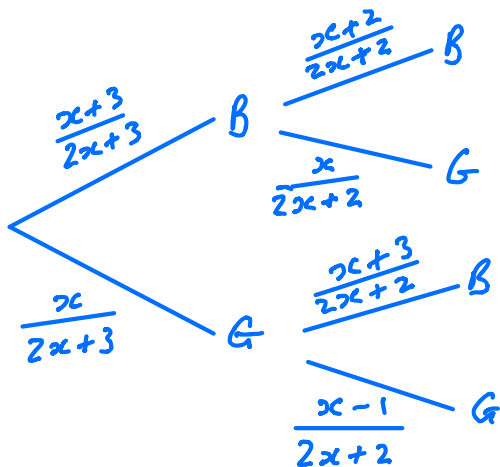
Simon is going to take at random two pens from the box.

The probability that Simon will take two pens of the same colour is $\frac{27}{55}$

Work out the number of green pens in the box.

Say

x green
 $x+3$ blue



$$P(2 \text{ same colour}) = \frac{(x+3)}{2x+3} \times \frac{(x+2)}{2x+2} + \frac{x}{2x+3} \times \frac{x-1}{2x+2} = \frac{27}{55}$$

$$\frac{x^2 + 3x + 2x + 6}{(2x+3)(2x+2)} + \frac{x^2 - x}{(2x+3)(2x+2)} = \frac{27}{55}$$

$$\frac{2x^2 + 4x + 6}{4x^2 + 6x + 4x + 6} = \frac{27}{55}$$

$$\frac{\cancel{2}(x^2 + 2x + 3)}{\cancel{2}(2x^2 + 5x + 3)} = \frac{27}{55}$$

$$55x^2 + 110x + 165 = 54x^2 + 135x + 81$$

$$x^2 - 25x + 84 = 0$$

21

(Total for Question 22 is 6 marks)

$$(x-4)(x-21) = 0$$

$$x = 4 \text{ or } x = 21$$

TOTAL FOR PAPER IS 80 MARKS

$$\text{but } 2x+3 > 12$$

$$\text{so } x \neq 4$$

