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Answer **all** the questions.

1 Factorise fully

(a) $(k+1)^2 - 25k^2$,

(b) $p^2q^2 - 3p^2q - 3pq^2 + pq^3$.

Answer (a) [2]

(b) [2]

2 Simplify

$$\frac{c^2 - 8c + 16}{c^2 - 2c} \times \frac{c - 2}{c - 4}$$

Answer [2]

- 3 One of the solution of $3x^2 + kx - 4 = 0$ is $x = 4$.
Find
(i) the value of k ,
(ii) the other solution of the equation.

Answer (i)..... [1]

(ii)..... [1]

-
- 4 Express as a single fraction in its simplest form.

$$2 - \frac{m-3n}{2n+m}$$

Answer [2]

- 5 (a) Given that $4^{17} \div 16 \times 2^0 = 4^k$, find the value of k .
- (b) Given that $m = 4.15 \times 10^2$ and $n = 2.12 \times 10^{-4}$, evaluate $\frac{3n}{m}$, giving your answer in standard form.

Answer (a) [2]

(b) [1]

- 6 Simplify each the following, expressing your answers in **positive** index form.

(a) $\sqrt{\frac{49b^6}{a^8}} \div \frac{a^{-1}b^6}{2},$

(b) $\frac{x^3y^{-3}}{3z} \times \left(\frac{x}{y}\right)^{-2}$

Answer (a) [2]

(b) [2]

7 (a) Given that p and q are integers where $-1 \leq p \leq 4$ and $0 \leq q \leq 3$, find

- (i) the least possible value of $\frac{2q}{p}$,
- (ii) the largest possible value of $q^2 - p^2$.

Answer (a)(i)[1]

(ii)[1]

(b) Solve the inequality $11 + 2x \leq x + 3 < 20$.

Answer (b).....[2]

- 8 (a) Stephen borrowed a sum of \$1000 from the bank. The bank charges an interest of 24% per annum compounded half yearly. Calculate the amount of money he has to return at the end of 2 years, correct to the nearest cent.

- (b) Given that $m = \sqrt{\frac{30}{n+2}}$, calculate the value of n when $m = 2$.

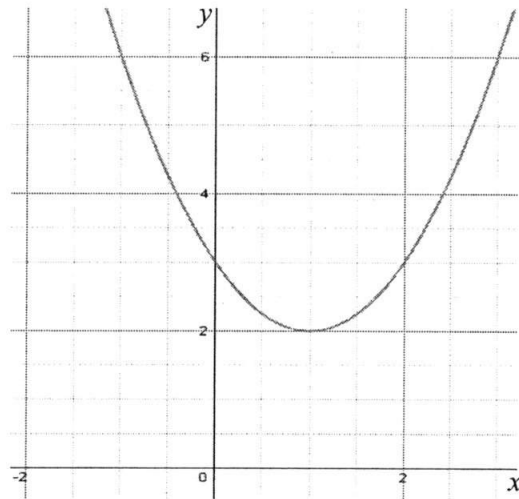
Answer (a) \$..... [2]

(b) [2]

- 9 (a) Solve the equation $\frac{2x}{x+1} = \frac{3}{x-2}$.

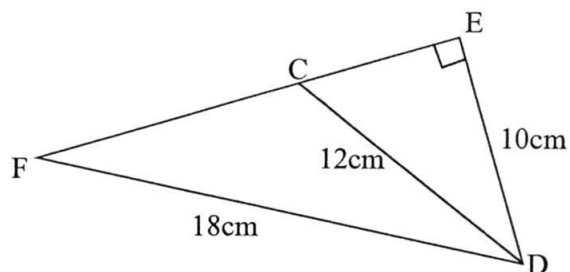
Answer (a) [2]

- (b) A quadratic graph in the form of $y = (x + a)^2 + b$ is shown below. Determine the values of a and b , where a and b are integers.



Answer (b) [2]

- 10 In $\triangle DEF$ shown below, C is a point on EF and $\angle DEF = 90^\circ$. $DE = 10$ cm, $DF = 18$ cm and $CD = 12$ cm.



- (a) Express $\sin \angle DCF$ as a fraction in its simplest form.

Answer (a) [1]

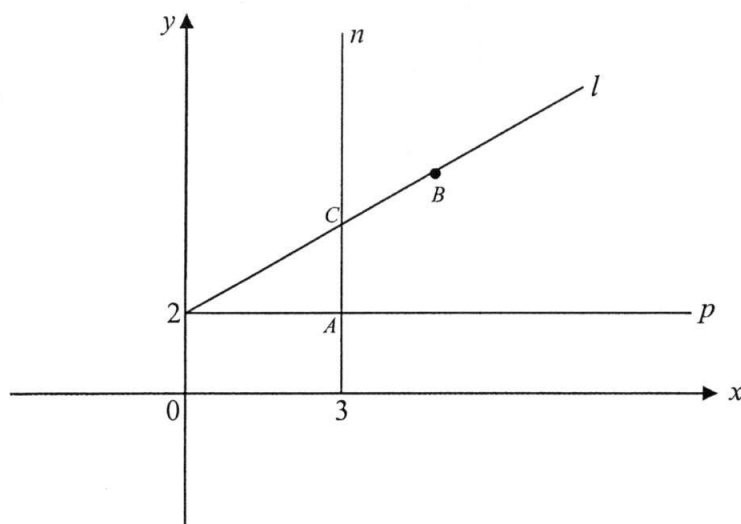
- (b) Calculate $\angle EFD$.

Answer (b) $^\circ$ [2]

- (c) Calculate the length of CF.

Answer (c)cm [2]

11



The diagram above shows three lines n , p and l . The point B has coordinate $(4, 4)$ and C is the point of intersection of lines n and l . Lines p and n intersect at A .

- (a) Write down the equation of lines n and p .

Answer (a)

..... [2]

- (b) Hence determine the coordinates of point A

Answer (b) [1]

- (c) Find the gradient of line l and hence write down the equation of line l .

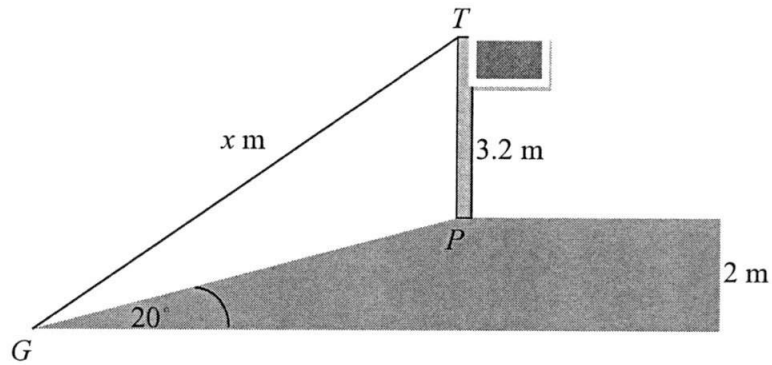
Answer (c) Gradient: [1]

Equation of line l : [1]

- (d) Given that point C has coordinates (x, y) , determine the values of x and y .

Answer (d) [2]

- 12 The diagram below shows a flag pole of 3.2m standing at a point P on the top of a slope which is inclined at 20° to the horizontal ground. The flag pole is 2m above the ground level. A x m taut rope at the top of the flag pole at point T is attached to point G at the end of the slope.



- (a) Find $\angle TPG$.

Answer (a) $^\circ$ [1]

- (b) Find the length of the slope GP .

Answer (b)m [2]

- (c) Find x .

Answer (c)m [3]

- (d) Hence, calculate the angle of elevation from point G to point T.

Answer (d)° [3]

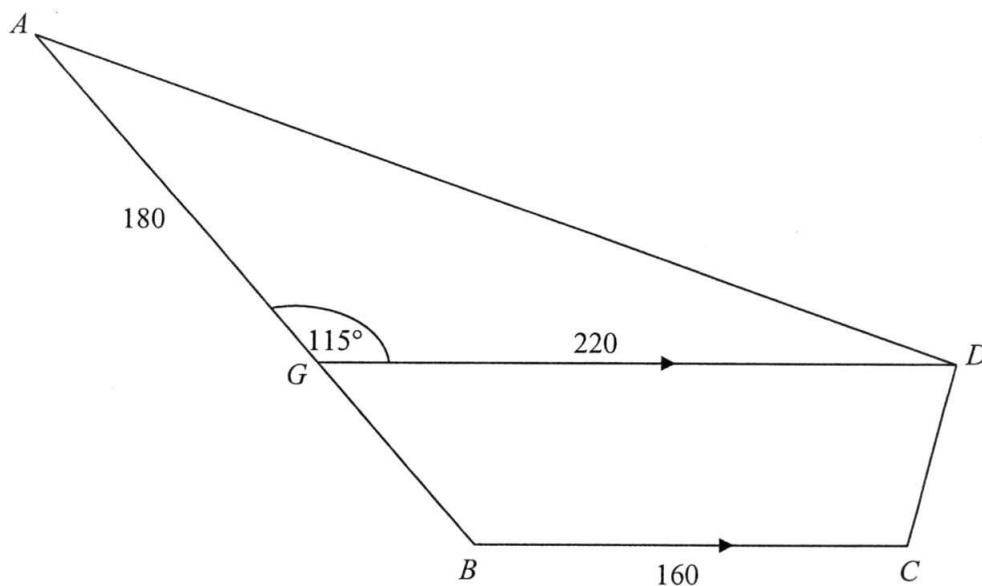
End of paper 1

Answer **all** the questions.

- 1 (a) Factorise completely $ac - 2bc + 5ak - 10bk$. [2]
- (b) Express as a single fraction in its simplest form $\frac{8x+1}{(3x-1)^2} + \frac{2}{(1-3x)}$. [2]
- (c) Given that $\frac{2}{p} = \sqrt{\frac{p-q}{q}}$, express q in terms of p . [3]
- 2 (a) Simplify $\frac{(2a)^3}{b^4} \div \frac{4a^{-2}}{b^2}$, leaving your answer in **positive index**. [2]
- (b) Patrick went to a car showroom to buy a new car. After looking at the cars, he decided to buy a new Toyota Camry. He needs a loan of \$138 000 to buy the car.
Bank A charges an interest rate of 2.25% per annum compounded monthly.
Bank B charges a simple interest rate of 2.35% per annum.
Which bank should he borrow from if he were to take a five year loan?
Justify your answer. You must show all your working clearly. [3]
- (c) Determine if 2^{5000} or 6^{2000} is greater. Explain your answer. [2]
- 3 (a) It is estimated that a female adult human body has 24 trillion red blood cells in 5000 cm^3 of blood.
- (i) Express 24 trillion in standard form. [1]
- (ii) Find the number of red blood cells in 1 cm^3 of blood, giving your answer in standard form. [1]
- (b) The population of Singapore in the year 2015 is approximately 5.54 million. This is a growth of 1.2% from the year 2014, the slowest in more than a decade.
- (i) 5.54 million can be written as $k \times 10^8$.
Find the value of k . [1]
- (ii) Find the estimated population of Singapore in the year 2014, giving your answer as an ordinary number, correct to three significant figures. [1]

- 4 (i) Given that $P(1, 5)$ and $Q(-3, 0)$, find
- (a) the length of the line segment PQ , giving your answer in exact form, [2]
 - (b) the gradient of PQ , [1]
 - (c) the equation of the line which is parallel to PQ and passing through the point $(8, 6)$. [2]
- (ii) If $x = 1$ is the line of symmetry of triangle PQR , state the coordinates of point R . [1]
- (iii) If the coordinate of S is $(7, -2)$ and $PQST$ forms a parallelogram, state the coordinates of the point T . [1]
- 5 (i) Solve the inequality $8\frac{1}{2} - x < 2x + 13 \leq \frac{x + 33}{2}$. [3]
- (ii) Hence, write down the integral values of x that satisfy this inequality. [1]
- 6 Abigail has a budget of \$180 to buy lemon-honey tarts for her friends .
- (a) Given that the price of each lemon-honey tart is \$ x , write down an expression, in terms of x , for the number of lemon-honey tarts she can buy. [1]
 - (b) At the shop, she discovers that the price of each lemon-honey tart has risen by 60 cents. Write down an expression, in terms of x , for the number of lemon-honey tarts she can buy now. [1]
 - (c) Due to the increase in price, Abigail could buy 4 fewer lemon-honey tarts. Write down an equation in x to represent this information, and show that it reduces to $5x^2 + 3x - 135 = 0$. [3]
 - (d) Solve the equation $5x^2 + 3x - 135 = 0$, giving your answers correct to two decimal places. [4]
 - (e) Hence, calculate the number of honey-lemon tarts she could buy before the increase in price. [1]

7



The diagram shows a park $ABCD$ in the shape of a quadrilateral on horizontal ground.

G is a point on AB such that $AG : GB = 3 : 2$ and GD is parallel to BC .

$AG = 180$ m, $GB = 220$ m, $BC = 160$ m and angle $AGD = 115^\circ$.

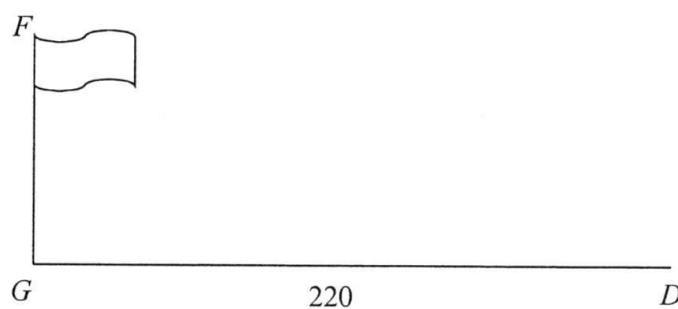
(a) Calculate

(i) AD , [3]

(ii) angle GDA , [2]

(iii) area of the park. [4]

(b) The base of a vertical flagpole, GF , is at vertex G on the park.



Given that the angle of elevation of F from D is 3.5° , find the height of the flagpole.

[2]

End of Paper 2

(Have you checked your work?)

Answer all the questions.

1 Factorise each of the following expressions completely:

(a) $(k+1)^2 - 25k^2$,

(b) $p^2q^2 - 3p^2q - 3pq^2 + pq^3$.

$$\begin{aligned}
 (a) \quad & (k+1)^2 - (5k)^2 \\
 & = (k+1-5k)(k+1+5k) \text{ M1} \\
 & = (1-4k)(1+6k) \text{ A1}
 \end{aligned}$$

OR

$$\begin{aligned}
 & k^2 + 2k + 1 - 25k^2 \\
 & = -24k^2 + 2k + 1 \text{ M1} \\
 & = (-4k+1)(6k+1) \text{ A1}
 \end{aligned}$$

$$\begin{aligned}
 (b) \quad & p^2q(q-3) - pq^2(3-q) \\
 & = p^2q(q-3) + pq^2(q-3) \text{ M1} \\
 & = (p^2q + pq^2)(q-3) \\
 & = pq(p+q)(q-3) \text{ A1}
 \end{aligned}$$

Answer (a) $(1-4k)(1+6k)$ [2]

(b) $pq(p+q)(q-3)$ [2]

2 Simplify

$$\frac{c^2 - 8c + 16}{c^2 - 2c} \times \frac{c-2}{c-4}$$

$$\begin{aligned}
 & \frac{(c-4)^2}{c(c-2)} \times \frac{c-2}{c-4} = \frac{c-4}{c} \text{ A1} \\
 & \text{M1}
 \end{aligned}$$

Answer $\frac{c-4}{c}$ [2]

3 One of the solutions of $3x^2 + kx - 4 = 0$ is $x = 4$.
Find

- (i) the value of k ,
(ii) the other solution of the equation.

$$\begin{aligned} \text{(i)} \quad & 3(4)^2 - 4k - 4 = 0 \\ & 48 - 4k - 4 = 0 \\ & -4k = -44 \\ & k = -11 \quad |B| \end{aligned}$$

$$\begin{aligned} \text{(ii)} \quad & 3x^2 - 11k - 4 = 0 \\ & (3x + 1)(x - 4) = 0 \end{aligned}$$

$$x = 4 \text{ or } x = -\frac{1}{3} \quad |B|$$

Answer (i)..... $k = -11$ [1]

(ii)..... $x = -\frac{1}{3}$ [1]

4 Express as a single fraction in its simplest form.

$$2 - \frac{m-3n}{2n+m},$$

$$\frac{2(2n+m) - m + 3n}{2n+m} \quad |M|$$

$$= \frac{4n + 2m - m + 3n}{2n+m}$$

$$= \frac{\cancel{3n} + 5n + 7n + m}{2n+m} \quad |A|$$

$$\frac{7n+m}{2n+m}$$

Answer [2]

5 (a) Given that $4^{17} \div 16 \times 2^0 = 4^k$, find the value of k .

(b) Given that $m = 4.15 \times 10^2$ and $n = 2.12 \times 10^{-4}$, evaluate $\frac{3n}{m}$, giving your answer in standard form.

(a) $4^{17-2} = 4^k$ M1 - as law of indices applied.
 $k = 15$ A1

Answer (a) $k = 15$ [2]

(b) 1.53×10^{-6} B1 [1]

6 Simplify each the following, expressing your answers in positive index form.

(a) $\sqrt{\frac{49b^6}{a^8}} \div \frac{a^{-1}b^6}{2},$

(b) $\frac{x^3y^{-3}}{3z} \times \left(\frac{x}{y}\right)^{-2}$

(a) $\frac{7b^3}{a^4} \times \frac{2}{a^{-1}b^6} = \frac{14}{a^3b^3}$ A1
 M1

(b) $\frac{x^3y^{-3}}{3z} \times \frac{x^{-2}}{y^{-2}}$ M1

$= \frac{xy^{-1}}{3z} = \frac{x}{3yz}$ A1

Answer (a) $\frac{14}{a^3b^3}$ [2]

(b) $\frac{x}{3yz}$ [2]

7 (a) Given that p and q are integers where $-1 \leq p \leq 4$ and $0 \leq q \leq 3$, find

- (i) the least possible value of $\frac{2q}{p}$,
 (ii) the largest possible value of $q^2 - p^2$.

Answer (a)(i) -6 BI [1]

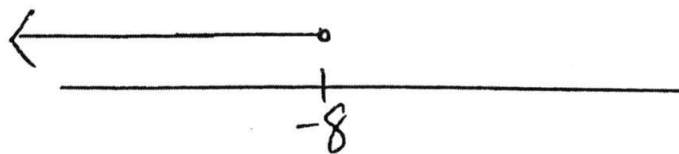
(ii) 9 BI [1]

(b) Solve the inequality $11 + 2x \leq x + 3 < 20$.
 Show your answer on a number line.

$$11 + 2x \leq x + 3 \quad \text{and} \quad x + 3 < 20$$

$$x \leq -8$$

$$x < 17 \quad \text{BI}$$



Answer (b) $x \leq -8$ BI [2]

- 8 (a) Stephen borrowed a sum of \$1000 from the bank. The bank charges an interest of 24% per annum compounded half yearly. Calculate the amount of money he has to return at the end of 2 years, correct to the nearest cent.

(b) Given that $m = \sqrt{\frac{30}{n+2}}$, calculate the value of n when $m = 2$.

$$(a) A = 1000 \left[1 + \frac{24}{2} \right]^4 M1$$

$$= \$1573.52 A1$$

$$(b) 2 = \sqrt{\frac{30}{n+2}}$$

$$4 = \frac{30}{n+2} M1$$

$$n+2 = \frac{30}{4}$$

$$n = \frac{30}{4} - 2 = 5\frac{1}{2} A1$$

Answer (a) \$1573.52 [2]

(b) $5\frac{1}{2}$ or 5.5 [2]

- 9 (a) Solve the equation $\frac{2x}{x+1} = \frac{3}{x-2}$.

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

$$2x^2 - 7x - 3 = 0$$

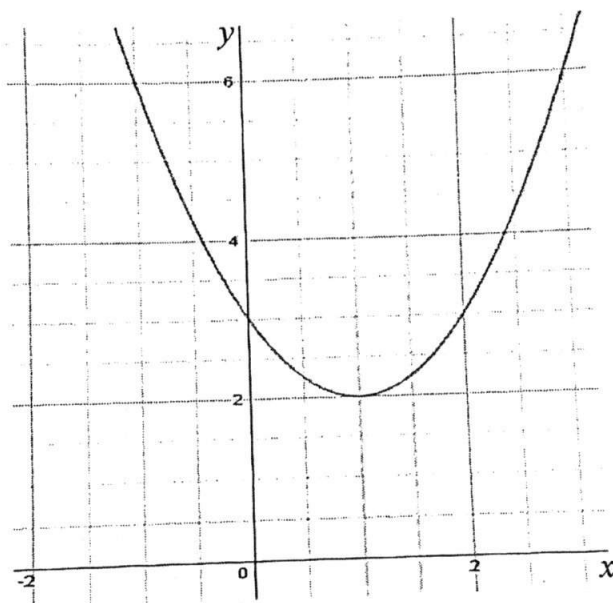
$$x = \frac{7 \pm \sqrt{49+24}}{4} M1$$

$$x = \frac{7+8.544}{4} \text{ or } x = \frac{7-8.544}{4}$$

$$= 3.89 \quad = -0.386 A1$$

Answer (a) $x = 3.89$ or -0.386 [2]

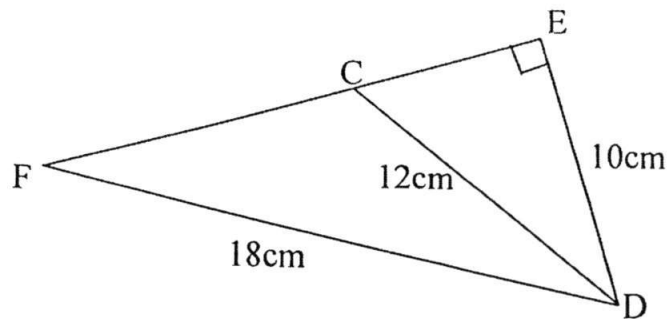
- (b) A quadratic graph in the form of $y = (x + a)^2 + b$ is shown below. Determine the values of a and b .



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

Answer (b) $\overset{\text{BI}}{a} = -1$, $\overset{\text{BI}}{b} = 2$ [2]

- 10 In $\triangle DEF$ shown below, C is a point on EF and $\angle DEF = 90^\circ$. $DE = 10$ cm, $DF = 18$ cm and $CD = 12$ cm.



- (a) Express $\sin \angle DCF$ as a fraction in its simplest form.

Answer (a) $\frac{5}{6}$ BI [1]

- (b) Calculate $\angle EFD$.

$$EF^2 = \sqrt{18^2 - 10^2}$$

$$= 224$$

$$EF = \sqrt{224}$$

$$\tan \hat{EFD} = \frac{10}{\sqrt{224}}$$

$$\hat{EFD} = \tan^{-1} \left[\frac{10}{\sqrt{224}} \right] \approx 33.7^\circ$$

Answer (b) 33.7° AI [2]

- (c) Calculate the length of CF.

$$\hat{CDF} = 180^\circ - 33.7^\circ - 123.6^\circ$$

$$= 22.7^\circ$$

Using sine rule,

$$\frac{18}{\sin \hat{DCF}} = \frac{CF}{\sin 22.7^\circ}$$

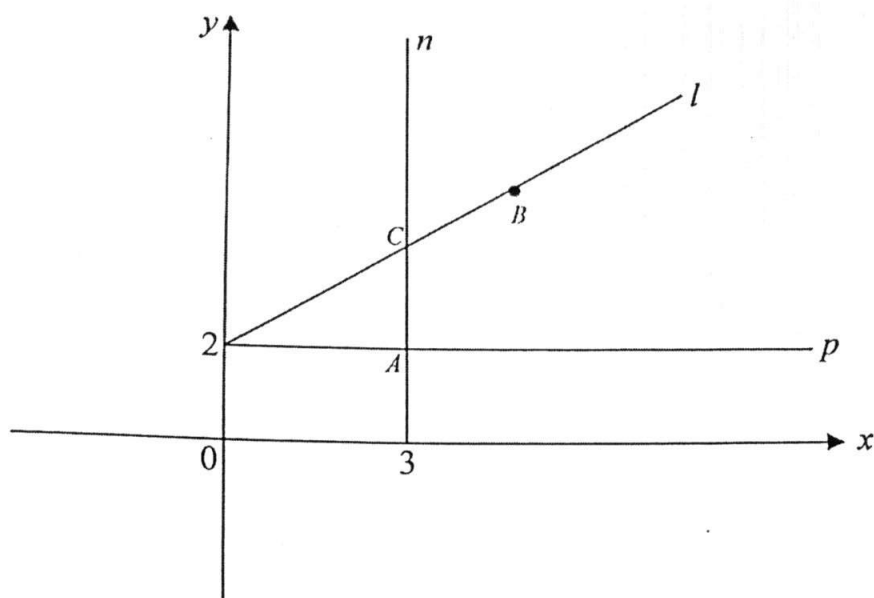
OR

$$CF = \sqrt{18^2 - 10^2} - \sqrt{12^2 - 10^2}$$

$$= \sqrt{224} - \sqrt{44} \approx 8.33 \text{ cm}$$

$$\therefore CF \approx 8.34 \text{ cm}$$

Answer (c) 8.34 cm AI [2]



The diagram above shows three lines n , p and l . The point B has coordinate $(4, 4)$ and C is the point of intersection of lines n and l . Lines p and n intersect at A .

- (a) Write down the equation of lines n and p .

Answer (a) $x = 3$ BI
 $y = 2$ BI [2]

- (b) Hence determine the coordinates of point A

Answer (b) $(3, 2)$ BI [1]

- (c) Find the gradient of line l and hence write down the equation of line l .

Gradient = $\frac{4-2}{4-0} = \frac{2}{4} = \frac{1}{2}$.
 $y = \frac{1}{2}x + c$
 Sub $(0, 2)$ into eqn above, Answer (c) Gradient: $\frac{1}{2}$ BI [1]
 $2 = \frac{1}{2}(0) + c \Rightarrow c = 2$. Equation of line l : $y = \frac{1}{2}x + 2$ BI [1]
 $\therefore y = \frac{1}{2}x + 2$.

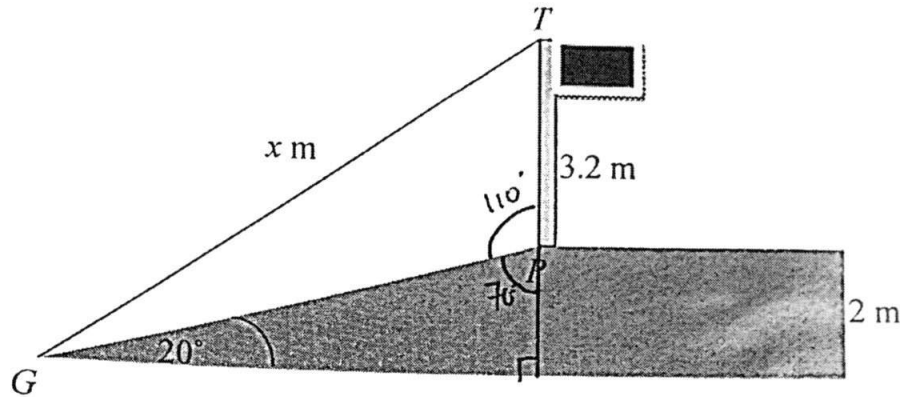
- (d) Given that point C has coordinates (x, y) , determine the values of x and y .

Sub $x = 3$ into the eqn of line l ,

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

Answer (d) $x = 3$, $y = 3\frac{1}{2}$ [2]
 BI BI

- 12 The diagram below shows a flag pole of 3.2m standing at a point P on the top of a slope which is inclined at 20° to the horizontal ground. The flag pole is 2m above the ground level. A x m taut rope at the top of the flag pole at point T is attached to point G at the end of the slope.



- (a) Find $\angle TPG$.

Answer (a) 110° BI $^\circ$ [1]

- (b) Find the length of the slope GP .

$$\sin 20^\circ = \frac{2}{GP}$$

$$\therefore GP = \frac{2}{\sin 20^\circ} = 5.8476 \text{ m}$$

$$\approx 5.85 \text{ m}$$

Answer (b) 5.85^{AI} m [2]

- (c) Find x . Using cosine rule,

$$x^2 = (3.2)^2 + (5.8476)^2 - 2(3.2)(5.8476)\cos 110^\circ$$

$$= 57.2675$$

$$\therefore x = \sqrt{57.2675} = 7.5675$$

$$\approx 7.57 \text{ m}$$

Answer (c)m [3]

- (d) Hence, calculate the angle of elevation from point G to point T.

Using sine rule,

$$\frac{7.5675}{\sin 110^\circ} = \frac{3.2}{\sin \angle G\hat{T}P}$$

$$\angle G\hat{T}P = \sin^{-1} \left[\frac{3.2 \sin 110^\circ}{7.5675} \right]$$

$$\approx 23.4^\circ$$

Hence $\angle$ of elevation

$$= 23.4^\circ + 20^\circ$$

$$= 43.4^\circ$$

Answer (d) $^\circ$ [3]

End of paper 1

SEL 3 EXP E-MATHS SA1 (PAPER 2)

1(a) $ac - 2bc + 5ak - 10bk = c(a - 2b) + 5k(a - 2b)$ [M1]
 $= (a - 2b)(c + 5k)$ *. [A1]

1(b) $\frac{8x+1}{(3x-1)^2} + \frac{2}{1-3x} = \frac{8x+1}{(3x-1)^2} - \frac{2}{3x-1}$ [M1]

* Many studs complicated the solⁿ by doing this: $\frac{8x+1}{(3x-1)^2} + \frac{2}{1-3x} = \frac{8x+1 - 2(3x-1)}{(3x-1)^2}$

And they did not factorise to simplify their answer at the end. $\frac{(8x+1)(1-3x) + 2(3x-1)^2}{(3x-1)^2(1-3x)} = \frac{8x+1 - 6x + 2}{(3x-1)^2}$

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

* Many studs did not put this bracket. $\frac{2x+3}{(3x-1)^2}$ *. [A1]

1(c) $\frac{2}{p} = \sqrt{\frac{p-q}{q}}$

$\frac{4}{p^2} = \frac{p-q}{q}$ [M1]

$4q = p^3 - p^2q$

$4q + p^2q = p^3$

$q(4 + p^2) = p^3$ [M1]

$\therefore q = \frac{p^3}{4 + p^2}$ *. [A1]

* Many studs could only square both sides to get rid of the square root sign; and they were stuck after that.

* Many studs could not factorise to isolate q

↳ Common mistake:

① $4q + qp^2 = p^3$

$5q = \frac{p^3}{p^2}$ (ERROR)

② $4q = p^3 - p^2q$

$\frac{4q}{q} = p^3 - p^2$

$$2(a) \quad \frac{(2a)^3}{b^4} \div \frac{4a^{-2}}{b^2} = \frac{[8a^3]}{b^4} \times \frac{b^2}{4a^{-2}} \rightarrow [M1]$$

* Common mistake:

$$(2a)^3 = 6a^3 \text{ or } 2a^3.$$

$$= \frac{2a^5}{b^2} \quad [A1]$$

* Common mistake:

$$\frac{8a^3}{b^4} \times \frac{b^2}{4a^{-2}} = \frac{8a^3}{b^4} \times 4a^2 b^2$$

2(b) Bank A

$$\text{Compound Int} = 138000 \left(1 + \frac{2.25}{100}\right)^{5 \times 12} - 138000 \quad [M1]$$

$$= \$16415.70489$$

$$\approx \$16415.70 \quad (2d.p.)$$

Bank B

$$\text{Simple Int} = \frac{138000(2.35)(5)}{100} = \$16215 \quad [M1]$$

* Many studs do not know the compound int. formula & the simple int. formula.

* Many studs compared total amount with simple int.

Patrick should borrow from Bank B as he will pay a lower interest. [A1]

$$2(c) \quad \left. \begin{aligned} 2^{5000} &= (2^5)^{1000} = 32^{1000} \\ 6^{2000} &= (6^2)^{1000} = 36^{1000} \end{aligned} \right\} [M1]$$

Given the same indices, since $36 > 32$,

$\therefore 6^{2000}$ is greater in value. [A1]

* Many studs presented only $2^5 = 32$ and $6^2 = 36$ without taking into account the index 1000.

* Many studs claimed that 6^{2000} is bigger because it has a bigger base.

* 2^{5000} = Math error

6^{2000} = Math error

$\Rightarrow$ Neither is greater than the other.

* Common mistake:

$$6^{2000} = 3(2^{2000})$$

$$3(a)(i) \text{ 24 trillion} = 24 \times 10^{12} \\ = 2.4 \times 10^{13} \#. \quad [B1]$$

* Many studs did not recognise that trillion = 10^{12}
* Common mistake: 2.4^{13} .

$$3(a)(ii) \quad \frac{2.4 \times 10^{13}}{5000} = 4.8 \times 10^9 \#. \quad [B1]$$

$$3(b)(i) \quad 5.54 \text{ million} = 5.54 \times 10^6 \\ = 0.0554 \times 10^8$$

$$\therefore k = 0.0554 \#. \quad [B1]$$

$$3(b)(ii) \quad \frac{5.54 \times 10^6}{101.2} \times 100 = 5474308.3 \\ \approx 5470000 \#. \quad [B1]$$

* Common mistake:

$$100\% - 1.2\% = 98.8\%$$

$$\therefore \frac{98.8}{100} \times 5540000 = 5473520 \\ \approx 5470000$$

$$4(i) (a) \text{ length of } PQ = \sqrt{(1-(-3))^2 + (5-0)^2} \quad [M1]$$

* Common mistake:

$$\text{length} = \sqrt{(1-(-3))^2 + (5-0)^2} = \sqrt{41} \quad \# \quad [A1]$$

* Many students did not leave answer in exact form.

* Many students think that writing 10 digits is leaving answer in exact form.

$$4(i) (b) \text{ Grad of } PQ = \frac{5-0}{1-(-3)} = \frac{5}{4} \quad \# \quad [B1]$$

$$4(i) (c) \quad y = \frac{5}{4}x + c$$

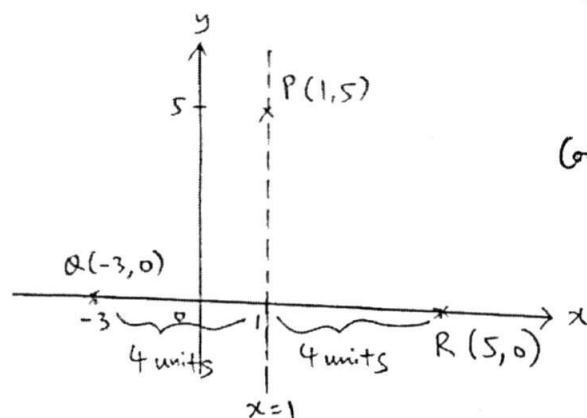
When $x = 8$, $y = 6$, we have,

$$6 = \frac{5}{4}(8) + c \quad [M1]$$

$$c = -4$$

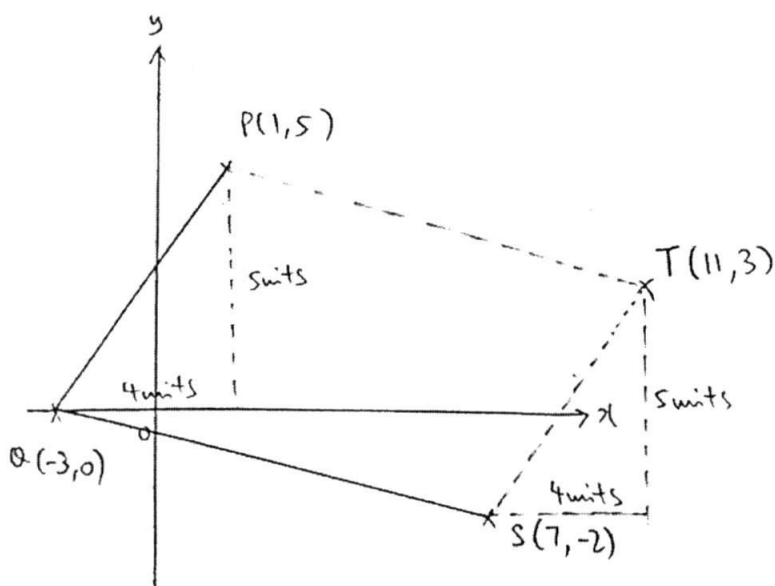
$$\therefore \text{eqn of the line is } y = \frac{5}{4}x - 4 \quad \# \quad [A1]$$

4(ii)



$$\text{Coord of } R = (5, 0) \quad \# \quad [B1]$$

4(iii)



$$\text{Coord of } T = (11, 3) \quad \# \quad [B1]$$

5 (i) $8\frac{1}{2} - x < 2x + 13 \leq \frac{x+33}{2}$

$$8\frac{1}{2} - x < 2x + 13 \quad \text{and} \quad 2x + 13 \leq \frac{x+33}{2}$$

$$17 - 2x < 4x + 26$$

$$4x + 26 \leq x + 33$$

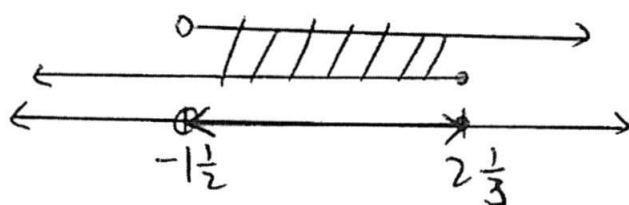
$$-6x < 9$$

$$3x \leq 7$$

$$x > -1\frac{1}{2} \quad [M1]$$

$$x \leq 2\frac{1}{3} \quad [M1]$$

* Many studs did not solve the inequality. Many left the answer $-1\frac{1}{2} \leq x \leq 2\frac{1}{3}$ as part (ii)'s answer.



Ans: $-1\frac{1}{2} < x \leq 2\frac{1}{3}$ #. [A1]

5 (ii) The integers are $-1, 0, 1, 2$ #. [B1]

* Many did not know that -1 and 0 are integers.

$$6(a) \quad \frac{180}{x} \text{ \pounds } [B1]$$

$$6(b) \quad \frac{180}{x+0.6} \text{ \pounds } [B1]$$

$$6(c) \quad \frac{180}{x} - \frac{180}{x+0.6} = 4 \quad [B1]$$

* many studs stop at the line
 $4x^2 + 2.4x - 108 = 0$.

$$180(x+0.6) - 180x = 4x(x+0.6) \quad [B1]$$

$$180x + 108 - 180x = 4x^2 + 2.4x$$

$$4x^2 + 2.4x - 108 = 0$$

$$40x^2 + 24x - 1080 = 0$$

$$5x^2 + 3x - 135 = 0 \text{ \pounds } (\text{shown})$$

} [B1]

$$6(d) \quad 5x^2 + 3x - 135 = 0$$

$$\therefore x = \frac{-3 \pm \sqrt{(3)^2 - 4(5)(-135)}}{2(5)} \quad \text{Discriminant [B1]}$$

$$[B1] \quad \frac{-3 \pm \sqrt{2709}}{10}$$

* Many studs still give this line
 $(x-4.90)(x+5.50) = 0$.

* Many studs rejected -5.50 in part (d).

$$= \frac{-3 \pm \sqrt{2709}}{10}$$

$$= 4.904805472 \quad \text{or} \quad -5.504805472$$

$$\approx 4.90 \text{ \pounds } (2 \text{ d.p.}) [B1] \text{ or } -5.50 \text{ \pounds } (2 \text{ d.p.}) [B1]$$

6(e) Since money cannot be negative, $x = -5.50$ is rejected.

$$\therefore \text{No. of honey lemon tarts Abigail could buy before the increase in price} = \frac{180}{4.904805472}$$

$$= 36.69870314$$

$$\approx 36 \text{ \pounds } [B1]$$

$$7(a)(i) \quad AD^2 = 180^2 + 220^2 - 2(180)(220)\cos 115^\circ \quad [M1]$$

$$\therefore AD = \sqrt{114271.3663} \quad [M1]$$

$$= 338.0404803$$

$$\approx 338 \text{ m} \# (3\text{s.f.}) \quad [A1]$$

$$7(a)(ii) \quad \frac{\sin \angle GDA}{180} = \frac{\sin 115^\circ}{338.0404803}$$

$$\therefore \angle GDA = \sin^{-1} \left(\frac{180 \sin 115^\circ}{338.0404803} \right) \quad [M1]$$

$$= 28.85478243$$

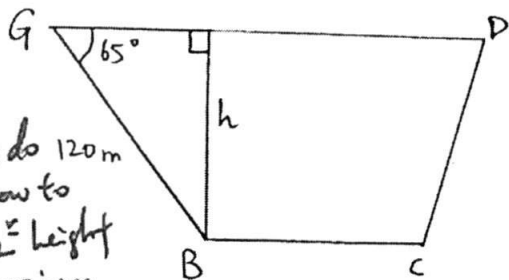
$$\approx 28.9^\circ \# (1\text{d.p.}) \quad [A1]$$

$$7(a)(iii) \quad \text{Area of } \triangle AGD = \frac{1}{2}(180)(220)\sin 115^\circ \quad [M1]$$

$$= 17944.89418 \text{ m}^2$$

$$\text{length of GB} = \frac{180}{3} \times 2 = 120 \text{ m}$$

let the vertical height of the trapezium GBCD be h .



* Most studs do 120m
not know how to
find the h height
of the trapezium.

$$\sin(180^\circ - 115^\circ) = \frac{h}{120}$$

$$\therefore h = 120 \sin 65^\circ \quad [M1]$$

$$= 108.7569344$$

$$\text{Area of trapezium} = \frac{1}{2}(160 + 220)(120 \sin 65^\circ) \quad [M1]$$

$$= 20663.81754 \text{ m}^2$$

$$\therefore \text{Total area of the park} = 17944.89418 + 20663.81754$$

$$= 38608.71173$$

$$\approx 38600 \text{ m}^2 \# (3\text{s.f.}) \quad [A1]$$

$$7(b) \quad \tan 3.5^\circ = \frac{FG}{220}$$

$$FG = 220 \tan 3.5^\circ \quad [M1]$$

$$\approx 13.5 \text{ m} \# (3\text{s.f.}) \quad [A1]$$