

BUKIT PANJANG GOVERNMENT HIGH SCHOOL PRELIMINARY EXAMINATION 2023 SECONDARY 4/5 GCE 'O' LEVEL SYLLABUS

MATHEMATICS Paper 2

4052 / 02

Date: 22 August, 2023 Duration: 2h 15 min Time: 0750 – 1005 h

Additional Materials: Graph paper

READ THESE INSTRUCTIONS FIRST

Write your name, class and index 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 in this question paper. You should follow the instructions below. If you need additional answer paper or graph paper ask the invigilator for answer paper or graph paper.

Answer **all** questions.

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 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 .

The number of marks is given in brackets [] at the end of each question or part question.

The total number of marks for this paper is 90.

Compound interest

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

Mensuration

Curved surface area of a cone = $\pi r l$ Surface area of a sphere = $4\pi r^2$ Volume of a cone = $\frac{1}{3}\pi r^2 h$ Volume of a sphere = $\frac{4}{3}\pi r^3$ Area of triangle $ABC = \frac{1}{2}ab\sin C$ Arc length = $r\theta$, where θ is in radians Sector area = $\frac{1}{2}r^2\theta$, where θ 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

Mean =
$$\frac{\sum fx}{\sum f}$$

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

~

1 (a) Solve $\frac{x}{5} - \frac{2x-10}{3} = 1$.

Answer x = [2]

(b) Simplify $\frac{8x^3y}{3y^5} \div \frac{2x}{16}$, leaving your answer in positive indices.

Answer

[2]

(c) (i) Express $y = x^2 - 6x + 5$ in the form $y = (x+a)^2 + b$, where *a* and *b* are constants.

Answer

[1]

(ii) Hence solve $x^2 - 6x + 5 = 10$ and give your solution correct to three decimal places.

Answer	<i>x</i> =	or	[2]

(**d**) Simplify
$$\frac{1+q+q^2+q^3}{1-q^4}$$
.

Answer

[4]

2 There are two travel agencies located in University X that provide loan packages for undergraduates to travel before they start working.

Travel Agency A	Travel Agency B
Charges <i>r</i> % per annum simple	Charges <i>r</i> % per annum compounded
interest.	monthly.

(a) Alice took the package from Travel Agency *B* and her tour package value is \$8000. At the end of 5 months, the total amount is \$8134.23. Show that *r* is approximately 4.00.

[4]

Answer

(b) Bernice took a loan from Travel Agency A and intends to pay within 6 months by monthly instalment. Her tour package to Australia was \$5000. Calculate the monthly instalment, using the same value for r from question (a).

Answer \$ [3]

(c) Bernice wants to add on a snorkeling session for her tour. The price of a snorkeling session in Australia is AUD 240. The diagram shows the conversion chart of 1 Singapore Dollar to Australian Dollar. Find the highest possible price of snorkeling in Singapore Dollar if she made the conversion between 21 April to 21 May.



Answer SGD [2]



The cumulative frequency curve shows the waiting time of 80 passengers at a bus station on 1 May 2023.

(a) (i) State the median waiting time.

3

Answer mins [1]

(ii) Find the interquartile range of the waiting time.

Answer mins [2]

(b) The waiting time of the buses on 1 June 2023 were recorded by 78 passengers. The table present some key statistical data.

Median	k
Lower quartile	54
Upper quartile	67

(i) Determine the range of k in the form of a < k < b if the waiting time on 1 June 2023 is shorter than that on 1 May 2023.

Answer [2]

[1]

(ii) Make another comment comparing the waiting time on 1 May 2023 and on 1 June 2023.

Answer

- (c) On the same cumulative frequency graph, draw the cumulative frequency curve for 1 June 2023 if the minimum and maximum waiting time are the same as that on 1 May 2023.
- (d) 80 passengers recorded their waiting time on 1 July 2023, and each waiting time recorded was 2 minutes more than those recorded on 1 May 2023.
 - (i) State the median waiting time for 1 July 2023.

Answer mins [1]

(ii) State the interquartile range for 1 July 2023.

Answer mins [1]

4 In the diagram, *ABC*, *ADE*, *AFG*, *DFB* and *EGC* are straight lines. *F* is a point on *DB* such that FB = 2DF. *AB* is produced to the point *C* such that 4AB = 3AC. *AD* is produced to the point *E* such that AD : DE = 3:1.



(a) By proving similarity, explain why *BD* is parallel to *CE*. [4]
 Answer

10

(b) It is given that \$\vec{AF} = p\$, \$\vec{AB} = q\$.
Express, as simple as possible, in terms of \$p\$ and/or \$q\$.
(i) \$\vec{FB}\$

Answer

[1]

(ii) \overline{DB} (iii) \overline{GF} Answer Answer (iv) \overline{EC}

Answer [2]

(c) Find the numerical value of

(i) Area $\triangle AEG$ Area $\triangle AGC$

Answer

(ii) Area $\triangle ADF$ Area $\triangle BFG$

Answer

[2]

[1]

[1]

[1]

5 The figure shows a paper in the shape of a sector *OPBQ*, with centre *O* and radius *OP*.

A circle, with centre *S* and radius 10 cm is enclosed in the sector and touches the sector at *A*, *B* and *C*.

(a) Show that OP = 30 cm.Answer

(b) Find the arc length *PBQ*, leaving your answer in terms of π .





Answer cm [3]

(c) (ii) A traffic cone (used on the road) is similar to the paper cone above. The ratio of the volume of the traffic cone to the volume of the paper cone is 27:1. Find the ratio of the curved surface area of the traffic cone to the curved surface area of the paper cone.

Answer

[2]

- 6 The water capacity of mini pool (used at home for young children) is 3853 litres.
 - (a) Tap *A* can fill the mini pool at a speed of *p* litres per minute. Write down an expression, in terms of *p*, for the duration (in minutes) taken by Tap *A*.

Answer mins [1]

(b) Tap *B* can fill the mini pool at a speed of (p-2) litres per minute. Write down an expression, in terms of *p*, for the duration (in minutes) taken by Tap *B*.

Answer mins [1]

(c) Tap *B* will take 30 minutes longer than Tap *A* to fill the mini pool. Write down an equation in *p*, and show that it reduces to $15p^2 - 30p - 3853 = 0$. [3] *Answer* (d) Solve $15p^2 - 30p - 3853 = 0$.

Answer [2]

(e) Find the duration (in minutes) if both taps are used.

Answer

mins [2]

- 7 An advertisement shows a swimming pool which has a water capacity of 10000 litres.
 - (a) In Singapore, water is charged per cubic metre (m³), which is equivalent to 1000 litres. The water charges include three components: tariff, water conservation tax and waterborne fee.

	For the first 40 m ³	$> 40 \text{ m}^3$
Tariff (\$/m ³)	1.21	1.52
Water conservation fee (\$/m ³)	0.61	0.99
Waterborne fee (\$/m ³)	0.92	1.18

The prices stated in the table does not include the 8% good and service tax.

Use the information to calculate the cost of filling the swimming pool with water

Answer \$

[4]

(b) The minimum height of a swimming pool is 0.84m for an adult user. The advertised swimming pool is circular in shape and its diameter is 4.5m. Calculate the height of the advertised pool and state whether this pool is suitable for adult users.
[3]

Answer



A typical dartboard (Diagram A) is modelled or simplified in a board as seen in Diagram B. It is made up of three concentric circles (of diameter 10 mm, 110 mm and 170mm when rounded off to the nearest tens). You may also assume that the thickness of the edges of the circles are negligible for this question.

The inner most circle is known as the bull. The inner ring is the region between the bull and the second circle. The outer ring is the region between second and third circles. The dartboard is divided into 20 equal sections with section numbers (1 to 20) written.

If dart lands on the	No of	See Diagram B using section
	points	number = 20 as illustration
bull	50	50 (regardless of section number)
inner ring and section number is <i>x</i> .	3 <i>x</i>	P = 60
outer ring and section number is <i>x</i> .	2x	Q = 40

The table shows the point system.

You may assume that the dart <u>will not</u> land outside these three concentric circles or the lines.

(a) A player throws a dart.

Explain why the probability of a player hitting the bull is $\frac{1}{289}$. Answer

[2]

(b) A player throws two darts. Find the probability that a player hits the bull twice.

Answer

[2]

(c) A player throws a dart.

(i)	Write down all possible ways to get 30 points.	[1]
	Answer	
(i)	Hence show that the probability of getting 30 points is $\frac{72}{1445}$.	[3]

Answer

(d) Jamie throws two darts. Find the probability that she gets a bull and a total of 80 points.

Answer

[2]

9 The variables x and y are connected by the function $y = \frac{x^3}{2} - 2x^2 + 5$. Some corresponding values of x and y are given in the table below.

x	-2	-1	0	1	2	2.5	3	4	4.5
у	-7	2.5	5	р	1	0.31	0.5	5	10

(a) Find the value of *p*.

Answer [1]

(b) Using a scale of 2 cm to represent 1 unit on the horizontal axis and 1 cm to represent 1 unit on the vertical axis, draw the above function for the values of x in the range of -2 ≤ x ≤ 4.5. [3]

Answer

(c) Use the graph to solve the following equations.

(i)
$$\frac{x^3}{2} - 2x^2 + 7 = 0$$

[1]

(ii) $x^3 - 4x^2 + 4x + 6 = 0$

Answer [3]

(d) The line y = k meets $y = \frac{x^3}{2} - 2x^2 + 5$ at exactly two points.

Find the values of *k*.

Answer or [2]

(e) By drawing a tangent, find the gradient of the curve at the point where x = -1.

Answer [2]

End of paper

1 (a) Solve
$$\frac{x}{5} - \frac{2x-10}{3} = 1$$
.
 $\frac{x}{5} - \frac{2x-10}{3} = 1$
 $\frac{3x-5(2x-10)}{15} = 1$
 $3x-10x+50 = 15$
 $-7x = -35$
 $x = 5$

Answer x = [2]

(b) Simplify
$$\frac{8x^3y}{3y^5} \div \frac{2x}{16}$$
, leaving your answer in positive indices.
 $\frac{8x^3y}{3y^5} \div \frac{2x}{16}$
 $= \frac{8x^3y}{3y^5} \times \frac{16}{2x}$
 $= \frac{64x^2}{3y^4}$

Answer

[2]

(c) (i) Express $y = x^2 - 6x + 5$ in the form $y = (x+a)^2 + b$, where *a* and *b* are constants.

 $y = x^{2} - 6x + 5$ = $(x - 3)^{2} - 9 + 5$ = $(x - 3)^{2} - 4$

Answer [1]

(ii) Hence solve $x^2 - 6x + 5 = 10$ and give your solution correct to three decimal places.

$$x^{2}-6x+5 = 10$$

(x-3)²-4=10
(x-3)² = 14
(x-3) = ±√14
x = ±√14+3
= 6.742 or -0.742

Answer x = or [2]

(d) Simplify
$$\frac{1+q+q^2+q^3}{1-q^4}$$
.
 $\frac{1+q+q^2+q^3}{1-q^4}$
 $=\frac{1(1+q)+q^2(1+q)}{(1-q^2)(1+q^2)}$
 $=\frac{(1+q)(1+q^2)}{(1-q)(1+q)(1+q^2)}$
 $=\frac{1}{(1-q)}$

Answer

[4]

2 There are two travel agencies located in University X that provide loan packages for undergraduates to travel before they start working.

Travel Agency A	Travel Agency B
Charges r % per annum simple	Charges r % per annum compounded
interest.	monthly.

(a) Alice took the package from Travel Agency *B* and her tour package value is \$8000. At the end of 5 months, the total amount is \$8134.23. Show that *r* is approximately 4.00.

[4]

Answer

$$8000 \left(1 + \frac{r}{1200}\right)^5 = 8134.23$$
$$\left(1 + \frac{r}{1200}\right)^5 = \frac{8134.23}{8000}$$
$$1 + \frac{r}{1200} = \sqrt[5]{1.01677875}$$

$$r = 1200 \left(\sqrt[5]{1.01677875} - 1 \right)$$
$$= 4.00 \quad (3sf)$$

(b) Bernice took a loan from Travel Agency A and intends to pay within 6 months by monthly instalment. Her tour package to Australia was \$5000. Calculate the monthly instalment, using the same value for r from question (a).

Monthly instalment

 $=\frac{5000+\frac{5000(4)(0.5)}{100}}{6}$ =\$850

Answer \$

[3]

(c) Bernice wants to add on a snorkeling session for her tour. The price of a snorkeling session in Australia is AUD \$240. The diagram shows the conversion chart of 1 Singapore Dollar to Australian Dollar. Find the highest possible price of snorkeling in Singapore Dollar if she made the conversion between 21 April to 21 May.







1 May 2023.

(a) (i) State the median waiting time.

63 minutes

Answer

mins [1]

(ii) Find the interquartile range of the waiting time.

Interquartile Range

= 67-58

= 9 mins

Answer mins [2]

(b) The waiting time of the buses on 1 June 2023 were recorded by 78 passengers. The table present some key statistical data.

Median	k
Lower quartile	54
Upper quartile	67

(i) Determine the range of k in the form of a < k < b if the waiting time on 1 June 2023 is shorter than that on 1 May 2023. 54 < k < 63

Answer [2]

(ii) Make another comment comparing the waiting time on 1 May 2023 and on 1 June 2023.

Answer

The spread of waiting time on 1 June 2023 is wider than that on 1 May 2023.

[1]

[2]

- (c) On the same cumulative frequency graph, draw the cumulative frequency curve for 1 June 2023 if the minimum and maximum waiting time are the same as that on 1 May 2023.
- (d) 80 passengers recorded their waiting time on 1 July 2023, and each waiting time recorded was 2 minutes more than those recorded on 1 May 2023.
 - (i) State the median waiting time for 1 July 2023.65 minutes

Answer mins [1]

(ii) State the interquartile range for 1 July 2023.9 mins

Answer mins [1]

4 In the diagram, *ABC*, *ADE*, *AFG*, *DFB* and *EGC* are straight lines. *F* is a point on *DB* such that FB = 2DF. *AB* is produced to the point *C* such that 4AB = 3AC. *AD* is produced to the point *E* such that *AD* : *DE* = 3:1.



$$4AB = 3AC \Rightarrow \frac{AB}{AC} = \frac{3}{4} \quad (S)$$

$$\angle DAB = \angle EAC \quad (common angle)$$

$$AD : DE = 3:1$$

$$AD : AE = 3:4 \quad (S)$$

Since $\triangle EAC$ and $\triangle DAB$ are similar (SAS similarity test)

 $\angle ADB = \angle AEC$

By the angle property "corresponding angle", BD//CE.

- (b) It is given that $\overrightarrow{AF} = p$, $\overrightarrow{AB} = q$. Express, as simple as possible, in terms of p or q or both.
 - (i) \overrightarrow{FB} $\overrightarrow{FB} = -p + q$

Answer [1]

(ii)
$$\overrightarrow{DB} = \frac{3}{2} (-p+q)$$

(iii) \overrightarrow{GF}
 $\overrightarrow{GF} = -\frac{1}{3} p$
(iii) \overrightarrow{GF}
 $\overrightarrow{GF} = -\frac{1}{3} p$
(iv) \overrightarrow{EC}
 $\overrightarrow{EC} = \frac{4}{3} D\overrightarrow{B}$ [M1]
 $= \frac{4}{3} (\frac{3}{2}) (-p+q)$
 $= -2p+2q$ [A1]
(c) Find the numerical value of
(i) $\overrightarrow{Area \ AAEG}$
 $\overrightarrow{Area \ AAEG} = \frac{1}{2}$
(ii) $\overrightarrow{Area \ AADF}$
 $\overrightarrow{Area \ AABF} = \frac{1}{2}$
 $\overrightarrow{Area \ AABF} = \frac{1}{2}$
 $\overrightarrow{Area \ AABF} = \frac{1}{3}$
 $\overrightarrow{Area \ ABF} = \frac{1}{3}$

5 The figure shows a paper in the shape of a sector *OPBQ*, with centre *O* and radius *OP*.

A circle, with centre *S* and radius 10 cm is enclosed in the sector and touches the sector at *A*, *B* and *C*.



(a) Show that OP = 30 cm.Answer

$$\sin \frac{\pi}{6} = \frac{10}{OS}$$
$$OS = 10 \div \sin \frac{\pi}{6}$$
$$= 20cm$$
$$OP = OB$$
$$= 20 + 10$$
$$= 30cm$$

(b) Find the arc length *PBQ*, leaving your answer in terms of π .

Arc length =
$$(30)\frac{\pi}{3}$$

= 10π

Answer cm [2]

(c) (i) If the paper is folded to form a cone such the edge *OAP* meets the edge *OCQ*, find the vertical height of the cone. circumference of cone base = arc PBQ $2\pi r = 10\pi$ r = 5cm

> $h = \sqrt{30^2 - 5^2}$ = 29.580... = 29.6 cm

> > Answer cm [3]

(c) (ii) A traffic cone (used on the road) is similar to the paper cone above. The ratio of the volume of the traffic cone to the volume of the paper cone is 27:1. Find the ratio of the curved surface area of the traffic cone to the curved surface area of the paper cone.

$$\frac{V \text{ (traffic cone)}}{V \text{ (paper cone)}} = \frac{27}{1}$$
$$\frac{\text{length (traffic cone)}}{\text{length (paper cone)}} = \frac{3}{1}$$
$$\frac{\text{curved SA (traffic cone)}}{\text{curved SA (paper cone)}} = \frac{9}{1}$$
$$Ratio = 9:1$$

Answer

[2]

- 6 The water capacity of mini pool (used at home for young children) is 3853 litres.
 - (a) Tap A can fill the mini pool at a speed of p litres per minute. Write down an expression, in terms of p, for the duration (in minutes) taken by Tap A.

 $\frac{3853}{p}$

Answer

mins [1]

(b) Tap *B* can fill the mini pool at a speed of (p-2) litres per minute. Write down an expression, in terms of *p*, for the duration (in minutes) taken by Tap *B*.

 $\frac{3853}{p-2}$

Answer mins [1]

(c) Tap *B* will take 30 minutes longer than Tap *A* to fill the mini pool. Write down an equation in *p*, and show that it reduces to $15p^2 - 30p - 3853 = 0$. [3]

Answer

$$\frac{3853}{p-2} - \frac{3853}{p} = 30$$

$$3853p - 3853(p-2) = 30p(p-2)$$

$$30p^2 - 60p - 7706 = 0$$

$$15p^2 - 30p - 3853 = 0$$

(d) Solve
$$15p^2 - 30p - 3853 = 0$$
.

$$p = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$= \frac{-(-30) \pm \sqrt{30^2 - 4(15)(-3853)}}{30}$$

$$= \frac{-(-30) \pm \sqrt{232080}}{30}$$

$$= 17.05822 \text{ or } -15.05822$$

$$= 17.1 \text{ or } -15.1$$

Answer p = [2]

(e) Find the duration (in minutes) if both taps are used.

p = 17.1 (reject -15.1 as speed >0) $\frac{3853}{17.06+15.06}$ = 119.956= 120 mins

Answer mins [2]

- 7 An advertisement shows a swimming pool which has a water capacity of 10000 litres.
 - (a) In Singapore, water is charged per cubic metre (m³), which is equivalent to 1000 litres. The water charges include three components: tariff, water conservation tax and waterborne fee.

	For the first 40 m ³	$>40 \text{ m}^3$
Tariff (\$/m ³)	1.21	1.52
Water conservation fee (\$/m ³)	0.61	0.99
Waterborne fee (\$/m ³)	0.92	1.18

The prices stated in the table does not include the 8% good and service tax.

Use the information to calculate the cost of filling the swimming pool with water.

$$=\frac{10000}{1000} \times (\$1.21 + \$0.61 + \$0.92) \times \frac{108}{100}$$
$$= \$29.592$$
$$= \$29.59 \text{ (2dp)}$$

Answer \$

[4]

(b) The minimum height of a swimming pool is 0.84m for an adult user. The advertised swimming pool is circular in shape and its diameter is 4.5m. Calculate the height of the advertised pool and state whether this pool is suitable for adult users.

[3]

Answer

Vol of mini pool = $\pi(r)^2 h$ $\frac{10000}{1000} = \pi(\frac{4.5}{2})^2 h$ h = 0.62876m= 0.629m

Since h < 0.84 m, it is not suitable for adult users. correct

For this question, h = 0.63 m is not penalized as the minimum height 0.84m is in 2 decimal places.



A typical dartboard (Diagram A) is modelled or simplified in a board as seen in Diagram B. It is made up of three concentric circles (of diameter 10 mm, 110 mm and 170mm when rounded off to the nearest tens). You may also assume that the thickness of the edges of the circles are negligible for this question.

The inner most circle is known as the bull. The inner ring is the region between the bull and the second circle. The outer ring is the region between second and third circles. The dartboard is divided into 20 equal sections with section numbers (1 to 20) written.

If dart lands on the	No of	See example in Diagram B
	points	where section number = 20
bull	50	50 (regardless of section number)
inner ring and section number is <i>x</i> .	3 <i>x</i>	P = 60
outer ring and section number is <i>x</i> .	2x	Q = 40

You may assume that the dart will not land outside the dartboard.

(a) A player throws a dart.

Explain why the probability of a player hitting the bull is $\frac{1}{289}$.

Answer

Probability (bull)

$$= \frac{\pi(5)^2}{\pi(85)^2} \\ = \frac{1}{289}$$

(b) A player throws two darts. Find the probability that a player hits the bull twice.

$$\left(\frac{1}{289}\right)^2 = \frac{1}{83521}$$

Answer [2]

[2]

- (c) A player throws a dart.
 - (i) Write down all possible ways to get 30 points. [1]
 Inner ring with 10 Outer ring with 15
 - (i) Hence show that the probability of getting 30 points is $\frac{72}{1445}$. [3]

Answer

Use similarity

P (10 point, inner ring) + P(15 points, outer ring)

$$= \frac{1}{20} \left(\frac{110^2 - 10^2}{170^2} + \frac{170^2 - 110^2}{170^2} \right)$$
$$OR \frac{1}{20} \left(\frac{170^2 - 10^2}{170^2} \right)$$
$$= \frac{72}{1445}$$

OR use area

$$\frac{1}{20} \left(\frac{\pi (55)^2 - \pi (5)^2}{85^2 \pi} + \frac{\pi (85)^2 - \pi (55)^2}{85^2 \pi} \right)$$

$$OR \frac{1}{20} \left(\frac{3000}{7225} + \frac{4200}{7225} \right)$$

$$= \frac{72}{1445}$$

(d) Jamie throws two darts. Find the probability that she gets a bull and a total of 80 points.

$$P(30,50) + P(50,30)$$
$$= \frac{72}{1445} \times \frac{1}{289} \times 2$$
$$= \frac{144}{417605}$$

Answer

[2]

9 The variables x and y are connected by the function $y = \frac{x^3}{2} - 2x^2 + 5$. Some corresponding values of x and y are given in the table below.

x	-2	-1	0	1	2	2.5	3	4	4.5
у	-7	2.5	5	р	1	0.31	0.5	5	10

(a) Find the value of *p*.

p = 3.5

- Answer [1]
- (b) Using a scale of 2 cm to represent 1 unit on the horizontal axis and 1 cm to represent 1 unit on the vertical axis, draw the above function for the values of *x* in the range of -2 ≤ x ≤ 4.5. [3] *Plot correct points [B1] Smooth curve [B1] correct scales and label curve [B1]*
- (c) Use the graph to solve the following equations.

(i)
$$\frac{x^3}{2} - 2x^2 + 7 = 0$$

 $y = -2$
 $x = -1.6 \pm 0.2$

Answer

[1]

(ii)
$$x^{3} - 4x^{2} + 4x + 6 = 0$$

 $x^{3} - 4x^{2} + 4x + 6 = 0$
 $\frac{x^{3}}{2} - 2x^{2} + 2x + 3 = 0$
 $\frac{x^{3}}{2} - 2x^{2} + 5 = -2x + 2$
Draw $y = -2x + 2$
 $x = -0.8 \pm 0.2$

Answer [3]

(d) The line
$$y = k$$
 meets $y = \frac{x^3}{2} - 2x^2 + 5$ at exactly two points.

Find the values of *k*.

k = 5 [B1] or k = 0.25 (accept 0.1 to 0.31)

Answer or [2]

(e) By drawing a tangent, find the gradient of the curve at the point where x = -1. Draw tangent [M1] *gradient* = 5.5 ± 1 [A1]

Answer [2]

End of paper

