

1. [Maximum mark 15]

A right-angled triangle has 3 sides, known to be $(x - 5)$, $(2x + 1)$, and $(2x)$.

- i) Draw a diagram of the right angled triangle and clearly label the appropriate sides. [1 mark]
- ii) By use of Pythagoras' theorem show how the sides can give the quadratic equation, $x^2 - 14x + 24 = 0$ [3 marks]
- iii) A graph of $y = x^2 - 14x + 24$ is to be drawn to help determine the sides of the triangle. Some of the values have been calculated below to help plot the graph.

x	0	2	4	6	8	10	12	14
y	24	0	a	-24	b	-16	0	c

Find the missing letters a , b , and c . [3 marks]

- iv) Using a scale of 1 cm = 2 units on the x -axis and 1 cm = 5 units on the y -axis draw the graph of $y = x^2 - 14x + 24$. [5 marks]
- v) Using your graph or otherwise solve the equation $x^2 - 14x + 24 = 0$. [2 marks]
- vi) Use your answer to find the 3 sides of the triangle. [1 mark]

2. *[Maximum mark 15]*

Two motorbikes are on a cross-country run in Mali. Both start in the town of Bamako. Akbar is travelling to Goundam on a bearing of 040° . Benny is travelling to Kayes on a bearing of 320° . Goundam is 800 km from Bamako, and Kayes is 250 km from Bamako.

- i) Draw a sketch to show all the information given in the paragraph above. *[4 marks]*
- ii) Find the distance between the two motorcyclists when they have completed their journeys. *[3 marks]*
- iii) Find the bearing of Kayes from Goundam. *[4 marks]*
- iv) Find the area enclosed between the towns of Bamako, Kayes, and Goundam. *[2 marks]*
- v) Akbar and Benny set off from Goundam and Kayes respectively (at the same time), travelling towards each other with a plan to meet half way between the towns.

Calculate the average speed must they travel at if they are to meet 10 hours after setting off. *[2 marks]*

3. [Maximum mark 20]

- i) The percentage of a radioactive substance present in a person's blood is measured at various distances away from a nuclear power station.

The observed frequencies are shown in the table below.

	0 – 10 km	11 – 20 km	21 – 30 km	31 – 40 km	Totals
0% - 0.5%	75	30	44	54	220
0.5% - 1.0%	80	40	26	52	180
1.0% - 1.5%	50	15	10	24	100
Totals	205	85	80	130	500

The table of expected values is then calculated and written below.

	0 – 10 km	11 – 20 km	21 – 30 km	31 – 40 km	Totals
0% - 0.5%	p	37.4	35.2	s	220
0.5% - 1.0%	73.8	q	28.8	46.8	180
1.0% - 1.5%	41	R	16	26	100
Totals	205	85	80	130	500

- a) Find the values of p , q , r , and s in the table above.
[4 marks]
- b) A χ^2 test is to be done to test whether the distance a person lives from the power station is independent of the amount of radioactive substance in their blood. State the alternate hypothesis.
[2 marks]
- c) Explain why the degrees of freedom are 6. [1 mark]
- d) Find the χ^2 value at the 10% level of significance from the Chi-squared tables.
[1 mark]
- e) The test χ^2 value is calculated as 12.40. Explain clearly what your conclusion is how you arrived at this conclusion.
[2 marks]

- ii) A maths teacher is marking students responses to an aural maths test, marked out of 20 and a written maths test, marked out of 50.

The results are tabulated below.

Aural mark (x)	12	8	13	9	17	5	11	16	8	14
Written mark (y)	31	17	39	16	42	25	34	46	19	40

- a) Write down the coefficient of correlation for this data.
[1 mark]
- b) Explain what your value from a) indicates. [1 mark]
- c) Write down the linear regression equation of y on x in the form $y=ax+b$.
[2 marks]
- d) An eleventh student missed the written test but scored 15 on the aural test. Estimate the student's score for the written test.
[2 marks]
- e) Comment on how reliable the answer to d) is.
[2 marks]

4. [Maximum mark 20]

- i) A chemical burns in the air producing energy, e . An equation to show the amount of energy produced after t seconds of being exposed to the air is given below.

$$e = 120t - 18t^2$$

- a) At 0 seconds ($t = 0$) no energy is produced. Find the time when the chemical has finished burning and no energy is produced.
[2 marks]
- b) Find the function that gives the rate of change of the energy produced by the chemical, $\frac{de}{dt}$.
[2 marks]
- c) Find rate of change of energy after 2 seconds. [1 mark]
- d) Find the time at which the maximum amount of energy is being produced and find the amount of energy being produced at this time.
[4 marks]

- ii) A particle is moving away from a it's starting position. It's displacement from it's starting position is given by the formula,

$$s = t^3 - 2t^2 - 3t - 1,$$

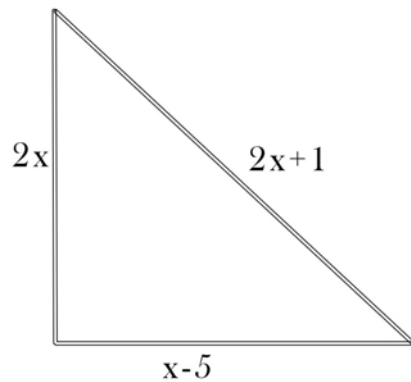
where s is the displacement in metres after t seconds.

- a) Sketch a graph to show the displacement of the particle from it's starting position during the first 4 seconds.
[2 marks]
- b) Find the time when the particle passes it's starting point again.
[2 marks]
- c) The velocity of the particle is given by the function $\frac{ds}{dt}$.
Find the velocity function.
[2 marks]
- d) Find the particle's velocity after 3 seconds. [2 marks]
- e) The particle comes to rest (stops) momentarily. Find the time at which the particle stops.
[3 marks]

5. *[Maximum mark 20]*

- i) Yolanda invests \$5600 in a bank account that pays her 6.5% interest per annum, compounded monthly.
- Calculate the value of the investment after 9 complete years. *[2 marks]*
 - Calculate the number of years it will take for Yolanda's investment to double. *[4 marks]*
 - Calculate the rate of simple interest per annum that would give the same value for the investment over 5 years. Give your answer to 2 decimal places. *[5 marks]*
- ii) Sharon is a newly qualified teacher. She starts on a basic pay of \$32000 per annum. She has a contract so that her salary will increase by 6% per annum for the first 6 years.
- Calculate Sharon's salary at the start of her sixth year of teaching. *[2 marks]*
 - Calculate Sharon's total earnings over the first six years of teaching. *[4 marks]*
 - At the end of five years, her pay increases by only 3% per annum. How many years after she first starts teaching will Sharon have earned \$350000 in total? *[3 marks]*

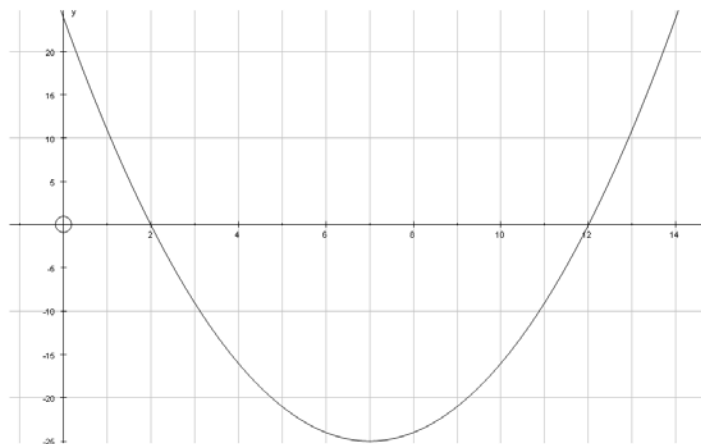
1. i)



ii)
$$(x-5)^2 + (2x)^2 = (2x+1)^2$$
$$x^2 - 10x + 25 + 4x^2 = 4x^2 + 4x + 1$$
$$x^2 - 14x + 24 = 0$$

iii) $a = -16, b = -24, c = 24$

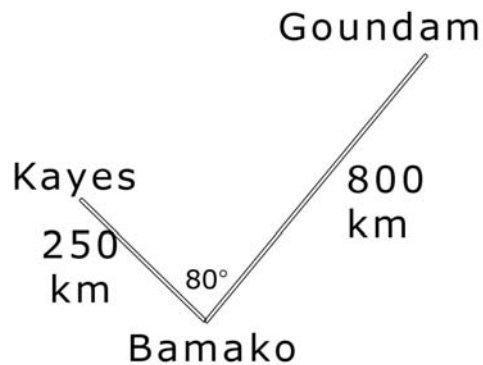
iv)



v) $x = 2, x = 12$

vi) 7, 24, 25

2. i)



ii) 796 km

iii) 238°

iv) 98481 km²

v) 39.8 km/h

3. i) a) $p = 90.2, q = 30.6, r = 17$ b) H_1 : the amount of radioactive substance present in the blood depends on the distance a person lives from the power station.c) $(\text{rows}-1) \times (\text{columns}-1) = 6$

d) 10.645

e) As the test statistic is greater than the value from the table we will reject H_0 in favour of H_1 .
Therefore, the amount of radioactive substance that exists in the bloodstream is dependent on the distance lived from the power station.ii) a) $r = 0.86$

b) Strong positive correlation.

c) $y = 2.49x + 2.82$

d) 40

e) There is not enough data to make a very accurate prediction.

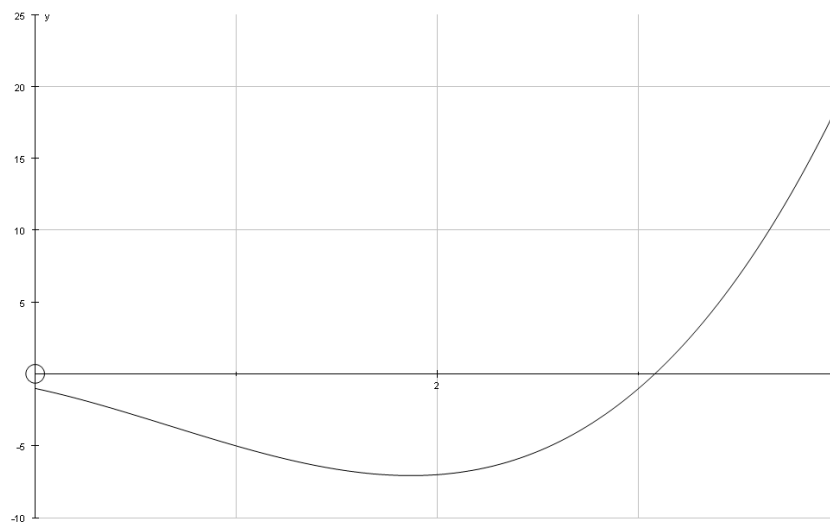
4. i) a) $t = 4.93$

b) $\frac{de}{dt} = 120 - 36t$

c) 48

d) $t = 3\frac{1}{3}, e = 200$

ii) a)



b) $t = 3.08$

c) $\frac{ds}{dt} = 3t^2 - 4t - 3$

d) 12 m/s

e) $t = 1.87$

Paper C

IB Studies Paper 2 Practice Tests

5. i) a) \$10036
b) 11
c) 7.66%
- ii) a) \$42823
b) \$223210
c) 8th year