The Father of Modern Computer Science

Edited By
Manjunath.R
manjunath5496@gmail.com
www.myw3schools.com
The Einstein of Modern Computer Science

Alan Turing

(1912 - 1954)
Alan Turing

BRITISH MATHEMATICIAN AND LOGICIAN

“We can only see a short distance ahead, but we can see plenty there that needs to be done.”

- Alan Turing

Born:
23 June 1912
Maida Vale, London, England

Died:
7 June 1954 (aged 41)
Wilmslow, Cheshire, England

Cause of death:
Cyanide poisoning

Resting place:
Ashes scattered near Woking Crematorium

Residence:
Wilmslow, Cheshire, England
Education:

King's College, Cambridge (BA, MA)
Princeton University (PhD)

Known for:

Cryptanalysis of the Enigma
Turing's proof
Turing machine
Turing test
Unorganised machine
LU decomposition

Awards:

Smith's Prize (1936)

Scientific career:

Fields

Logic
Mathematics
Cryptanalysis
Computer science
Mathematical and theoretical biology

Institutions:

University of Manchester
Government Code and Cypher School
National Physical Laboratory

Thesis:

Systems of Logic Based on Ordinals (1938)
Doctoral advisor:
Alonzo Church

Doctoral students:
Robin Gandy

Influences:
Max Newman

Signature:

Turing, age 5.
Turing starts his school education at the age of six at St. Michael’s School.

Alan Turing as a boy.
Alan Turing with his mother Ethel Sara Turing.

Alan Turing with his mother and brother on a beach on the South Coast of England in 1913.
Alan and his elder brother John.

Drawing of Alan Turing by his mother, at his preparatory school, Hazelhurst, Sussex, 1923.
Preparatory school, Hazelhurst.

Turing and friends on a Cornish beach, April 1930.
Alan Turing, second from right, with (L-R) Hogg, Geoffrey OHanlon (housemaster) and White.

Alan Turing with school friends, Robin and John Wainwright and Hugh Highet.
Turing in a photo from his days at the Sherborne School.

Alan Turing, aged 15, at Westcott House, Sherborne School.
Sherborne School.
Turing (front row far left), aged 13, at Westcott House Sherborne, 1926.
<table>
<thead>
<tr>
<th>Divinity</th>
<th>Master.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Principal Subjects</strong></td>
<td></td>
</tr>
<tr>
<td>Chemistry: He is a good boy, trying to improve his study. He worked hard with good results.</td>
<td>a. g. a.</td>
</tr>
<tr>
<td>Mathematics: His work in Higher Certificate papers shows distinct promise, but he must realize that ability to put a new idea, solution, in a paper - intelligible &amp; elegantly - is necessary for a first-rate mathematician. He has done some good work but generally gets it down roughly. He cannot remember that Cambridge was not round knowledge rather than volume.</td>
<td>D.E.E.</td>
</tr>
<tr>
<td><strong>Subsidiary Subjects</strong></td>
<td></td>
</tr>
<tr>
<td>French: Fair.</td>
<td>C.W.L.</td>
</tr>
<tr>
<td>His prose have been very weak. Most of the mistakes are elementary and the result of hasty work.</td>
<td>H. &amp; B.</td>
</tr>
<tr>
<td>English: Reading week. Essays show ideas but are more R.E.A.</td>
<td>a. &amp; a.</td>
</tr>
<tr>
<td><strong>Music</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Drawing</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Extra Tuition</strong></td>
<td></td>
</tr>
<tr>
<td><strong>House Report</strong></td>
<td></td>
</tr>
<tr>
<td>I am quite satisfied with him. I am very glad he is ready to come out of his shell. His Higher Certificate papers were pretty good.</td>
<td>C. W. L.</td>
</tr>
<tr>
<td><strong>Signature</strong></td>
<td></td>
</tr>
</tbody>
</table>

Alan Turing’s school report when he was 16-years-old.
This is the copy of the school prize which Turing chose in honour of his 'first love' Christopher Morcom.
Christopher Morcom with his parents in 1929.

Turing, age 18, next to Ben Davis, head of Mathematics at Sherborne School.
Young Alan Turing.

Alan Turing aged 19, bathing on the island of Sark

Alan Turing in his early 20s.
Turing running.

Turing reading.
Turing (right) and Mermagen in their last year at Sherborne.

Alan Turing in 1934.
Hut 8, where Turing's Naval Enigma section was based.

The young Alan Turing in more innocent times.

Plaque, 78 High Street, Hampton
As a fellow at King's, Cambridge.

On the right is a rare snapshot of Alan Turing in a seminar at Princeton at this period.
Princeton University.

Alan Turing in a boat just before the Second World War.
Alan Turing (far left) on a bus.

Alan Turing in a garden in Dene Road, Guildford in 1928.
Ratio Club at Cambridge 1952, Giles Brindley (yellow), Donald MacKay (red), Alan Turing (green).

Alan Turing (right) stands next to the Ferranti Mark I.
Conceptualization of the Turing Machine invented by Turing in 1936.

Mechanical Wooden Turing Machine.

This is a Turing machine built from Legos. It's a theoretical machine Turing designed for computing in the late 30s.
A letter which Alan Turing sent to his mother.

Despite his death being ruled suicide, Turing's mother said it was 'quite probably' his death from cyanide poisoning was a mistake.
Turing lived the last years of his life at this home in Wilmslow, Cheshire near Manchester. He took his own life at this house on June 7, 1954.
Turing led the Naval Enigma codebreaking efforts from this office in Hut 8. The building at Bletchley Park has been fully restored.

Hut 8 at Bletchley Park is the building Turing worked in during the early years of World War II. Turing was instrumental in breaking the German naval Enigma code.
In 1931, Turing began his studies at King's College, Cambridge.

Two cottages in the stable yard at Bletchley Park. Turing worked here in 1939 and 1940, before moving to Hut 8.
Alan Turing’s OBE currently held in Sherborne School archives.

Photograph of Alan Turing statue at University of Surrey.
Turing’s statue at Bletchley Park (made of layers of stacked slate, shown from the chest up).

Bombe machine, a code-breaking machine, originally developed by Alan Turing and others, used during World War II.
Turing memorial statue plaque in Sackville Park, Manchester.

Welsh codebreaker Mair Russell-Jones recognised Alan Turing's genius at an early age at Bletchley Park.
Crew of King's College's 2nd boat, May 1935. Alan Turing is second from the Right.
During World War II, Bletchley Park housed the UK’s code breaking efforts against the Axis powers. Turing worked here.

Turing was recruited to the National Physical Laboratory in 1945.
Alan Turing’s codebreakers decoding of the Enigma Machine helped win World War II.
ALAN TURING: Bletchley Park will reopen as the National College of Cyber Security.

U-BOATS: Breaking the Enigma code allowed Brit ships to evade German U-boats.
A page from the notebook of British mathematician and pioneer in computer science Alan Turing, displayed in front of his portrait during an auction preview in Hong Kong.

Cassandra Hatton, senior specialist in fine books and manuscripts and director of the history of science from Bonhams auction house, shows a notebook of British mathematician and pioneer in computer science Alan Turing, during an auction preview in Hong Kong.
The DEUCE: Digital Electronic Universal Computing Engine, was the first commercially produced digital model and was developed from earlier plans by Alan Turing.

A rare manuscript belonging to British mathematician and code breaker Alan Turing displayed in Hong Kong on March 19, 2015.
A page from the notebook of codebreaker Alan Turing seen at Bonham’s auction house during an auction in New York, on April 13, 2015. The paper, in which he details his work on the foundations of mathematical notation and computer science.

Bonham’s senior specialist Cassandra Hatton discusses a working Enigma cipher machine that along with the 1942 56-page notebook belonging to codebreaker Alan Turing.
A working Enigma cipher machine.

A rebuild of a machine made by Alan Turing.
Britain’s earliest stored program computers designed by the mathematician Alan Turing (1912–1954) at NPL between 1945 and 1947.

The Queen visits Bletchley Park and studies an Enigma machine. She grants Turing a royal pardon on 23 December 2013.
NOW KNOW YE that We, in consideration of circumstances humbly represented unto Us, are Graciously pleased to extend Our Grace and Mercy unto the said Alan Mathison Turing and to grant him Our Free Pardon posthumously in respect of the said convictions;

AND to pardon and remit unto him the sentence imposed upon him as aforesaid;

AND for so doing this shall be a sufficient Warrant.

GIVEN at Our Court at Saint James's the 24th day of December 2013;
In the sixty-second Year of Our Reign.

By Her Majesty's Command.

Alan Turing's Royal Pardon (UK Government).

Signature of Alan Turing's mother Sara, from when she visited after his death.
PARDONED
Queen acts on 1952 homosexuality conviction which destroyed life of wartime codebreaking hero Turing

Royal Prerogative that's rarely used

A great insight into our history

Alan M. Turing, codebreaker and an Enigma Code Machine

ST HELENA

30p

Alan Turing 1912-1954
Mathematician and WWII code breaker

Alan Turing Stamp
Alan Turing Letter Reveal Turmoil Over Sexuality, ‘Gay Cure’ Hormone Therapy
Letter Alan Turing wrote to Maria Greenbaum in July 1953 with his advice for playing Solitaire.

The detailed letter provided an explanation of how to avoid having pieces scattered around the board, including a series of moves to help crack the puzzle.
He used diagrams to help explain to his niece how she might succeed with the puzzle.
Alan Turing's letter to Christopher Morcom's mother. Christopher was Alan's first love, and he died very young.
Dear Dr. Ashby,

Sir Charles Darwin has shown me your letter, and I am most interested to find that there is someone working along these lines. In working on the ACE I am more interested in the possibility of producing models of the action of the brain than in the practical applications to computing. I am most anxious to read your paper.

The ACE will be used, as you suggest, in the first instance in an entirely disciplined manner, similar to the action of the lower centres, although the reflexes will be extremely complicated. The disciplined action carries with it the disagreeable feature, which you mentioned, that it will be entirely uncritical when anything goes wrong. It will also be necessarily devoid of anything that could be called originality. There is, however, no reason why the machine should always be used in such a manner: there is nothing in its construction which obliges us to do so. It would be quite possible for the machine to try out variations of behaviour and accept or reject them in the manner you describe and I have been hoping to make the machine do this. This is possible because, without altering the design of the machine itself, it can, in theory at any rate, be used as a model of any other machine, by making it remember a suitable set of instructions.

Dr. W. R. Ashby, M.A.,
"Green Hedges"
Church Way,
Weston Favell,
Northampton.
The ACE is in fact, analogous to the 'universal machine' described in my paper on computable numbers. This theoretical possibility is attainable in practice, in all reasonable cases, at worst at the expense of operating slightly slower than a machine specially designed for the purpose in question. Thus, although the brain may in fact operate by changing its neuron circuits by the growth of axons and dendrites, we could nevertheless make a model, within the ACE, in which this possibility was allowed for, but in which the actual construction of the ACE did not alter, but only the remembered data, describing the mode of behaviour applicable at any time. I feel that you would be well advised to take advantage of this principle, and do your experiments on the ACE, instead of building a special machine. I should be very glad to help you over this.

I hope you will find time to visit me here next time you are in town.

Yours sincerely,

A. M. TURING.
Alan Turing at the Science Museum.

The blue plaque at Alan Turing’s house on Adlington Road.

Bronze bust of Alan Turing presented to ACM by Tom and Grant Mackenzie.
ACM A.M. Turing Award.

A postcard Alan Turing sent to his psychologist “Dr Franz Greenbaum” while on holiday in Corfu.
Note from Alan Turing to Robin Gandy, March 1954.

Message from Turing to Gandy, printed off the Manchester Mark I, ca. 1953.
Alan Turing's Princeton University File.
Extracts from Turing’s notes on the Enigma Machine, c.1939–42.

A unique collection of letters and correspondence from Alan Turing found in an old filing cabinet in a storeroom at the University of Manchester.
Alan Turing autograph.

Visitor's Book signature: Alan Turing’s signature 8th from the top.
Alan Turing Letter to Alonzo Church.

MANCHESTER UNIVERSITY COMPUTING MACHINE LABORATORY

Alan Turing Scrapbook.
Referee report by C. G. Darwin on 'On the Chemical basis of Morphogenesis' by A. M. Turing.
This is a photograph of the official record of the charges, pleas, and sentences passed on Alan Turing and Arnold Murray in respect of their crimes, 31 March 1952.

A sample of the handwriting of Alan Turing.
Turing believes machines think.
Turing lies with men.
Therefore machines do not think.

Yours in closeness,
Alan.
Alan Turing's Code-Breaking Papers Discovered In Roof Holes At Bletchley Park.

A sample of Turing's typing.

One of Alan Turing's journals, written while he was hacking away on the German Enigma Code.
The unpublished work by the late Alan Turing (1912–1954). It includes many topics (how to play Go, elliptic functions...) and drawings and calculations related to his theory of morphogenesis.

The Alan Turing Building at the University of Manchester.
The London 2012 Olympic Torch flame was passed on in front of Turing’s statue in Manchester on his 100th birthday.

Colored diagrams showing patterns of dappling and calculations, made by Turing in connection with work on morphogenesis.
20th February, 1953.

D. MacKay, Esq.,
Physics Department,
King’s College,

Dear MacKay,

Thank you for your letter about the Macy meetings.

I had actually written some time before your letter to McCulloch to tell him I would not be there. I should have thought he would have had my letter by then. Perhaps he was hoping to get me to alter my decision.

Although the meetings themselves would appeal to me, I would very much prefer not to go. I would not like the journey, and I detest America; furthermore I do not wish to ask for leave of absence from the University, so I think it is best to leave it as it is.

Yours sincerely,

A. M. Turing.
COMPUTING MACHINE LABORATORY,

20th. November, 1951

B.H. Wood, Esq.,
Chess,
Sutton Coldfield.

Dear Mr. Wood,

I knew nothing of the game between Princeton and Manchester until someone quoted me the article in Electronics. I certainly am interested in the possibility of making machines do this sort of thing, but it is not easy and there always seems to be something more important to be done. I wrote a short article on the subject for a little book which Ferranti's are getting out to boost their machine, but at present I am afraid the printer's have the only copy. I would be quite willing to let it be reproduced but I don't know what they would think about it. Of course the machine is not itself a chess playing machine but a general purpose one which can in principle play chess as one of its many activities.

Yours sincerely,

Slate statue of Alan Turing at Bletchley Park with the best-known image of Turing on the wall to the right.
POST MORTEM EXAMINATION REPORT

Name of deceased: Alan Mathison Turing

Place and Time: The Public Mortuary, Milton, on 7th June 1954.

Date and Time: 5 p.m. Tuesday 9th June 1954

Place where performed: The Public Mortuary, Milton.

Estimated time of death: More than 24 hours previously, in my opinion/during the night of

EXTERNAL EXAMINATION

Body: Very strong and firm but not showing signs of rigor mortis. The right arm was flexed at 90 degrees across the body, the right hand was extended, the body lying to the left side. No marks of violence or identification marks.

Apparent age: 40

Height: 6 ft. 10 ins.

Weight: 175 lbs.

Stomach contents: Contents four ounces of fluid which smelled very strongly of bitter almonds, as does a solution of cyanide.

Brain: Normal. The brain smelled of bitter almonds.

Lungs: Normal. The lungs were normal, with no marks of violence or identification marks.

Mouth, Tongue, Larynx: Normal. The mouth was in normal condition.

Trachea, Lungs and Pleura: Normal. No signs of cyanide poisoning.

Blood vessels: Normal. The blood vessels were normal.

Blood vessels: Normal. The blood vessels were normal.

Blood vessels: Normal. The blood vessels were normal.

Bleeding: Normal.

Generative Organs: Normal.

The cause of death as shown by the examination appears to be: 

The body was washed and cleaned at the house of the deceased when a solution of cyanide (identified by characteristic smell) and a bottle of Sommasein Cyanide in solid form were found. The smell of the solid was identical with the smell of the liquid, and no other chemical smell was given.

Signature and Qualifications: [Signature] M.D., F.R.C.Path.

Address: Bletchley Park, Milton, Milton, Cambridge.

Post Mortem Examination report of Alan Turing.
## Death Certificate of Alan Turing

<table>
<thead>
<tr>
<th>No.</th>
<th>Name and surname</th>
<th>Date and hour of death</th>
<th>Sex</th>
<th>Age</th>
<th>Nature and cause of death</th>
<th>Inhabitance, occupation and occupation of informant</th>
<th>Inhabitance of informant</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Alan Turing</td>
<td>26/12/1954 11:00</td>
<td></td>
<td>58</td>
<td>Suicide</td>
<td>Computer Science Department, Cambridge University</td>
<td>Cambridge</td>
</tr>
</tbody>
</table>

The death was certified by

Dr. C. K. Rees

Registration District: Cambridge Sub-district

Registration: 0152

Certified Copy of an Entry of Death Pursuant to the Births and Deaths Registration Acts, 1836 to 1947.

[Signature]

Registrar
The Alan Turing Prize for Science

This prize is awarded in memory of

Alan Mathison Turing

O.B.E. Ph.D. (Princeton) F.R.S.
Sometime Fellow of King's College, Cambridge.

He was born on June the 23rd, 1912, and was at Sherborne School from 1926 to 1931.

He made a lasting contribution to the foundations of Mathematics by his logical analysis of computing processes, which took practical shape in his design for ACE, the automatic computing engine built by the National Physical Laboratory. His chemical theory of the growth and form of living things gave promise of equally far-reaching effects in Biological science. He was engaged in the first exact experimental tests of his theory when he died on the 7th of June, 1954.
The Turing residence at 22 Ennismore Avenue, Guildford.
von Neumann's formal letter of reference dated June 1, 1937, supporting Turing's application for a Procter Fellowship at Princeton for the year 1937-38.
Remarks of Prime Minister Gordon Brown
10 September 2009

This has been a year of deep reflection – a chance for Britain, as a nation, to commemorate the profound debts we owe to those who came before. A unique combination of anniversaries and events have stirred in us that sense of pride and gratitude that characterise the British experience. Earlier this year, I stood with Presidents Sarkozy and Obama to honour the service and the sacrifice of the heroes who stormed the beaches of Normandy 65 years ago. And just last week, we marked the 70 years which have passed since the British government declared its willingness to take up arms against fascism and declared the outbreak of the Second World War.

So I am both pleased and proud that, thanks to a coalition of computer scientists, historians and LGBT (lesbian, gay, bisexual and transgender) activists, we have this year a chance to mark and celebrate another contribution to Britain’s fight against the darkness of dictatorship: that of code-breaker Alan Turing.

Turing was a quite brilliant mathematician, most famous for his work on breaking the German Enigma codes. It is no exaggeration to say that, without his outstanding contribution, the history of the Second World War could have been very different. He truly was one of those individuals we can point to whose unique contribution helped to turn the tide of war. The debt of gratitude he is owed makes it all the more horrifying, therefore, that he was treated so inhumanely.

In 1952, he was convicted of “gross indecency” – in effect, tried for being gay. His sentence – and he was faced with the miserable choice of this or prison – was chemical castration by a series of injections of female hormones. He took his own life just two years later.
Thousands of people have come together to demand justice for Alan Turing and recognition of the appalling way he was treated. While Turing was dealt with under the law of the time, and we can’t put the clock back, his treatment was of course utterly unfair, and I am pleased to have the chance to say how deeply sorry I and we all are for what happened to him. Alan and the many thousands of other gay men who were convicted, as he was convicted, under homophobic laws, were treated terribly. Over the years, millions more lived in fear in conviction. I am proud that those days are gone and that in the past 12 years this Government has done so much to make life fairer and more equal for our LGBT community. This recognition of Alan’s status as one of Britain’s most famous victims of homophobia is another step towards equality, and long overdue.

But even more than that, Alan deserves recognition for his contribution to humankind. For those of us born after 1945, into a Europe which is united, democratic and at peace, it is hard to imagine that our continent was once the theatre of mankind’s darkest hour. It is difficult to believe that in living memory, people could have become so consumed by hate – by anti-Semitism, by homophobia, by xenophobia and other murderous prejudices – that the gas chambers and crematoria became a piece of the European landscape as surely as the galleries and universities and concert halls which had marked out the European civilisation for hundreds of years.

It is thanks to men and women who were totally committed to fighting fascism, people like Alan Turing, that the horrors of the Holocaust and of total war are part of Europe’s history and not Europe’s present. So on behalf of the British government, and all those who live freely thanks to Alan’s work, I am very proud to say: we’re sorry. You deserved so much better.

The complete text of Gordon Brown’s apology to Alan Turing.
Letter to Winston Churchill

Secret and Confidential
Prime Minister only

Hut 6 and Hut 8
21st October 1941

Dear Prime Minister,

Some weeks ago you paid us the honour of a visit, and we believe that you regard our work as important. You will have seen that, thanks largely to the energy and foresight of Commander Travis, we have been well supplied with the ‘bombs’ for the breaking of the German Enigma codes. We think, however, that you ought to know that this work is being held up, and in some cases is not being done at all, principally because we cannot get sufficient staff to deal with it. Our reason for writing to you direct is that for months we have done everything that we possibly can through the normal channels, and that we despair of any early improvement without your intervention. No doubt in the long run these particular requirements will be met, but meanwhile still more precious months will have been wasted, and as our needs are continually expanding we see little hope of ever being adequately staffed.

We realise that there is a tremendous demand for labour of all kinds and that its allocation is a matter of priorities. The trouble to our mind is that as we are a very small section with numerically trivial requirements it is very difficult to bring home to the authorities finally responsible either the importance of what is done here or the urgent necessity of dealing promptly with our requests. At the same time we find it hard to believe that it is really impossible to produce quickly the additional staff that we need, even if this meant interfering with the normal machinery of allocations.

We do not wish to burden you with a detailed list of our difficulties, but the following are the bottlenecks which are causing us the most acute anxiety.

1. Breaking of Naval Enigma (Hut 8)

Owing to shortage of staff and the overworking of his present team the Hollerith section here under Mr Freeborn has had to stop working night shifts. The effect of this is that the finding of the naval keys is being delayed at least twelve hours every day. In order to enable him to start night shifts again Freeborn needs immediately about twenty more untrained Grade III women clerks. To put himself in a really adequate position to deal with any likely demands he will want a good many more.
A further serious danger now threatening us is that some of the skilled male staff, both with the British Tabulating Company at Letchworth and in Freeborn’s section here, who have so far been exempt from military service, are now liable to be called up.

2. Military and Air Force Enigma (Hut 6)

We are intercepting quite a substantial proportion of wireless traffic in the Middle East which cannot be picked up by our intercepting stations here. This contains among other things a good deal of new ‘Light Blue’ intelligence. Owing to shortage of trained typists, however, and the fatigue of our present decoding staff, we cannot get all this traffic decoded. This has been the state of affairs since May. Yet all that we need to put matters right is about twenty trained typists.

3. Bombe testing, Hut 6 and Hut 8

In July we were promised that the testing of the ‘stories’ produced by the bombes would be taken over by the WRNS in the bombe hut and that sufficient WRNS would be provided for this purpose. It is now late in October and nothing has been done. We do not wish to stress this so strongly as the two preceding points, because it has not actually delayed us in delivering the goods. It has, however, meant that staff in Huts 6 and 8 who are needed for other jobs have had to do the testing themselves. We cannot help feeling that with a Service matter of this kind it should have been possible to detail a body of WRNS for this purpose, if sufficiently urgent instructions had been sent to the right quarters.

4. Apart altogether from staff matters, there are a number of other directions in which it seems to us that we have met with unnecessary impediments. It would take too long to set these out in full, and we realise that some of the matters involved are controversial. The cumulative effect, however, has been to drive us to the conviction that the importance of the work is not being impressed with sufficient force upon those outside authorities with whom we have to deal.

We have written this letter entirely on our own initiative. We do not know who or what is responsible for our difficulties, and most emphatically we do not want to be taken as criticising Commander Travis who has all along done his utmost to help us in every possible way. But if we are to do our job as well as it could and should be done it is absolutely vital that our wants, small as they are, should be promptly attended to. We have felt that we should be failing in
our duty if we did not draw your attention to the facts and to the effects which they are having and must continue to have on our work, unless immediate action is taken.

We are, Sir, Your obedient servants,

A M Turing
W G Welchman
C H O’D Alexander
P S Milner-Barry

Alan Turing’s letter to Churchill.

Brian Randell Letter to Alan Turing’s mother.
Alan Turing's belongings from school and university days.

The Turing Bombe Rebuild Project, Bletchley Park Museum.
Alan Turing Teddy Bear, Bletchley Park Museum.
Bletchley Park : Mansion : Turing’s Blade.

The will of Alan Turing.
Letter written by Turing on solitaire.

Alan Turing’s Possessions.
Ethel Sara Turing (nee Stoney) in her old age. She died in 1976 aged 95.

Alan Turing monument in Sackville Gardens.
Alan Turing has been crowned the greatest person of the 20th Century by BBC viewers.

Turing was injected with Stilboestrol - a synthesised form of oestrogen.
Statement of apology by the Prime Minister, Gordon Brown, 10 September 2009:
... a quite brilliant mathematician... whose unique contribution helped to turn the tide of war... horrifying that he was treated so inhumanely...

Alan Turing – Timeline

1912 (23 June): Birth, Paddington, London

1926-31: Sherborne School

1930: Death of friend Christopher Morcom

1931-34: Undergraduate at King's College, Cambridge University

1932-35: Quantum mechanics, probability, logic. Fellow of King's College, Cambridge

1936: The Turing machine, computability, universal machine

1936-38: Princeton University. Ph.D. Logic, algebra, number theory

1938-39: Return to Cambridge. Introduced to German Enigma cipher machine

1939-40: The Bombe, machine for Enigma decryption

1939-42: Breaking of U-boat Enigma, saving battle of the Atlantic

1943-45: Chief Anglo-American crypto consultant. Electronic work.

1945: National Physical Laboratory, London

1946: Computer and software design leading the world.

1947-48: Programming, neural nets, and artificial intelligence
1948: Manchester University, first serious mathematical use of a computer

1950: The Turing Test for machine intelligence

1951: Elected FRS. Non-linear theory of biological growth

1952: Arrested as a homosexual, loss of security clearance

1953-54: Unfinished work in biology and physics

1954 (7 June): Death (suicide) by cyanide poisoning, Wilmslow, Cheshire.
CRG researchers confirm that a mathematical theory first proposed by Alan Turing in 1952 can explain the formation of fingers.

"Sometimes it is the people no one can imagine anything of who do the things no one can imagine."
— Alan Turing

"We can only see a short distance ahead, but we can see plenty there that needs to be done."
— Alan Turing, *Computing machinery and intelligence*

“I’m afraid that the following syllogism may be used by some in the future.

Turing believes machines think

Turing lies with men

Therefore machines do not think

Yours in distress,

Alan”

— Alan Turing
"I believe that at the end of the century the use of words and general educated opinion will have altered so much that one will be able to speak of machines thinking without expecting to be contradicted."
— Alan Turing, Computing machinery and intelligence

"Those who can imagine anything, can create the impossible."
— Alan Turing

"Sometimes it is the people who no one imagines anything of who do the things that no one can imagine."
— Alan Turing

"If a machine is expected to be infallible, it cannot also be intelligent."
— Alan Turing

"Finding such a person makes everyone else appear so ordinary...and if anything happens to him, you've got nothing left but to return to the ordinary world, and a kind of isolation that never existed before."
— Alan Turing

"The original question, 'Can machines think?' I believe to be too meaningless to deserve discussion."
— Alan Turing, Mechanical Intelligence: Collected Works of A.M. Turing

"A very large part of space-time must be investigated, if reliable results are to be obtained."
— Alan Turing

"Sometimes it is the people no one imagines anything of who do the things that no one can imagine."
— Alan Turing
"Do you know why people like violence? It is because it feels good. Humans find violence deeply satisfying. But remove the satisfaction, and the act becomes hollow."

— Alan Turing

"It is possible to invent a single machine which can be used to compute any computable sequence."

— Alan Turing

"We are not interested in the fact that the brain has the consistency of cold porridge."

— Alan Turing

"It is not possible to produce a set of rules purporting to describe what a man should do in every conceivable set of circumstances."

— Alan Turing, Computing machinery and intelligence

"The works and customs of mankind do not seem to be very suitable material to which to apply scientific induction."

— Alan Turing, Computing machinery and intelligence

"We like to believe that Man is in some subtle way superior to the rest of creation. It is best if he can be shown to be necessarily superior, for then there is no danger of him losing his commanding position."

— Alan Turing, Computing machinery and intelligence

"Can machines think?... The new form of the problem can be described in terms of a game which we call the " imitation game." It is played with three people, a man (A), a woman (B), and an interrogator (C) who may be of either sex. The interrogator stays in a room apart front the other two. The object of the game for the interrogator is to determine which of the other two is the man and which is the woman. He knows them by labels X and Y, and at the end of the game he says either "X is A and Y is B" or "X is B and Y is A." The interrogator is allowed to put questions to A and B... We now ask the question, "What will happen when a machine takes the part of A in this game?" Will the interrogator decide wrongly as often when the game is played
like this as he does when the game is played between a man and a woman? These questions replace our original, “Can machines think?”

— Alan Turing, Computing machinery and intelligence

"I've now got myself into the kind of trouble that I have always considered to be quite a possibility for me, though I have usually rated it at about 10:1 against. I shall shortly be pleading guilty to a charge of sexual offences with a young man. The story of how it all came to be found out is a long and fascinating one, which I shall have to make into a short story one day, but haven't the time to tell you now. No doubt I shall emerge from it all a different man, but quite who I've not found out."

— Alan Turing

"The popular view that scientists proceed inexorably from well-established fact to well-established fact, never being influenced by any unproved conjecture, is quite mistaken. Provided it is made clear which are proved facts and which are conjectures, no harm can result. Conjectures are of great importance since they suggest useful lines of research."

— Alan Turing, Alan Turing: The Enigma

---

Alan Turing--Report Card Teachers' Comments, 1926-1931

Subject: Mathematics

1926. Works well. He is still very untidy. He must try to improve in this respect

1927. Very good. He has considerable powers of reasoning and should do well if he can quicken up a little and improve his style.

____. A very good term’s work, but his style is dreadful and his paper always dirty.

____. Not very good. He spends a good deal of time apparently in investigations in advanced mathematics to the neglect of his elementary work. A sound ground work is essential in any subject. His work is dirty.

____. Despite absence he has done a really remarkable examination (1st paper). A mathematician I think.

____ I think he has been somewhat tidier, though there is still plenty of room for improvement. A keen & able mathematician.
1928. *Easily the best mathematician in the set. His position is caused by untidiness and carelessness due largely to impatience to let on something great as soon as he has seen his way through a problem.*

____. *This term has been spent, & the next two terms will have to be spent, in filling in the many gaps in his knowledge & organising it. He thinks very rapidly & is apt to be “brilliant”, but unsound in some of his work. He is seldom defeated by a problem, but his methods are often crude, cumbersome & untidy. But thoroughness & polish will no doubt come in time.*

1929. *His work on Higher Certificate papers shows distinct promise, but he must realise that ability to put a neat & tidy solution on paper – intelligible & legible – is necessary for a first-rate mathematician.*

1930. *He has faced the uninspiring task of revision & consolidation of his previous knowledge with determination, and I think he has succeeded in improving his style of written work, which is more convincing & less sketchy than last year. If he does not get flustered & relapse into slip-shod work, he should do very well in the H.C. this year.*

____. *A really able mathematician. His trouble is his untidiness & poor style, but he has tried hard to improve in this. He sometimes fails over a simple problem by trying to do it by complicated methods, instead of by an elementary one.*

1931. *He has done some post-scholarship reading without encountering any serious difficulties. He should be able to take the Higher Certificate next July in his stride.*

____. *He has gone on with his reading as well as revising the elementary work for the Higher Certificate, & I expect him to get a Distinction with ease. He has my best wishes for an equally successful career at Cambridge.*

Subject: **Natural Science**

1926. *He is keen & has a natural bent for science, but his work is badly spoilt by extreme untidiness.*

Subject: **English.**

1926. *Without being lazy, he seems to do his work rather perfunctorily. I should like to see rather more life in him.*

1928. *His English work is becoming less feeble. He undoubtedly has brains, but is only slowly learning to apply them to subjects for which he has little interest.*

1930. *His reading is too deliberate. On paper he is usually sensible.*

Subject: **Chemistry.**

1930. *If the questions suit him, he is certain of getting a scholarship: but I do not feel that his knowledge is sufficiently all-round to make him independent of luck in the examination.*

Subject: **Physics.**

1928 *He has done some quite good work by himself in my room. Good work.*

1930. *He has done some excellent work, mostly strict training for his scholarship examination. I can only hope Cambridge will think as well of him as I do.*

1931. *He continues to take a genuine interest in physics.*

**House Report**

1927 *He is frankly not one who fits comfortably for himself into the ordinary life of the place – on the whole I think he is tidier.*
No doubt he is a strange mixture: trying to build a roof before he has laid the foundations. Having secured one privileged exemption, he is mistaken in acting as if idleness and indifference will procure further release from uncongenial subjects.

Rather more tidy: & the one paper I looked over of his was certainly better than I expected in neatness. He certainly has ideas & imagination.

I have seen cleaner productions than this specimen, even from him. No doubt he is very aggravating: & he should know by now that I don’t care to find him boiling heaven knows what witches’ brew by the aid of two guttering candles on a naked wooden window sill. However he has borne his afflictions very cheerfully: & undoubtedly has taken more trouble, e.g. with physical training. I am far from hopeless.

1928. Satisfactory. I am very glad that he is sociable & makes friends: & he seems unselfish in temper. He is certainly ambitious.

1931. He has had an interesting career, with varied experience: & brought it to a very successful close. I am grateful to him for his essentially loyal help: & I hope he will reap further reward at King’s, both in work & friendships.
Alan Turing’s secret papers.

Alan Turing, who worked at Bletchley Park breaking codes. Plans are now afoot to restore Block C.
Turing was prosecuted in 1952 for homosexual acts, when such behavior was still criminalized in the UK. He accepted treatment with oestrogen injections (chemical castration) as an alternative to prison. Turing died in 1954, 16 days before his 42nd birthday, from cyanide poisoning.

Open letter asking the government to pardon 49,000 men who were prosecuted for being gay.
PROPOSED ELECTRONIC CALCULATOR.

PART I.

Descriptive Account.

1. Introductory.

Calculating machinery in the past has been designed to carry out accurately and moderately quickly small parts of calculations which frequently recur. The four processes addition, subtraction, multiplication and division, together perhaps with sorting and interpolation, cover all that could be done until quite recently, if we except machines of the nature of the differential analyser and wind tunnels, etc. which operate by measurement rather than by calculation.

It is intended that the electronic calculator now proposed should be different in that it will tackle whole problems. Instead of repeatedly using human labour for taking material out of the machine and putting it back at the appropriate moment all this will be looked after by the machine itself. This arrangement has very many advantages.

(1) The speed of the machine is no longer limited by the speed of the human operator.

(2) The human element of fallibility is eliminated, although it may to an extent be replaced by mechanical fallibility.

(3) Very much more complicated processes can be carried out than could easily be dealt with by human labour.

Once the human brake is removed the increase in speed is enormous. For example, it is intended that multiplication of two ten figure numbers shall be carried out in 500 μs. This is probably about 20,000 times faster than the normal speed with calculating machines.
Dear Dr. Ashby,

Sir Charles Darwin has shown me your letter, and I am most interested to find that there is someone working along these lines. In working on the ACE I am more interested in the possibility of producing models of the action of the brain than in the practical applications to computing. I am most anxious to read your paper.

The ACE will be used, as you suggest, in the first instance in an entirely disciplined manner, similar to the action of the lower centres, although the reflexes will be extremely complicated. The disciplined action carries with it the disagreeable feature, which you mentioned, that it will be entirely unsatisfactory when anything goes wrong. It will also be necessarily devoid of anything that could be called originality. There is, however, no reason why the machine should always be used in such a manner; there is nothing in its construction which obliges us to do so. It would be quite possible for the machine to try out variations of behaviour and accept or reject them in the manner you describe and I have been hoping to make the machine do this. This is possible because, without altering the design of the machine itself, it can, in theory at any rate, be used as a model of any other machine, by making it remember a suitable set of instructions.

Dr. W. R. Ashby, M.A.,
"Green Tidges"
Church Way,
Worton Poyell,
Northampton.

Letter from Turing to Sir W. Ross Ashby, describing how ACE could be used to mimic how the human brain works.
A report written by Turing in 1948 titled "Intelligent Machinery" is the most detailed treating of artificial intelligence written before 1950. It was not published during Turing's lifetime.
CALCULUS TO SONNET

Mr. Turing said yesterday: "This is only a foretaste of what is to come, and only the shadow of what is going to be. We have to have some experience with the machine before we really know its capabilities. It may take years before we settle down to the new possibilities, but I do not see why it should not enter any one of the fields normally covered by the human intellect, and eventually compete on equal terms.

"I do not think you can even draw the line about sonnets, though the comparison is perhaps a little bit unfair because a sonnet written by a machine will be better appreciated by another machine."

Mr. Turing added that the university was really interested in the investigation of the possibilities of machines for their own sake. Their research would be directed to finding the degree of intellectual activity of which a machine was capable, and to what extent it could think for itself.

News of the experiments was disclosed by Professor Jefferson in the Lister oration reported in The Times yesterday.
1. The Imitation Game.

I propose to consider the question, 'Can machines think?' This should begin with definitions of the meaning of the terms 'machine' and 'think'. The definitions might be framed so as to reflect as far as possible the normal use of the words, but this attitude is dangerous. If the meaning of the words 'machine' and 'think' are to be found by examining how they are commonly used it is difficult to escape the conclusion that the meaning and the answer to the question, 'Can machines think?' is to be sought in a statistical survey such as a Gallup poll. But this is absurd. Instead of attempting such a definition I shall replace the question by another, which is closely related to it and is expressed in relatively unambiguous words.

The new form of the problem can be described in terms of a game which we call the 'imitation game'. It is played with three people, a man (A), a woman (B), and an interrogator (C) who may be of either sex. The interrogator stays in a room apart from the other two. The object of the game for the interrogator is to determine which of the other two is the man and which is the woman. He knows them by labels X and Y, and at the end of the game he says either 'X is A and Y is B' or 'X is B and Y is A'. The interrogator is allowed to put questions to A and B thus:

C: Will X please tell me the length of his or her hair?

Now suppose X is actually A, then A must answer. It is A's
Alan Turing (1912-1954)

British cryptanalyst, logician, philosopher and mathematician widely recognized as a pioneer of artificial intelligence and the father of computer science.
In August 2009, petition started urging the British Government to posthumously apologize to Alan Turing for prosecuting him as a homosexual. The petition received thousands of signatures. Prime Minister Gordon Brown acknowledged the petition, releasing a statement on 10 September 2009 apologizing and describing Turing’s treatment as “appalling”:

“Thousands of people have come together to demand justice for Alan Turing and recognition of the appalling* way he was treated. While Turing was dealt with under the law of the time and we can’t put the clock back, his treatment was of course utterly unfair and I am pleased to have the chance to say how deeply sorry I and we all are for what happened to him ...

So on behalf of the British government, and all those who live freely thanks to Alan’s work I am very proud to say: we’re sorry, you deserved so much better.”

* = inexcusable.

In August 2009, petition started urging the British Government to posthumously apologize to Alan Turing for prosecuting him as a homosexual.
POST SECRET

ENIGMA - POSITION

1. Stabilisation and synchronisation are carried through. We have enough Enigmas.
   Plain catalogue is complete and punched. At moment under revision. Will be duplicated for French. This is the only work on hand at present.

2. CYCLOMETERS.
   Gadget (a). An old (P.O.) cycloimeter too elaborate for use, since original purpose does not now obtain.
   Gadget (b). A small hand sex-cycloimeter which was a mere draft, cannot be worked at a remunerative speed and is more often in course of repair than working.
   Gadget (c). A machine sex-cycloimeter is promised in a fortnight. Its [sic] results should be punched.

3. PUNCHES.
   We have two, and two more punches on order. Probably two more punch machines will be required.

4. A large 30 Enigma bomb machine, adapted to use for crypts, is on order and parts are being made at the British Tabulating Company.

5. ENIGMA MAINTENANCE.
   6. See Appendix I.
   7. See Appendix II.

6. ENIGMA MAINTENANCE.

8. Machine of silo order to work on cycloimeter results. No good results can be obtained from applying hand methods either.

SIGNED: A.O. KNOX
         P.F.G. TURNI
         W.G. HELOWAN
         A.H. TURING
         J.R. Jefferys [Handwritten]
1st November, 1939.

APPENDIX II

NAVAL ENIGMA SITUATION

The solution of Naval Enigma will divide itself into two parts, that of solving one message of a day, and that of solving further messages.

The first problem is to be tackled by:

(b). By the machine now being made at Letchworth, resembling, but far larger than the Bombe of the Polish (superbombe machine).

If one message is solved by one of these means we shall have the machine settings for the day, viz. Waleinlage, Steckerverbindungen, Ringstellung, but not Grundstellung nor list of bigrams used in the indicating system. We might also obtain the Stecker by capture.

For the second problem i.e. solving further messages, we may either:

(i) Guess three or four letters of the message.
(ii) Make use of another machine, the "rack", which operates by so setting the messages that the decode contains sufficiently many letters E.

We have at present no information which will be of use for Method (i), although when a number of messages have been solved it may be applicable. Without a "rack" we shall, therefore, not be able to get any further if, for instance, position stecker were captured from a submarine.

With the "rack" we shall, in such cases, almost certainly be able to solve 40% of the messages, and probably 70%. If by that time we are able to apply Method (ii) as well, we may be able to solve as many as 200 messages on that day. If this ever happens it will be possible to solve the indicating system, i.e. to obtain the bigram list. This will enable us to solve all further messages for that day at once, and, on later days while the bigram list lasts, to solve all the messages as soon as a single message has been solved for that day.

We feel that no unnecessary time should be lost in experimenting with and constructing such a machine.

SIGNED: A.O. KNOX
         P.F.G. TURNI
         W.G. HELOWAN
         A.H. TURING
         J.R. Jefferys [Handwritten]
1st November, 1939.
“Let us return for a moment to Lady Lovelace’s objection, which stated that the machine can only do what we tell it to do.”
- Alan Turing
A University of Wolverhampton building has been renamed in honour of mathematician and wartime codebreaker Alan Turing.
In 2009, the British Government issued this posthumous apology to Alan Turing but he was not pardoned.

Papers belonging to and associated with Alan Turing.
Alan Turing’s Secret Code-Breaking Essay.

“I believe that at the end of the century the use of words and general educated opinion will have altered so much that one will be able to speak of machines thinking without expecting to be contradicted.”

— Alan Turing, Computing machinery and intelligence