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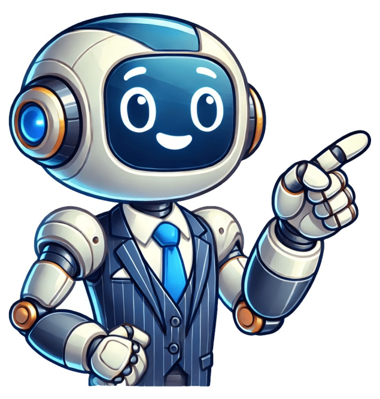

,the free encyclopedia that anyone can edit.117,937 active editors 7,000,601 articles in EnglishAndrea Navagero (14831529) was a Venetian diplomat and writer. He entered the Great Council of Venice at the age of twenty, five years younger than was normal at the time. He edited manuscripts at the Aldine Press, garnering a reputation as a scholar and a highly skilled writer. In 1515, he was appointed the official historian of the Republic of Venice as well as the caretaker of a library containing the collection of the scholar Bessarion. Navagero was named the Venetian ambassador to Spain in 1523 and navigated the volatile diplomatic climate caused by the conflict between CharlesV of Spain and FrancisI of France. By the time Navagero arrived back in Venice in 1528, he had grown disillusioned with politics and wished to return to editing manuscripts and cultivating his prized gardens. Much to his dismay, he was appointed ambassador to France in January 1529. After traveling to meet with FrancisI, he fell ill and died that May.(Fullarticle...)Recently featured: Nosy KombaMcDonnell Douglas Phantom in UK serviceTransportation during the 2024 Summer Olympics and ParalympicsArchiveBy emailMore featured articlesAboutEngraving of the Great Pyramid of Giza... that the 1572 Eight Wonders of the World (engraving pictured) is the source of the modern list of classical Seven Wonders of the World?... that Hedwig Tam gained 20 pounds to play a postpartum mother in Montages of a Modern Motherhood?... that the Alfonsine Ordinances punished Jews and Muslims with enslavement if they disguised their identity with the intention of "sinning with Christian women"?... that even though he had never seen a field hockey game, Willy Miranda became a high school coach and went on to win over 450 games across a 42-year tenure?... that a false viral rumour claimed 42 people committed suicide after their homoerotic fan art was included in the film Crazy About One Direction?... that an Arizona TV station put a satellite dish in a vacant swimming pool?... that 42 years after Jilly Cooper's How to Stay Married was first published, she described it as "terribly politically incorrect"?... that wrestler Kurt Howell won all 108 of his matches in high school?... that the second-place candidate in the 2018 Taipei mayoral election lost by just 0.23%, demanded a recount, and ended up losing by even more?ArchiveStart a new articleNominate an articleJafar Panahinosato Daiki becomes sumo's 75th yokozuna.In motor racing, lex Palou wins the Indianapolis 500.In basketball, the EuroLeague concludes with Fenerbahe winning the Final Four Playoff.It Was Just an Accident (director Jafar Panahi pictured) wins the Palme d'Or at the Cannes Film Festival.Ongoing: Gaza warM23 campaignRussian invasion of UkrainetimelineSudanese civil wartimelineRecent deaths: Mary K. GaillardPeter DavidAlan YentobGerry ConnollySebastio SalgadoAlfredo PalacioNominate an articleMay 29: Feast day of Saint PaulVI (Catholicism)Headline in the New York Times1233 MongolJin War: The Mongols entered and began looting Kaifeng, the capital of the Jin dynasty of China, after a 13-month siege.1416 A squadron of the Venetian navy captured many Ottoman ships at the Battle of Gallipoli, confirming Venetian naval superiority in the Aegean Sea for the next few decades.1913 During the premiere of the ballet Le Sacre du printemps by Igor Stravinsky at the Thtre des Champs-lyses in Paris, the avant-garde nature of the music and choreography caused a near-riot in the audience (report pictured).1999 Charlotte Perrelli, representing Sweden, won the Eurovision Song Contest, the first edition not to feature an orchestra or live accompaniment.2011 Residents of Portland, Oregon, held a rally called Hands Across Hawthorne in response to an attack against a gay couple holding hands while crossing the Hawthorne Bridge.Benedetto Pistrucci (b.1783)G.K. Chesterton (b.1874)Hubert Opperman (b.1904)Uro Drenovi (d.1944)More anniversaries: May 28May 29May 30ArchiveBy emailList of days of the yearAboutThe Australian white ibis (Threskiornis molucca) is a wading bird of the ibis family, Threskiornithidae. It is widespread across much of Australia, and has a predominantly white plumage with a bare, black head, long downcurved bill, and black legs. While it is closely related to the African sacred ibis, the Australian white ibis is a native Australian bird. Due to its increasing presence in the urban environment and its habit of rummaging in garbage, the species has acquired a variety of colloquial names such as "tip turkey" and "bin chicken". This Australian white ibis was photographed at the Royal Botanic Garden, Sydney.Photograph credit: Charles J. SharpRecently featured: Hell Gate BridgeAnemonoides blandaBluespotted ribbontail rayArchiveMore featured picturesCommunity portal The central hub for editors, with resources, links, tasks, and announcements.Village pump Forum for discussions about Wikipedia itself, including policies and technical issues.Site news Sources of news about Wikipedia and the broader Wikimedia movement.Teahouse Ask basic questions about using or editing Wikipedia.Help desk Ask questions about using or editing Wikipedia.Reference desk Ask research questions about encyclopedic topics.Content portals A unique way to navigate the encyclopedia.Wikipedia is written by volunteer editors and hosted by the Wikimedia Foundation, a non-profit organization that also hosts a range of other volunteer projects: CommonsFree media repository MediaWikiWiki software development Meta-WikiWikimedia project coordination WikibooksFree textbooks and manuals WikidataFree knowledge base WikinewsFree-content news WikiquoteCollection of quotations WikisourceFree-content library WikispeciesDirectory of species WikiversityFree learning tools WikivoyageFree travel guide WiktionaryDictionary and thesaurusThis Wikipedia is written in English. Many other Wikipedias are available; some of the largest are listed below. 1,000,000+ articles DeutschEspaolFranaisItalianoNederlandsPolskiPortugusSvenskaTing Vit 250,000+ articles Bahasa IndonesiaBahasa MelayuBn-lm-gCataletinaDanskEestiEsperantoEuskaraMagyarNorsk bokmlRomnSimple EnglishSloveninaSrpskiSrpskohrvatskiSuomiTrkeOzbekcha 50,000+ articles AsturianuAzrbaycancaBosanskiFryskGaeilgeGalegoHrvatskiKurdLatvieuLietuviNorsk nynorskShqipSlovenina Retrieved from " 2Calendar yearYearsMillennium2ndmillenniumCenturies12thcentury13thcentury 14thcenturyDecades1210s1220s1230s 1240s1250sYears1230123112321233 123412351236vte1233 by topicLeadersPolitical entitiesState leadersReligious leadersBirth and death categoriesBirths DeathsEstablishments and disestablishments categoriesEstablishments DisestablishmentsArt and literature1233 in poetryvte1233 in various calendarsGregorian calendar1233MCCXXXIIIAb urbe condita1986Armenian calendar682 Assyrian calendar5983Balinese saka calendar11541155Bengali calendar639640Berber calendar2183English Regnal year17Hen.318Hen.3Buddhist calendar1777Burmese calendar595Byzantine calendar67416742Chinese calendar (WaterDragon)3930 or 3723to (WaterSnake)3931 or 3724Coptic calendar949950Discordian calendar2399Ethiopian calendar12251226Hebrew calendar49934994Hindu calendars- Vikram Samvat12891290- Shaka Samvat11541155- Kali Yuga43334334Holocene calendar11233Igbo calendar233234Iranian calendar611612Islamic calendar630631Japanese calendarJei 2 / Tenpuku 1()Javanese calendar11421143Julian calendar1233MCCXXXIIIKorean calendar3566Minguo calendar679 before ROC679Nanakshahi calendar235Thai solar calendar17751776Tibetan calendar(male Water-Dragon)1359 or 978 or 206to(female Water-Snake)1360 or 979 or 207 Henry I of Cyprus receives a messageYear 1233 (MCCXXXIII) was a common year starting on Saturday of the Julian calendar.War of the Lombards: Lombard forces at Kyrenia surrender to John of Beirut, after a 10-month siege. The defenders, with their personal belongings, are allowed to retire to Tyre. Captured prisoners are exchanged for those held by Richard Filangieri, commander of the Lombards, at Tyre. Cyprus is wholly restored under the rule of the 16-year-old King Henry I ("the Fat"). His vassals are rewarded, and loans that they have made are repaid.[1]August 20 Oath of Bereg: King Andrew II of Hungary vows to the Holy See that he will not employ Jews and Muslims to administer royal revenues, which causes diplomatic complaints and ecclesiastical censures.[2]Winter Reconquista: King Ferdinand III of Castile ("the Saint") conquers the cities of Trujillo and beda. The Castilian army besieges the city of Peniscola. Ferdinand forces Ibn Hud, ruler of the Taifa of Zaragoza, to sign a truce.[3]August Richard Marshal, 3rd Earl of Pembroke, signs an alliance with Llywelyn the Great, to join forces to revolt against King Henry III. Richard is faced by demands from royal bailiffs in September where the garrison of Usk Castle is forced to surrender.November Henry III's army camped at Grosmont Castle is attacked in the night, by a force of Welsh and English rebels. Several of Henry's supporters are captured, and the castle is returned to Hubert de Burgh, one of the rebels.May 29 MongolJin War: The Mongol army led by gedei Khan captures Kaifeng, capital of the Jin dynasty ('Great Jin'), after the 13-month Siege of Kaifeng (1232). The Mongols plunder the city, while Emperor Aizong of Jin flees for the town of Caizhou. Meanwhile, gedei departs and leaves the final conquest to his favoured general, Subutai.December Siege of Caizhou: The Mongols under gedei Khan besiege Caizhou and ally themselves with the Chinese Song dynasty to eliminate the Jin Dynasty.Gendt receives its city rights from Otto II ("the Lame"), count of Guelders (modern Netherlands).Pope Gregory IX establishes the Papal Inquisition, to regularize the persecution of heresy.June/July Ibn Manzur, Arab lexicographer and writer (d. 1312)August 15 Philip Benizi de Damiani, Italian religious leader (d. 1285)October Al-Nawawi, Syrian scholar, jurist and writer (d. 1277)Adelaide of Burgundy, duchess of Brabant (d. 1273)Choe Ui, Korean military leader and dictator (d. 1258)Ibn al-Quff, Ayyubid physician and surgeon (d. 1286)Sancho of Castile, archbishop of Toledo (d. 1261)January 6 Matilda of Chester, Countess of Huntingdon (or Maud), English noblewoman (b. 1171)January 18 Yang (or Gongsheng), Chinese empress (b. 1162)February 12 Ermengarde de Beaumont, queen of ScotlandMarch 1 Thomas I (or Tommaso), count of Savoy (b. 1178)May Simon of Joinville, French nobleman and knight (b. 1175)June Yolanda de Courtenay, queen consort of HungaryJuly 8 Konoe Motomichi, Japanese nobleman (b. 1160)July 26 Wilbrand of Oldenburg, prince-bishop of UtrechtJuly 27 Ferdinand (or Ferrand), count of Flanders (b. 1188)July 29 Savari de Maulon, French nobleman (b. 1181)July 30 Konrad von Marburg, German priest (b. 1180)October 8 Ugo Canefri, Italian health worker (b. 1148)October 22 Fujiwara no Shunshi, Japanese empress consort (b. 1209)November 22 Helena, duchess of Brunswick-LneburgNovember 27 Shi Miyuan, Chinese politician (b. 1164)Ibn al-Athir, Seljuk historian and biographer (b. 1160)Bertran de Born lo Filhs, French troubadour (b. 1179)Bohemond IV ("the One-Eyed"), prince of Antioch (b. 1175)Gkbri ("Blue-Wolf"), Ayyubid general and ruler (b. 1154)Guilln Prez de Guzmn, Spanish nobleman (b. 1180)John Apokaukos, Byzantine bishop and theologianMathilde of Angoulme, French noblewoman (b. 1181)Sayf al-Din al-Amidi, Ayyubid scholar and jurist (b. 1156)William Comyn, Scoto-Norman nobleman (b. 1163)^ Steven Runciman (1952). A History of The Crusades. Vol III: The Kingdom of Acre, pp. 169170. ISBN978-0-241-29877-0.^ Berend, Nora (2001). At the Gate of Christendom: Jews, Muslims and "Pagans" in Medieval Hungary, c. 1000-c.1300. Cambridge University Press. p.158. ISBN978-0-521-02720-5.^ Lourie, Elena (2004). Jews, Muslims, and Christians in and around the Crown of Aragon: essays in honour of Professor Elena Lourie. Brill. p.270. ISBN90-04-12951-0.[permanent dead link]Retrieved from " 3One hundred years, from 1101 to 1200See also: Renaissance of the 12th centuryMillennia2ndmillenniumCenturies11thcentury12thcentury13thcenturyTimelines11thcentury12thcentury13thcenturyState leaders11thcentury12thcentury13thcenturyDecades1100s1110s1120s1130s1140s1150s1160s1170s1180s1190sCategories:Births Deaths Establishments DisestablishmentsvteEastern Hemisphere at the beginning of the 12th centuryThe 12th century is the period from 1101 to 1200 in accordance with the Julian calendar. In the history of European culture, this period is considered part of the High Middle Ages and overlaps with what is often called the "'Golden Age' of the Cistercians". The Golden Age of Islam experienced significant development, particularly in Islamic Spain.In Song dynasty China, an invasion by Jurchens caused a political schism of north and south. The Khmer Empire of Cambodia flourished during this century, while the Fatimids of Egypt were overtaken by the Ayyubid dynasty. Following the expansions of the Ghaznavids and Ghurid Empire, the Muslim conquests in the Indian subcontinent took place at the end of the century.The Ghurid Empire converted to Islam from Buddhism.1101: In July, the Treaty of Alton is signed between Henry I of England and his older brother Robert, Duke of Normandy in which Robert agrees to recognize Henry as king of England in exchange for a yearly stipend and other concessions. The agreement temporarily ends a crisis in the succession of the Anglo-Norman kings.11011103: David the Builder takes over Kakheti and Hereti (now parts of Georgia).1102: King Coloman unites Hungary and Croatia under the Hungarian Crown.1102: Muslims conquer Seoro de Valencia.11031104: A church council is convened by King David the Builder in Urbnisi to reorganize the Georgian Orthodox Church.1104: In the Battle of Ertsukhi, King David the Builder defeats an army of Seljuks.1104: King Jayawarsa of Kadiri (on Java) ascends to the throne.[citation needed]1106: Battle of Tinchebray.11071111: Sigurd I of Norway becomes the first Norwegian king to embark on a crusade to the Holy Land. He fights in Lisbon and on various Mediterranean isles and helps the King of Jerusalem to take Sidon from the Muslims.1108: By the Treaty of Devol, signed in September, Bohemond I of Antioch has to submit to the Byzantine Empire, becoming the vassal of Alexius I.1109: On June 10, Bertrand of Toulouse captures the County of Tripoli (northern Lebanon/western Syria).1109: In the Battle of Nako, Boleslaus III Wrymouth defeats the Pomeranians and re-establishes Polish access to the sea.1109: On August 24, in the Battle of Hundsfeld, Boleslaus III Wrymouth defeats Emperor Henry V of Germany and stops German expansion eastward.1111: On April 14, during Henry V's first expedition to Rome, he is crowned Holy Roman Emperor.1113: Paramavishnulok is crowned as King Suryavarman II in Cambodia. He expands the Khmer Empire and builds Angkor Wat during the first half of the century. He establishes diplomatic relations with China.1115: The Georgian army occupies Rustavi in the war with the Muslims.1115: In Java, King Kamesvara of Kadiri ascends to the throne. Janggala ceases to exist and comes under Kadiri domination, highly possible under royal marriage. During his reign, Mpu Dharmaja writes Kakawin Smaradahana, a eulogy for the king which become the inspiration for the Panji cycle tales, which spread across Southeast Asia.[1]1116: The Byzantine army defeats the Turks at Philomelion.1116: Death of doa Jimena Daz, governor of Valencia from 1099 to 1102.c. 1119: The Knights Templar are founded to protect Christian pilgrims in Jerusalem.A Black and White Photo of the 12th century Cuenca Cathedral (built from 1182 to 1270) in Cuenca, Spain1120: On January 16, the Council of Nablus, a council of ecclesiastic and secular lords in the crusader Kingdom of Jerusalem, establishes the first written laws for the kingdom.1120: On November 25, William Adelin, the only legitimate son of King Henry I of England, drowns in the White Ship Disaster, leading to a succession crisis which will bring down the Norman monarchy of England.1121: On August 12, in the Battle of Didgori, the greatest military victory in Georgian history, King David the Builder with 45,000 Georgians, 15,000 Kipchak auxiliaries, 500 Alan mercenaries and 100 French Crusaders defeats a much larger Seljuk-led Muslim coalition army.1121: On December 25, St. Norbert and 29 companions make their solemn vows in Premontre, France, establishing the Premonstratensian Order.1122: The Battle of Beroia (Modern-day Stara Zagora, Bulgaria) results in the disappearance of the Pechenegs Turkish tribe as an independent force.1122: On September 23, the Concordat of Worms (Pactum Calixtinum) is drawn up between Emperor Henry V and Pope Calixtus II bringing an end to the first phase of the power struggle between the papacy and the Holy Roman Empire.1122: King David the Builder captures Tbilisi and declares it the capital city of Georgia, ending 400 years of Arab rule.1123: The Jurchen dynasty of China forces Koryo (now Korea) to recognize their suzerainty.1124: In April or May, David I is crowned King of the Scots.1125: On June 11, in the Battle of Azaz, the Crusader states, led by King Baldwin II of Jerusalem, defeat the Seljuk Turks.1125: In November, the Jurchens of the Jin dynasty declare war on the Song dynasty, beginning the JinSong wars.1125: Lothair of Supplinburg, duke of Saxony, is elected Holy Roman Emperor instead of the nearest heir, Frederick of Swabia, beginning the great struggle between Guelphs and Ghibellines.1127: The Northern Song dynasty loses power over northern China to the Jin dynasty.1128: On June 24, the Kingdom of Portugal gains independence from the Kingdom of Len at the Battle of So Mamede; (recognised by Len in 1143).The temple complex of Angkor Wat, built during the reign of Suryavarman II in Cambodia of the Khmer Era.11301180: 50-year drought in what is now the American Southwest.11301138: Papal schism, Pope Innocent II vs. Antipope Anacletus II.1130: On March 26, Sigurd I of Norway dies. A golden era of 95 years comes to an end for Norway as civil wars between the members of Harald Fairhair's family line rage for the remainder of the century.1130: On Christmas Day, Roger II is crowned King of Sicily, the royal title being bestowed on him by Antipope Anacletus II.1132: The Southern Song dynasty establishes China's first permanent standing navy, although China had a long naval history prior. The main admiral's office is at the port of Dinghai.11321183: the Chinese navy increases from a mere 3,000 to 52,000 marine soldiers stationed in 20 different squadrons. During this time, hundreds of treadmill-operated paddle wheel craft are assembled for the navy to fight the Jin dynasty in the north.1135: King Jayabaya of Kadiri ascends to the throne.[2]11351154: The Anarchy takes place, during a period of civil war in England.1136: Suger begins rebuilding the abbey church at St Denis north of Paris, which is regarded as the first major Gothic building.1137: On July 22, the future King Louis VII of France marries Eleanor, the Duchess of Aquitaine.1138: On October 11, the 1138 Aleppo earthquake devastates much of northern Syria.1139: in April, the Second Lateran Council ends the papal schism.1139: On July 5, in the Treaty of Mignano, Pope Innocent II confirms Roger II as King of Sicily, Duke of Apulia, and Prince of Capua and invests him with his titles.1139: On July 25, the Portuguese defeat the Almoravids led by Ali ibn Yusuf in the Battle of Ourique; Prince Afonso Henriques is acclaimed King of Portugal by his soldiers.Averroes in a 14th-century painting by Andrea di Bonaiuto11401150: Collapse of the Ancestral Puebloan culture at Chaco Canyon (modern-day New Mexico).1141: The Treaty of Shaoxing ends the conflict between the Jin dynasty and Southern Song dynasty, legally establishing the boundaries of the two countries and forcing the Song dynasty to renounce all claims to its former territories north of the Huai River. The treaty reduces the Southern Song into a quasi-tributary state of the Jurchen Jin dynasty.1143: Manuel I Komnenos is crowned as Byzantine emperor after the death of John II Komnenos.1143: Afonso Henriques is proclaimed King of Portugal by the cortes.1143: The Treaty of Zamora recognizes Portuguese independence from the Kingdom of Len. Portugal also recognizes the suzerainty of the pope.1144: On December 24, Edessa falls to the Atabeg Zengi.11451148: The Second Crusade is launched in response to the fall of the County of Edessa.1147: On October 25, the four-month-long Siege of Lisbon successfully brings the city under definitive Portuguese control, expelling the Moorish overlords.1147: A new Berber dynasty, the Almohads, led by Emir Abd al-Mu'min, takes North Africa from the Almoravides and soon invades the Iberian Peninsula. The Almohads began as a religious movement to rid Islam of impurities.1147: The Wendish Crusade against the Polabian Slavs (or "Wends") in what is now northern and eastern Germany.1150: Ramon Berenguer IV, Count of Barcelona marries Petronilla, the Queen of Aragon.1151: The Treaty of Tudiln is signed by Alfonso VII of Len and Raymond Berengar IV, Count of Barcelona, recognizing the Aragonese conquests south of the Jcar and the right to expand in and annex the Kingdom of Murcia.1153: The Treaty of Wallingford, ends the civil war between Empress Matilda and her cousin King Stephen of England fought over the English crown. Stephen acknowledges Matilda's son Henry of Anjou as heir.1153: The First Treaty of Constance is signed between Emperor Frederick I and Pope Eugene III, by the terms of which, the emperor is to prevent any action by Manuel I Comnenus to reestablish the Byzantine Empire on Italian soil and to assist the pope against his enemies in revolt in Rome.1154: the Moroccan-born Muslim geographer Muhammad al-Idrisi publishes his Geography.1154: On December 27, Henry II is crowned King of England at Westminster Abbey.1155: Pope Adrian IV grants overlordship of Ireland to Henry II of England in the bull Laudabiliter.1156: On June 18, the Treaty of Benevento is entered into by Pope Adrian IV and the Norman Kingdom of Sicily. After years of turbulent relations, the popes finally settles down to peace with the Hauteville kings. The kingship of William I is recognized over all Sicily, Apulia, Calabria, Campania, and Capua. The tribute to the pope of 600 schifati agreed upon by Roger II in 1139 at Mignano is affirmed and another 400 shift is added for the new lands.1158: The Treaty of Sahagn ends the war between Castile and Len.The Liuhe Pagoda of Hangzhou, China, 11651161: the Song dynasty Chinese navy, employing gunpowder bombs launched from trebuchets, defeats the enormous Jin dynasty navy in the East China Sea in the Battle of Tangdao and on the Yangtze River in the Battle of Caishi.1161: Kilij Arslan II, Sultan of Rum, makes peace with the Byzantine Empire, recognizing the emperor's primacy.1161: In the siege of Ani, troops from the Kingdom of Georgia take control over the city, only to have it sold for the second time to the Shaddadids, a Kurdish dynasty.1162: Genghis Khan, the founder of the Mongol Empire, is born as Temjin in present-day Mongolia.1163: The Norwegian Law of Succession takes effect.11651182: Tensions and disputes between the Pagan Empire and the Kingdom of Polonnaruwa causes the Sinhalese under Parakramabahu the Great to raid Burma.1168: King Valdemar I of Denmark conquers Arkona on the Island of Rgen, the strongest pagan fortress and temple in northern Europe.1169: Political disputes within the Pandya Empire sparks the decade-long Pandyan Civil War.1169: On May 1, the Norman invasion of Ireland begins. Richard fitzGilbert de Clare ('Strongbow') allies with the exiled Irish chief, Dermot MacMurrough, to help him recover his kingdom of Leinster.The defense of the Carroccio during the battle of Legnano (1176) by Amos Cassioli (18321891)1170: The Treaty of Sahagn is signed by Alfonso VIII of Castile and Alfonso II of Aragon. Based on the terms of the accord, Alfonso VIII agrees to provide Alfonso II with three hostages, to be used as tribute payments owed by Ibn Mardan of Valencia and Murcia.1170: On December 29, Thomas Becket is murdered in Canterbury Cathedral.1171: Saladin deposes the last Fatimid Caliph Al-'id and establishes the Ayyubid dynasty.1171: On November 11, Henry II of England lands in Ireland to assert his claim as Lord of Ireland.1172: The Pandyan city of Madurai is sacked by the Sinhalese army due to an attempt to drive off the rival throne claimant, Kulasekara Pandyan.1173: Sinhalese king Parakramabahu the Great gains a decisive victory by invading the Chola Empire as an ally of the Pandyas in the Pandyan Civil War.1174: On July 12, William I of Scotland is captured by the English in the Battle of Alnwick. He accepts the feudal overlordship of the English crown and pays ceremonial allegiance at York.1175: Hnen Shnin (Genk) founds the Jdo sh (Pure Land) sect of Buddhism.1175: The Treaty of Windsor is signed by King Henry II of England and the High King of Ireland, Ruaidr Ua Conchobair.1176: On May 29, Frederick Barbarossa's forces are defeated in the Battle of Legnano by the Lombard League which results in the emperor's acknowledgment of the pope's sovereignty over the Papal States and Alexander acknowledging the emperor's overlordship of the imperial Church.1176: On September 17, The Battle of Myriokephalon (Myriocephalum; Turkish: Miryakefalon Sava) is fought between the Byzantine Empire and the Seljuk Turks in Phrygia. It is a serious reversal for the Byzantine forces and will be the final, unsuccessful, effort by the Byzantines to recover the interior of Anatolia from the Seljuk Turks.1177: The Treaty or Peace of Venice is signed by the papacy and its allies, and Frederick I, Holy Roman Emperor. The Norman Kingdom of Sicily also participates in negotiations and the treaty thereby determines the political course of all of Italy for the next several years.1178: Chinese writer Zhou Qufei, a Guangzhou customs officer, writes of an island far west in the Indian Ocean (possibly Madagascar), from where people with skin "as black as lacquer" and with frizzy hair were captured and purchased as slaves by Arab merchants.1179: The Treaty of Cazola (Cazorla) is signed by Alfonso II of Aragon and Alfonso VIII of Castile, dividing Andalusia into separate zones of conquest for the two kingdoms, so that the work of the Reconquista would not be stymied by internecine feuding.1180: The Portuguese Navy defeats a Muslim fleet off the coast of Cape Espichel.11801185: the Genpei War in Japan.1181: Parakramabahu the Great conducts a large-scale raid on Burma, after a ship transporting a Sinhalese princess to the Khmer Empire is attacked by Burmese naval fleets.1182: Religious reformations of Theravada Buddhism in Pagan Burma under the patronage of Narapatisithu are continued with the end of the Polonnaruwa-Pagan War.1182: Revolt of the people of Constantinople against the Latins, whom they massacre, proclaiming Andronicus I Comnenus as co-emperor.1183: On January 25, the final Peace of Constance between Frederick Barbarossa, the pope and the Lombard towns is signed, confirming the Peace of Venice of 1177.1183: On September 24, Andronicus I Comnenus has his nephew Alexius II Comnenus strangled.1184: On March 24, Queen Tamar, King of Georgia, accedes to the throne as sole ruler after reigning with her father, George III, for six years.1184: Diet of Pentecost organised by Emperor Frederick I in Mainz.1185: The Uprising of Asen and Peter against the Byzantine Empire leads to the restoration of the Bulgarian Empire.1185: Andronicus I Comnenus is deposed and, on September 12, executed as a result of the Norman massacre of the Greeks of Thessalonika.1185: The cathedral school (Katedralskolan) in Lund, Sweden, is founded. The school is the oldest in northern Europe and one of the oldest in all of Europe.1185: Beginning in this year the Kamakura shogunate deprives the emperor of Japan of political power.1186: On January 27, the future Holy Roman Emperor Henry VI marries Constance of Sicily, the heiress to the Sicilian throne.1187: On July 4, in the Battle of Hattin, Saladin defeats the king of Jerusalem.1187: In August, the Swedish royal and commercial center Sigtuna is attacked by raiders from Karelia, Couronia, and/or Estonia.[3]1188: The Riah were introduced into the Habt and south of Tetouan by the Almohad caliph, Abu Yusuf Yaqub al-Mansur, and Jochem and Acem were introduced in Tamesna.[4]1189: On September 3, Richard I is crowned King of England at Westminster.1189: On November 11, William II of Sicily dies and is succeeded by his illegitimate cousin Tancred, Count of Lecce instead of Constance.11891192: The Third Crusade is an attempt by European leaders to wrest the Holy Land from Saladin.Richard I of England, or Richard the Lionheart.1190: On June 10, Emperor Frederick Barbarossa drowns in the River Salef, leaving the Crusader army under the command of the rivals Philip II of France and Richard I of England, which ultimately leads to the dissolution of the army.1191: Holy Roman Emperor Henry VI attacked the Kingdom of Sicily from May to August but fails and withdrawn, with Empress Constance captured (released 1192).1191: On September 7, Saladin is defeated by Richard I of England at the Battle of Arsuf.1192: In April, Isabella I begins her reign as Christian Queen of the Kingdom of Jerusalem1192: In the Battle of Jaffa, King Richard the Lionheart defeats Saladin.1192: In June, the Treaty of Ramla is signed by Saladin and Richard Lionheart. Under the terms of the agreement, Jerusalem will remain under Muslim control. However, the city will be open to Christian pilgrims. The Latin Kingdom is reduced to a coastal strip that extends from Tyre to Jaffa.1192: Minamoto no Yoritomo is appointed Sei-i Taishgun, "barbarian-subduing great general", shgun for short, the first military dictator to bear this title.1192: Sultan Shahbuddin Muhammad Ghori establishes the first Muslim empire in India for 14 years (11921206) by defeating Prithviraj Chauhan.1193: Nalanda, the great Indian Buddhist educational centre, is destroyed.1194: Emperor Henry VI conquers the Kingdom of Sicily.1195: On June 16, the struggle of Shamqori. Georgian forces annihilate the army of Abu Baqar.1198: The brethren of the Crusader hospital in Acre are raised to a military order of knights, the Teutonic Knights, formally known as the Order of the Knights of the Hospital of St. Mary of the Teutons in Jerusalem.1199: Pope Innocent III writes to Kaloyan, inviting him to unite the Bulgarian Church with the Roman Catholic Church.1200: Construction begins on the Grand Village of the Natchez near Natchez, Mississippi. This ceremonial center for the Natchez people is occupied and built until the early 17th century.[5]Eastern Hemisphere at the end of the 12th centuryChina is under the Northern Song dynasty. Early in the century, Zhang Zeduan paints Along the River During the Qingming Festival. It will later end up in the Palace Museum, Beijing.In southeast Asia, there is conflict between the Khmer Empire and the Champa. Angkor Wat is built under the Hindu king Suryavarman II. By the end of the century, the Buddhist Jayavarman VII becomes the ruler.Japan is in its Heian period. The Chj-jinbutsu-giga is made and attributed to Toba Sj. It ends up at the Kzan-ji, Kyoto.In Oceania, the Tui Tonga Empire expands to a much greater area.Europe undergoes the Renaissance of the 12th century. The blast furnace for the smelting of cast iron is imported from China, appearing around Lapphyttan, Sweden, as early as 1150.Alexander Neckam is the first European to document the mariner's compass, first documented by Shen Kuo during the previous century.Christian humanism becomes a self-conscious philosophical tendency in Europe. Christianity is also introduced to Estonia, Finland, and Karelia.The first medieval universities are founded. Pierre Abelard teaches.Middle English begins to develop, and literacy begins to spread outside the Church throughout Europe.[6] In addition, churchmen are increasingly willing to take on secular roles. By the end of the century, at least a third of England's bishops also act as royal judges in secular matters.[7]The Ars antiqua period in the history of the medieval music of Western Europe begins.The earliest recorded miracle play is performed in Dunstable, England.Gothic architecture and trouvre music begin in France.During the middle of the century, the Cappella Palatina is built in Palermo, Sicily, and the Madrid Skylitzes manuscript illustrates the Synopsis of Histories by John Skylitzes.Fire and plague insurance first become available in Iceland, and the first documented outbreaks of influenza there happens.The medieval state of Serbia is formed by Stefan Nemanja and then continued by the Nemanji dynasty.By the end of the century, both the Capetian dynasty and the House of Anjou are relying primarily on mercenaries in their militaries. Paid soldiers are available year-round, unlike knights who expected certain periods off to maintain their manor lifestyles.[8]In India, Hoysala architecture reaches its peak.In the Middle East, the icon of Theotokos of Vladimir is painted probably in Constantinople. Everything but the faces will later be retouched, and the icon will go to the Tretyakov Gallery of Moscow.The Georgian poet Shota Rustaveli composes his epic poem The Knight in the Panther's Skin.Shahab al-Din Suhrawardi founds his "school of illumination".In North Africa, the kasbah of Marrakesh is built, including the city gate Bab Agnaou and the Koutoubia mosque.In sub-Saharan Africa, Kente cloth is first woven.In France, the first piedfort coins were minted.The city of Tula burns down, marking the end of the Toltec EmpireIn West Africa the Ife Empire is established.See also: Timeline of historic inventions 12th century1104: The Venice Arsenal of Venice, Italy, is founded. It employed some 16,000 people for the mass production of sailing ships in large assembly lines, hundreds of years before the Industrial Revolution.1106: Finished building of Gelati.1107: The Chinese engineer Wu Deren combines the mechanical compass vehicle of the south-pointing chariot with the distance-measuring odometer device.1111: The Chinese Donglin Academy is founded.1165: The Liuhe Pagoda of Hangzhou, China, is built.1170: The Roman Catholic notion of Purgatory is defined.[9]1185: First record of windmills.Wikimedia Commons has media related to 12th century.^ Soekmono, R, Drs., Pengantar Sejarah Kebudayaan Indonesia 2, 2nd ed. Penerbit Kanisius, Yogyakarta, 1973, 5th reprint edition in 1988 p.57^ Britannica, T. Editors of Encyclopaedia (1998, July 20). Kairi. Encyclopedia Britannica.^ Enn Tarvel (2007). Sigtuna hukkumine. Archived 2017-10-11 at the Wayback Machine Haridus, 2007 (7-8), p 3841^ Notice sur les Arabes hilaliens. Ismal Hamet. p.248.^ Francine Weiss and Mark R. 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ISBN9780520036437. {{cite book}}: ISBN / Date incompatibility (help)Retrieved from " 4The following pages link to 12th century External tools(link counttransclusion countsorted list) See help page for transcluding these entriesShowing 50 items.View (previous 50 | next 50) (20 | 50 | 100 | 250 | 500)Antisemitism in Christianity (links | edit)Catharism (links | edit)List of decades, centuries, and millennia (links | edit)Dialect (links | edit)House of Habsburg (links | edit)House of Hohenzollern (links | edit)History of Mali (links | edit)Maimonides (links | edit)Passport (links | edit)Sumba (links | edit)Taoism (links | edit)Weregild (links | edit)20th century (links | edit)1040 (links | edit)15th century (links | edit)16th century (links | edit)17th century (links | edit)18th century (links | edit)14th century (links | edit)1st century (links | edit)13th century (links | edit)4th century (links | edit)11th century (links | edit)1282 (links | edit)7th century (links | edit)10th century (links | edit)9th century (links | edit)8th century (links | edit)6th century (links | edit)5th century (links | edit)3rd century (links | edit)2nd century (links | edit)4th century BC (links | edit)1st century BC (links | edit)2nd century BC (links | edit)3rd century BC (links | edit)5th century BC (links | edit)6th century BC (links | edit)21st century (links | edit)11th century BC (links | edit)1000s (decade) (links | edit)1040s (links | edit)1299 (links | edit)1154 (links | edit)1163 (links | edit)1160s (links | edit)1141 (links | edit)1135 (links | edit)1204 (links | edit)7th century BC (links | edit)View (previous 50 | next 50) (20 | 50 | 100 | 250 | 500)Retrieved from " WhatLinksHere/12th_century" Share copy and redistribute the material in any medium or format for any purpose, even commercially. 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For example, other rights such as publicity, privacy, or moral rights may limit how you use the material. The particle in the box model system is the simplest non-trivial application of the Schrdinger equation, but one which illustrates many of the fundamental concepts of quantum mechanics. For a particle moving in one dimension (again along the x- axis), the Schrdinger equation can be written \[-\dfrac{\hbar^2}{2m}\psi {}''(x)+ V (x)\psi (x) = E \psi (x)\label{3.5.1}\] Assume that the particle can move freely between two endpoints \(x = 0\) and \(x = L\), but cannot penetrate past either end. This is equivalent to a potential energy dependent on x with \[V(x)=\begin{cases}0 & 0\leq x\leq L \\\infty & x< 0 \; and\; x> L \end{cases}\label{3.5.2}\] This potential is represented in Figure \(\ref{3.5.1}\). The infinite potential energy constitutes an impenetrable barrier since the particle would have an infinite potential energy if found there, which is clearly impossible. Figure \(\PageIndex{1}\): The barriers outside a one-dimensional box have infinitely large potential, while the interior of the box has a constant, zero potential. (CC-BY 4.0; OpenStax). The particle is thus bound to a "potential well" since the particle cannot penetrate beyond \(x = 0\) or \(x = L\) \[\psi (x)=0\; \; \; for \; \; xL\label{3.5.3}\] By the requirement that the wavefunction be continuous, it must be true as well that \[\psi (0)=0\; \; and\; \; \psi (L)=0\label{3.5.4}\] which constitutes a pair of boundary conditions on the wavefunction within the box. Inside the box, \(V(x) = 0\), so the Schrdinger equation reduces to the free-particle form: \[-\dfrac{\hbar^2}{2m}\psi{}''(x)=E\psi (x) \label{3.5.5}\] with \(0\leq x\leq L\). We again have the differential equation \[\psi {}''(x) +k^2\psi (x)=0 \label{3.5.6}\] with \[k^2=2mE/\hbar^2 \label{3.5.6a}\] The general solution can be written \[\psi (x)=A\: \sin\; kx\,+\, B\: \cos\; kx\label{3.5.7}\] where \(A\) and \(B\) are constants to be determined by the boundary conditions in Equation \(\ref{3.5.4}\). By the first condition, we find \[\psi (0)=A\, \sin\, 0\, +\, B\, \cos\, 0\, =\, B\,= 0\label{3.5.8}\] The second boundary condition at \(x = L\) then implies \[\psi (a)=A\, \sin\, kL\,=\, 0\label{3.5.9}\] It is assumed that \(A eq 0\), for otherwise \(\psi(x)\) would be zero everywhere and the particle would disappear (i.e., the trivial solution). The condition that \(\sin kx = 0\) implies that \[kL\, =\, n\pi \label{3.5.10}\] where \(n\) is a integer, positive, negative or zero. The case \(n = 0\) must be excluded, for then \(k = 0\) and again \(\psi(x)\) would vanish everywhere. Eliminating \(k\) between Equation \(\ref{3.5.6}\) and \(\ref{3.5.10}\), we obtain \[E_{n}=\dfrac{\hbar^2\pi^2}{2mL^2}\, n^2=\dfrac{h^2}{8mL^2}n^2 \label{3.5.11}\] with \(n=1,2,,3...\). These are the only values of the energy which allows solutions of the Schrdinger Equation \(\ref{3.5.5}\) consistent with the boundary conditions in Equation \(\ref{3.5.4}\). The integer \(n\), called a quantum number, is appended as a subscript on \(E\) to label the allowed energy levels. Negative values of \(n\) add nothing new because the energies in Equation \(\ref{3.5.11}\) depends on \(n^2\). Figure \(\PageIndex{2}\): A plot of \(_n(x)\) for the first four wavefunctions. (CC-BY 4.0; OpenStax). Figure \(\PageIndex{2}\) shows part of the energy-level diagram for the particle in a box. The occurrence of discrete or quantized energy levels is characteristic of a bound system, that is, one confined to a finite region in space. For the free particle, the absence of confinement allowed an energy continuum. Note that, in both cases, the number of energy levels is infinite-denumerably infinite for the particle in a box, but nondenumerably infinite for the free particle. The particle in a box assumes its lowest possible energy when \(n = 1\), namely \[E_{1}=\dfrac{h^2}{8mL^2}\label{3.5.12}\] The state of lowest energy for a quantum system is termed its ground state. An interesting point is that \(E_{1} > 0\), whereas the corresponding classical system would have a minimum energy of zero. This is a recurrent phenomenon in quantum mechanics. The residual energy of the ground state, that is, the energy in excess of the classical minimum, is known as zero point energy. In effect, the kinetic energy, hence the momentum, of a bound particle cannot be reduced to zero. The minimum value of momentum is found by equating \(E_{1}\) to \(p^2/2m\), giving \(p_{min}\) = \(\pm h/2L\). This can be expressed as an uncertainty in momentum given by \(\Delta p\approx h/L\). Coupling this with the uncertainty in position, \(\Delta x\approx L\), from the size of the box, we can write \[\Delta x\Delta p\approx h\label{3.5.13}\] This is in accord with the Heisenberg uncertainty principle. The particle-in-a-box eigenfunctions are given by Equation \(\ref{3.5.14}\), with \(B = 0\) and \(k = n\pi/L=a\), in accordance with Equation \(\ref{3.5.10}\) \[\psi _{n}(x)=A\, \sin\dfrac{n\pi x}{L} \label{3.5.14} \] with \[n=1,2,3...\label{3.5.14a}\] These, like the energies, can be labeled by the quantum number \(n\). The constant \(A\), thus far arbitrary, can be adjusted so that \(\psi _{n}(x)\) is normalized. The normalization condition is, in this case, \[\int_{0}^{a}\begin{bmatrix}\psi_{n}(x) \end{bmatrix}^2\,dx=1\label{3.5.15}\] the integration running over the domain of the particle \(0\leq x\leq a\). Substituting Equation \(\ref{3.5.14}\) into Equation \(\ref{3.5.15}\), \[\begin{align} A^2\: \int_{0}^{L}\, \sin^2\, \dfrac{n\pi x}{L}dx &=A^2\dfrac{L}{n\pi}\int_{0}^{n\pi}\sin^2\, \theta \,d\theta \\[4pt] &=A^2\dfrac{L}{2}=1\label{3.5.16} \end{align}\] We have made the substitution \(\theta=n\pi x/L\) and used the fact that the average value of \(\sin^2 \theta\) over an integral number of half wavelengths equals 1/2 (alternatively, one could refer to standard integral tables). From Equation \(\ref{3.5.16}\), we can identify the general normalization constant \[A = \sqrt{ \dfrac{2}{L}}\] for all values of \(n\). Finally we can write the normalized eigenfunctions: \[\psi _{n}(x)=\sqrt{\dfrac{2}{L}} \sin \dfrac{n\pi x}{L} \label{3.5.17} \] with \[n=1,2,3...\label{3.5.17b}\] The first few eigenfunctions and the corresponding probability distributions are plotted in Figure \(\PageIndex{3}\). There is a close analogy between the states of this quantum system and the modes of vibration of a violin string. The patterns of standing waves on the string are, in fact, identical in form with the wavefunctions in Equation \(\ref{3.5.17}\). Figure \(\PageIndex{3}\): The probability density distribution \(|\psi_n(x)|^2\) for a quantum particle in a box for: (a) the ground state, \(n = 1\); (b) the first excited state, \(n = 2\); and, (c) the nineteenth excited state, \(n = 20\). (CC-BY 4.0; OpenStax). A significant feature of the particle-in-a-box quantum states is the occurrence of nodes. These are points, other than the two end points (which are fixed by the boundary conditions), at which the wavefunction vanishes. At a node there is exactly zero probability of finding the particle. The nth quantum state has, in fact, \(n-1\) nodes. It is generally true that the number of nodes increases with the energy of the quantum state, which can be rationalized by the following qualitative argument. As the number of nodes increases, so does the number and the steepness of the 'wiggles' in the wavefunction. It's like skiing down a slalom course. Accordingly, the average curvature, given by the second derivative, must increase. But the second derivative is proportional to the kinetic energy operator. Therefore, the more nodes, the higher the energy. This will prove to be an invaluable guide in more complex quantum systems. For a particle in a one-dimensional box of length \(L\), the second excited state wavefunction \((n=3)\) is \[\psi_3=\sqrt{\dfrac{2}{L}}\sin{\dfrac{3\pi x}{L}} onumber\] What is the probability that the particle is in the left half of the box? What is the probability that the particle is in the middle third of the box? Probability that the particle will be found between \(a\) and \(b\) is \[P(a,b)=\int^b_a \psi^2\,dx onumber \] For this problem, \[\psi_3=\sqrt{\dfrac{2}{L}}\sin{\dfrac{3\pi x}{L}} onumber \] therefore, \[\begin{align*} P(a,b) &=\dfrac{2}{L} \int^b_a \sin^2 {\dfrac{3\pi x}{L}}\,dx \\ &=\left.\dfrac{2}{L}\left(\dfrac{x}{2}-\dfrac{L\sin \left(\dfrac{6\pi x}{L}\right)}{12\pi} \right) \right|^b_a \\[4pt] &=\dfrac{b-a}{L}-\dfrac{1}{6\pi} \left[\sin \left(\dfrac{6\pi b}{L}\right) - \sin \left(\dfrac{6\pi a}{L} \right) \right] \end{align*}\] (a) The probability that the particle is in the left half of the box is \[\begin{align*} P\left(0,\dfrac{L}{2}\right) &=\dfrac{\dfrac{L}{2}-0}{L}-\dfrac{1}{6\pi}\left[\sin \left(\dfrac{6\pi \left(\dfrac{L}{2}\right)}{L}\right) - \sin \left(\dfrac{6\pi (0)}{L}\right) \right] \\[4pt] &= \dfrac{1}{2} \end{align*}\] (b) The probability that the particle is in the middle third of the box \[\begin{align*} P\left(\dfrac{L}{3},\dfrac{2L}{3}\right) &=\dfrac{\dfrac{2L}{3}-\dfrac{L}{3}}{L}-\dfrac{1}{6\pi}\left[{\sin {\dfrac{6\pi \left(\dfrac{2L}{3}\right)}{L} }-\sin {\dfrac{6\pi \left(\dfrac{L}{3}\right)} {L} }}\right] \\[4pt] &=\dfrac{1}{3} \end{align*}\] For a particle in a one-dimensional box, the ground state wave function is \[\psi_1 = \sqrt{\dfrac{2}{L}} \sin\dfrac{x\pi}{L} onumber\] What is the probability that the particle is in the left half of the box in the ground state? Answer \[\begin{align} P\left(0,\frac{L}{2}\right) &= \dfrac{2}{L} \int^{ \frac{L}{2}}_0 \sin^2 \dfrac{x\pi}{L} dx onumber onumber\\ &=\dfrac{2}{L} \left(\dfrac{L\pi}{2}+\sin 0+\sin \dfrac{L\pi}{L}\right){\dfrac{4\pi}{L}} onumber\\ &=\dfrac{1}{2} onumber \end{align} onumber\] This is the same answer as for the \(\psi_3\) state in Example \(\PageIndex{1}\). This is because the eigenstate squared (i.e., probability density) for the particle in a 1D box will always be symmetric around the center of the box. So there will be equal probability to be on either side (i.e., no side is favored). Recall that the time-dependence of the wavefunction with time-independent potential was discussed in Section 3.1 and is expressed as \[\Psi(x,t)=\psi(x)e^{-iEt / \hbar}\] so for the particle in a box, these are \[\psi _{n}(x)=\sqrt{\dfrac{2}{L}} \sin \dfrac{n\pi x}{L} e^{-iE_nt / \hbar} \label{PIBtime} \] with \(E_n\) given by Equation \ref{3.5.11}. The phase part of Equation \ref{PIBtime} can be expanded into a real part and a complex components. So the total wavefunction for a particle in a box is \[\Psi(x,t)= \underbrace{\left(\sqrt{\dfrac{2}{L}} \sin \dfrac{n\pi x}{L}\right) \left(\cos \dfrac{E_nt}{\hbar}\right)}_{\text{real part}} - \underbrace{i \left(\, \sqrt{\dfrac{2}{L}} \sin \dfrac{n\pi x}{L} \right) \left(\sin \dfrac{E_nt}{\hbar} \right) }_{\text{imaginary part}}\] which can be simplified (slightly) to \[\Psi(x,t)= \underbrace{\left(\sqrt{\dfrac{2}{L}} \sin \dfrac{n\pi x}{L}\right) \left(\cos \dfrac{E_nt}{\hbar}\right)}_{\text{real part}} - \underbrace{i \left(\, \sqrt{\dfrac{2}{L}} \sin \dfrac{n\pi x}{L} \right) \left(\cos \dfrac{E_nt}{\hbar} - \dfrac{\pi}{2} \right) }_{\text{imaginary part}}\] As discussed previously, the imaginary part of the total wavefunction oscillates out of phase by \(/2\) with respect to the real part (we call this "out of phase"). This is demonstrated in the time-dependent behavior of the first three eigenfunctions in Figure \(\PageIndex{4}\). Figure \(\PageIndex{5}\): Some trajectories of a particle in a box according to Newton's laws of classical mechanics (A), and according to the Schrdinger equation of quantum mechanics (B-F). In (B-D), the horizontal axis is position, and the vertical axis is the real part (blue) and imaginary part (red) of the wavefunction. The states (B,C,D) are energy eigenstates. (Public Domain; Sbyrnes321 via Wikipedia). Note that as \(n\) increased, the energy of the wavefunction increases (Equation \ref{3.5.11}) and both the number of nodes and antinodes increase and the frequency of oscillation of the wavefunction increases.It is generally true in quantum systems (not just for particles in boxes) that the number of nodes in a wavefunction increases with the energy of the quantum state. Another important property of the eigenfunctions in Equation \(\ref{3.5.17}\) applies to the integral over a product of two different eigenfunctions. It is easy to see from Figure \(\PageIndex{5}\) that the integral \[\int_{0}^{a}\psi _{2}(x)\psi _{1}(x)dx=0 \label{3.5.18}\] Figure \(\PageIndex{5}\): Product of \(n=1\) and \(n=2\) eigenfunctions. To prove this result in general, use the trigonometric identity \[\sin\,\alpha \: \sin\, \beta =\dfrac{1}{2}\begin{bmatrix}\cos(\alpha -\beta)-\cos(\alpha +\beta)\end{bmatrix} \label{trig}\] to show that \[\int_{0}^{L}\psi _{m}(x)\psi _{n}(x)dx=0\: \: \: if\: \: \: m eq n\label{3.5.19}\] This property is called orthogonality. We will show in the next Chapter, that this is a general result from quantum-mechanical eigenfunctions. The normalization (Equation \(\ref{3.5.18}\)) together with the orthogonality (Equation \(\ref{3.5.19}\)) can be combined into a single relationship \[\int_{0}^{L}\psi _{m}(x)\psi _{n}(x)dx=\delta _{mn}\label{3.5.20}\] In terms of the Kronecker delta \[\delta _{mn}=\begin{cases}1 & \text{if} \,\, m=n \\[4pt]0 & \text{if} \,\, m eq n \end{cases}\label{3.5.21}\] A set of functions \(\begin{Bmatrix}\psi_n\end{Bmatrix}\) which obeys Equation \(\ref{3.5.20}\) is called orthonormal. Evaluate \(\langle \psi_3| \psi_3 \rangle \) \(\langle \psi_4| \psi_4 \rangle \) \(\langle \psi_3| \psi_4 \rangle \) \(\langle \psi_4| \psi_4 \rangle = \) for the normalized wavefunctions: \[|\psi_3 \rangle = \sqrt{ \dfrac{2}{L}} \sin\dfrac{3\pi x}{L} onumber \] and \[|\psi_4 \rangle = \sqrt{ \dfrac{2}{L}} \sin\dfrac{4\pi x}{L}onumber\] Strategy These are four different integrals and we can solve them directly or use orthonormality (Equation \ref{3.5.21}) to evaluate. a. \[\begin{align*} \langle \psi_3| \psi_3 \rangle &= \int_{-\infty}^{+\infty} \left(\sqrt{ \dfrac{2}{L}} \sin\dfrac{3\pi x}{L} \right)\left(\sqrt{ \dfrac{2}{L}} \sin\dfrac{3\pi x}{L} \right)\, dx \\[4pt] &= \dfrac{2}{L} \int_{-\infty}^{+\infty} \sin^2 \dfrac{3\pi x}{L} \, dx \end{align*}\] This is an integration over an even function, so it cannot be tossed out via symmetry. We can use the Trigonometry relationship in Equation \ref{trig} to get \[\dfrac{2}{L} \int_{-\infty}^{+\infty} \sin^2 \dfrac{3\pi x}{L} \, dx = \dfrac{2}{L} \int_{-\infty}^{+\infty} \dfrac{1}{2} \left(1 - \cos \dfrac{6\pi x}{L}\right) \, dx onumber \] and we can continue the fun. However, there is no need. Since the we can recognize that \(\langle \psi_3| \psi_3 \rangle \) is 1 by the normalization criteria which is folded into the orthonormal criteria (Equation \ref{3.5.21}). Therefore \(\langle \psi_3| \psi_3 \rangle = 1\). b. \[\begin{align*} \langle \psi_4| \psi_4 \rangle &= \int_{-\infty}^{+\infty} \left(\sqrt{ \dfrac{2}{L}} \sin\dfrac{4\pi x}{L} \right)\left(\sqrt{ \dfrac{2}{L}} \sin\dfrac{4\pi x}{L} \right)\, dx \\[4pt] &= \dfrac{2}{L} \int_{-\infty}^{+\infty} \sin^2 \dfrac{4\pi x}{L} \, dx \end{align*}\] We can expand and solve, but again there is no need. The wavefunctions are normalized therefore \(\langle \psi_4| \psi_4 \rangle = 1\). c. \[\begin{align*} \langle \psi_3| \psi_4 \rangle &= \int_{-\infty}^{+\infty} \left(\sqrt{ \dfrac{2}{L}} \sin\dfrac{3\pi x}{L} \right)\left(\sqrt{ \dfrac{2}{L}} \sin\dfrac{4\pi x}{L} \right)\, dx \\[4pt] &= \dfrac{2}{L} \int_{-\infty}^{+\infty} \sin^2 \dfrac{4\pi x}{L} \, dx \end{align*}\] We can expand this integral and evaluate, but since the integrand is odd, this integral is zero. Alternatively, we can use the orgonality criteria into the greater orthonormal criteria (Equation \ref{3.5.21}). d. \[\begin{align*} \langle \psi_4| \psi_3 \rangle &= \int_{-\infty}^{+\infty} \left(\sqrt{ \dfrac{2}{L}} \sin\dfrac{4\pi x}{L} \right)\left(\sqrt{ \dfrac{2}{L}} \sin\dfrac{3\pi x}{L} \right)\, dx \\[4pt] &= \dfrac{2}{L} \int_{-\infty}^{+\infty} \sin^2 \dfrac{4\pi x}{L} \, dx \end{align*}\] We can expand this integral and evaluate, but since the integrand is odd, this integral is zero. Alternatively, we can use the orthogonality criteria into the greater orthonormal criteria (Equation \ref{3.5.21}). However, since the wavefunctions are real, then \[\langle \psi_4| \psi_3 \rangle = \langle \psi_3| \psi_4 \rangle onumber \] which also means \[\langle \psi_4| \psi_3 \rangle = 0 onumber\] from the results of section c. Contributors The heading of this page refers to the hypotheticalsystemthat will be considered on it. Though in itself this problem may appear quite a trivial one, it introduces various important concepts, and paves the way for exploration of some slightly morecomplexand physically relevant systems. It may also itself be used as a first approximation to some actual physical problems.A particle in a one-dimensional box is the name given to a hypothetical situation where a particle of mass m is confined between two walls, atx=0 and x=L. In theinfinite square wellthat we will consider, the potentialenergyis zero within the box but rises instantaneously to infinity at the walls.Note that a particle cannot be found in a region where the potential is infinite, as the particle would then have infinite energy:Within the box, theSchrdinger equationfor the particle is precisely the same as that for a particle in free space (V = 0), which was solved onthis page. We may thus immediately write out thewavefunctionfor the particle within the box as:However, it will prove more convenient to use the basic relation ei= cos + isin to write the solution in this form:where C and D are two more arbitrary constants, and 0xL .Now, because of the presence of the potential walls, we shall see that further restrictions upon the permitted wavefunctions arise. For x > L or x < 0 , the wavefunction may be simply be stated to be = 0 , since the particle may not be found in these regions.We have established that for the total wavefunction of the particle to be acceptable it must be continuous. The wavefunction for the particle within the box must be zero at the walls for it to be continuous with the wavefunction for the particle within the walls. This imposes twoboundary conditionsupon the wavefunction k:(The notation k(x) means the value of the wavefunction kat the point x.)If we use the first of the boundary conditions we obtain 0 = C (as cos 0 = 1 and sin 0 = 1) which implies that the wavefunction for the particle in a one-dimensional box reduces toIf we then put x = L and apply the second boundary condition, we obtain:There are two ways this equation may be satisfied. First, D may be equal to zero. However, this means that the wavefunction for the particle would be zero everywhere, which means the particle does not exist. Such a solution, though mathematically acceptable, is ruled out on physical grounds.The boundary condition may thus only be satisfied if kL is an integer multiple of , as the sine of any integer multiple of pi is zero. Thus we may write:Note that n = 0 is not an acceptable solution, as it implies k = 0, which again makes the wavefunction zero everywhere. The acceptable wavefunctions are therefore:and n is a positive integer.Note that the above equation tells us that the energy of the particle is now quantised, limited to discrete values. This quantisation arises due to the restriction of n to discrete values, and this arises out of a need to fulfil the boundary conditions imposed on the system.It is a general observation that quantisation of a physical property such as the energy arises due to boundary conditions, as it is these conditions that render some solutions unacceptable.Note also that the gaps between adjacent energy levels decrease as the integer n increases.We shall now normalise the wave function. Since it is real (does not contain i) its square modulus is the same as the square of the wavefunction. We integrate this over all space available to the particle and require the integral to be equal to one (since the particle is certain to be found somewhere in the space that it is physically permitted to occupy). Note that since the particle may not be found in regions of infinite potential, the limits on the integration are 0 and L :This integral may be solved using standard integration techniques, which allow us to obtain the answer C = (2/L)Thus the complete, normalised wavefunction for the particle in a one-dimensional box is:The wavefunctions and energies are labeled with aquantum number, n.A quantum number is a number (an integer, or in some cases a half-integer) which labels the state of the system. For aparticle in a box, there are an infinite number of acceptable wavefunctions (and thus an infinite numbers of states in which the system may found) , and the quantum number n specifies which state the system is in.The energy and wavefunction of a given state often depend solely upon the quantum number of that state. This diagram represents the first three wavefunctions of a particle in a 1-D box, each labeled with their quantum number, n:These wavefunctions are all sine functions of the same amplitude but with different wavelengths. Note that the degree of curvature of the waves increases with n. Since curvature of a wavefunction is directly related to the kinetic energy implied by the wavefunction, we can say this indicates that the energy of the particle increases with n also. This can be confirmed from inspection of the equation for the energy of the particle.The fact that n cannot be zero means that the lowest amount of energy the particle may possess (when n is 1) is not zero, as would be permitted in classical mechanics (and would imply a completely stationary particle) but is in fact:This minimum, irremovable energy of the particle is called itszero-point energy.The existence of a zero-point energy may be explained two ways:Firstly, we may consider the wavefunctions that satisfy the boundary conditions of a particle in a box. The wavefunction must be zero at both walls of the box, and smooth, continuous and nonzero elsewhere. This implies that a satisfactory wavefunction must be curved, and curvature of a wavefunction automatically implies the possession of kinetic energy.Secondly, the situation may be considered in terms of the uncertainty principle (seeherefor a full explanation of the principle). Roughly speaking, the principle asserts that the uncertainty in the position of a particle multiplied by the uncertainty in its linear momentum must be greater than or equal to/ 2 .Now, if the particle had zero energy, it would have no kinetic energy, and so would have to be stationary. Its linear momentum would then have a precisely defined value of zero. Since the uncertainty in the linear momentum is zero, the only way for the uncertainty principle not to be violated is for the uncertainty in the particles position to be infinite. However, for a particle in a box this can never occur the uncertainty in its position can never be infinite as we know it must be somewhere between the two walls that define the box. Thus it is not possible for a particle in a box to be stationary, and hence it must possess a zero-point energy.The final property of a particle in a box that needs to be examined is the probability density, which according to the Born interpretation is given by:Note that in a case such as this, where the wavefunction is purely real, the square modulus of the wavefunction is equivalent to the square of the function.This probability density varies with position within the box. Below the first two wavefunctions for a particle in a box are shown, and below them are corresponding probability densities, as defined by the above equation:This is an example of thecorrespondence principle, which states that at high quantum numbers, quantum mechanical results reduce to classical mechanical ones.The probability distribution is decidedly nonuniform at low quantum numbers, but as n increases, the probability distribution does become more uniform. The distribution at high quantum numbers is consistent with the classical result that a particle moving between the two walls should, on average, spend equal amounts of time at all positions within the box.

Particle in one-dimensional box problems. Explain the particle in one dimensional box energy quantization. Explain zero point energy of particle in one dimensional box. Application of particle in one dimensional box. Particle in a box. Particle in a box one dimensional. Explain the particle in one dimensional box in detail.